
(Kitab al-Taffyim li Awail Sina'at al-Tanjim - Book of Instruction in the Elements of the Art of Astrology)
English translation with parallel Arabic / Persian text.

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## THE BOOK OF INSTRUCTION

IN THE ELEMENTS OF THE ART OF

ASTROLOGY

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B y
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## ABU'L-RAYHĀN MUḤAMMAD IBN AḤMAD

AL-BĪRŪNİ

Written in Ghaznah, 1029 A.D.
Reproduced from Brit. Mus. MS. Or. 8349
The Translation facing the Text by
R. Ramsay Wright, M.A. Edin., LL.D. Tor. and Edin. Emeritus Professor of Biology

University of Toronto

1934
LONDON
LUZAC \& CO.
46 Great Russell Street




المـكتوب فی غزنه
فد التم طبه



NOTE.


This work had occupied Dr. Ramsay Wright for many years. The whole of the text, translation and notes had been printed and the title page and most of the preface finaliy revised by him berore his death on 5th September 1933. The remainder of the preface was awaiting his last oorrections. An inder has been added.

The edition is limited to one hundred copies of winich this 15
NO. . . .

The fistory of science is oultivated a assiduousIs at the presont time, as one may judge from. the periodionis exolusively devoted to $1 t$, and from the important books whioh appear from time to time eluoldating the history of certain subjects or or oertain periods, that the translation of a book whioh served as a primer of solence ior two or thres hundred years ofter it was oritten requires no apology. 1

Thio appiles Hith apecial significanoe to the Tafnim of $\bar{i}$-BírūnI becouse its author is one of the most outstanding figures of the eleventh oentary, wioh has been deboribed as the blossoming time of Mohamsedan nulture, and as the olimex of mediaaval thought.

So onaracteristic for h1s age is its autnor that Sarton in his admirable "Introduction to the History of Solenoen atyles the first half of that oentury the "Tlme of AI-BIrani. 2

Intimacy with Six William Osler, whose fine Ilbreay wes assembled in illuatration or the Bistory of Salence, ${ }^{3}$ and with Dr. Charles Singer whose notable contributians to it are mell-known formed a favourable atmosphere for increasing intereat thersin and led to my undertahing the task of this translation.

The suggestion that the Tafhim was both worthy of being transleted, and alio sultable as a representative of its period was made by professor s. B. Browne to Dr. singer who kindly placed a rotograph of the paraian veraion (PL) at my disposel. It mas from this thet the tramalation was made in the first instance.

An enswer to question as to the persian acuroe of Greaves. "Astronomica queedam" brought ne into oommunioation with Profossor lifiedemann of Eriangen. 4

He
1 Chron. Text, XV.
2 Washington, 1927, Vol. I, 69s-737. I am indebted to professor Fuiton of Fale for this reference.
3 Blbliothea Osieriana, orford, 1928.
Teber die Sohrift "Astronomioa quaedam" von Greaves: R. Ramsay mright mit einem Zusatz von F . Wiedemann, Be土traege, LyxVII.
hed tranalated vardous passages from the Teftim in his "Beitraege zur oeschichte der Netumisaenschatten" oom munlaated to the physiconfedical soolety of Erlangen, and was good enough to look over my translation of this work and to mske a number of valuable buggestions whion have been incorporated 1nto $1 t$. He advised that the arabio versions should be oollated Fith the peralan, lending me with this object photographs or the two Berlin ks. (AB.AB'.) and presenting me with coples of his numerous papers on Arabic Science. He was about to Write at my request a shorti Introduotion to this mork, Whi oh he did not live to oomplete, in which he proposed to oompere the ilfe and works of al-siruni in the East With thoos of his oonterporary Ibn al-Hasthem, better known in the West as flazen, 90 distinguished for bis researones in optios.l

A warm tribute to professor wiedemann, by his former assistant H.J seemann, disouases his oontributions to the fletory of Arabio Soienoe, and gives a ilat of his numerous pepers, which testify to the extent and diversity of bis studies therein.

I take this opportunity of aseociating myself with Dr. Seemann in expressing my admiration of Professor Tiedemann's aohlevements, and my indobtedness for the interest te showed in my work.

Sarton thus characterizes Al-EIrani in comperison With bls more widely-known oontemporary AVioenne (Ion Sina) "ll-Birani repregents the wore edventuroud and critioal epirit, Ibn sina the synthetio; si-Biruni wes more of a discoverer and in that respent oomen nearer to the modern solentistis ideali Ibn SIna was essentially an organizer, an encyolopaedist, a philobopher."

Two other oontemporariea may be mentioned; Ibn Yunus distinguished for his astronomioal work in ceiro. and rill ibn rife for hia reacarohes in ophthalmology. I one of Wiedemany papers deals with the lives and warks of Ibn 2l-Haltham and al-Kindi; Jahrb. f. Photo. u. Reproduationstechnik, 1911. 2 Iess, wey 1930 pp 186-186 3 Not to be oonfused with the ustrolabe-maker (p. 119) who lived under the Callph Ma'mun nearly 200 gears eariler, and whose tradt on the $A B t r o l a b e$ has recentiy been edited by Father L. Choikhu S.J. IDn Finus reters to nim With enthusiasm (Not, et EItr. VIT, 54) ranking

The Tefnin is a Book of Instruction on the principisa of the Art of Astrology (KItab al-tarhim il awé 11 Inarat al-tandim) but may be regarded as a primer of Itsanth oentury solance, because apart from the elements of caometry and dstronomy, ( Film al-nujü, vilm al-falak) and the use of the astrolobe for astronomioel and astarylogionl purpores (Astrology is differentiated as inm 1-tanjIm, "llm ahrim al-nujam it has sections on ography and Chronology both favourite topics at this pariod. It is, therefore, often classified with oiber work Cesignoted as ocsmographies but the guthor places it at the head of his Ifst of works on astrology. AlHirlni inelsts that no one is entitied to oall himself an Astrologer unless he possesses a thorough knowledge an tstrologer unless he poss

The author, sou'1-Rayban wuhemad 1 bn Ahmed al-gimin ( 14 -chwärizmi) generally known by bis nisbah, which meens that he belonged to the suburbs, outside (biran) the walls of the Khrirsman capital, but also often referred to by his kunyah, wich 18000 sosionally mititon Abu Ragten. Ho mation is made of Al-BIrani's offspring nor is there any indioation my 'raybun' (literally sweet-basil, but elao not unoommon name) should bave bean seleoted as his luyyeh. $s$ ppigs of this fregrant plant are often worm by craba, and it mey have been as oharaoteristio for him an or orahl for a distinguished politioisy. In its fenInine form, Rayhenah, it is a woman's name ilka ny other tatren from flower or plant like cyrtie. One of Muhnuere Wira, highlyweducated Jewigh giri from Kanaibar, wes soadiled. It is also the mame of the ladyg Raypgong the dodionted, and at whor of Al-Hasan, to whom this book 18 dedionted, and at whose request, indeed, 14 was written

The Tarbin oocure in botin Arybic and persian ver slons, neither of which eccording to Rieu purports to have been translated the one from the other. Browne of 1 than of the bilingual Tafhim (Lit. Hist. II, 102) and gunges (Chaher been composed simultaneously in both lanregardad on (Char Kaqaiah) While a Paria 1s. (AP) has bean that it had been trate grounds as favouring the vief author. ( $p$ biv under ip.) from the persian by the (D.ELV under dP.)
 taohed to the court aphyaician or the $3 x d$ oentury atwaned to the court of whtawakkil (and Murtamid?)

Rayfanah belng a native of Khwarizm mould necessar lly be more familiar with Parsian than with Arabic, which mould account for the pergian vergion. di-BIranI wrote in arabic and was accustomed to make use or assistants in his interary output. There are some indications that the transiator into Persian was leas
familiar With Arabic than Al-BIrani. (v. note p. Bi)
The following sketch of tine life of Al-biranils oompled from that by Sachau in the prefeae to the Arebic edition of the Chronology, and from materiel translated by Hiedemann from Yaqut'a Blographical Dictionary,


Al-Birūni was born in 362 A.H. ( 973 A.D.) in a suburb (bIrun) of the Capital of the Principality of Khwar12 m, corresponding roughly to the former Khanate of Khiva, at that time a Province of the Samanid Empire under Noh ion lansar (ob. 387/997-8). The Capitel, kath, situated on the right bank of the cxus, where is now
 sh而h, abu bodall oh wuhamenad, a direct descendant of the Kinsrawa, but the greater part of the Provinoe was governed by the Enir Ma'mur ibn Mobammad fron Gurganj, an important city, now Kuhns Urgenj, a hundred miles to the N.F. situated on the branoh of the oxus leading to the Caspian.

He overthrew the anolent dynasty of the khwerizmshāhs in 385 A.H., appropriating the title. 3 By this time the oxus had already destroyed the citadel of the Capital, and was maxing further inroads in the city. These cirokmstanges may have led to Al-Birani's leaving for the court of kansur, for in a verse quoted by Yaqut, he refers to fim as his first patron. 4

Little is known up to this tine or Al-birini's cariy history; he knep little of his cranofather ond no thing of his father, but he must have prorited by his studies under abu Nase Mansur ibn rall ibn Träq, for he had already rititen a number of golentlfie papera, and had had discussions with his younger oontemporary avioenna before leaving Khwarizm, and while avioenna was atili in pukhera.
FWiederann u. Yyell; Mitth. z, Gasoh. व. Naturins. U. Med. XI, 373. 2 \#iedemann, seitraege, IX, XXVIII, IX.
V. gote 3 D. 180. 4 F1edemann, Beitraege, LX, p.61,No. 2. 5 Hiedemann, Beitraeze, LX, p. 62, NO. 4.

Wiedemann, Beitraege, LX, p. 81, No. 3.

While at the Samanda court he probably met Qābūs 10 Fashaglr shams el-ka'alil who had ivken refuge there, ond when Qūūs regained his Frinoipelity in 388 Al-birunj at his invitation joined him in Gurgén at the S.E. angle of the Caspian. To hirn Al-BIrunjis first important work, the Chronology of Ancient Nationa, is dedicated; $1 t$ was finished in 390-1/1000 4.D., and, although not his first mork, representa the sumation of his rasearohes up till that time.

It is uncertain when al-birani returned to Khwarizm, certainly before 398 A. Fi., for he speaks of his kind reception at ourgänj by Aou'r-Hesan ralí, the eldegt on of Marman who succeeded his father in 387, ${ }^{2}$ CAll died in 309, and was followed by his brother Abu'l-'Abbes Na'men ibn Ma'mūn, with whom Al-BIrinil oocupied an honourable position ${ }^{3}$ as councillor during the whole of his reign till 407, when he was murdered by rebellious subjeots.

It was to revenge this murder that Mehaū of Gheznah Ka'mün's brother-1n-law, set out to oonquer Khwarizn, placed Altuntash on the throne, and oarried the surviving members of the Royel family and other nobles to Arghanistan 10408,5 and with them alBIrunI and two other aavants Abu'l-Fbair ibn Khemme the physialan, and Abu Nass ion 'Iraq the mathemetio 1an.

Mapmúd had previously tried to attract the learned men of Gurgang to his own court for already Avioenna (ADu Áll ibn Sinā) and Abu Sahl rīà ibn Yahya al-Masinic had fled from Gurgand, probably in 398 before Al-BIrūn's arrival, rather than acoept capmud's somewnat peremptory invitation.

[^0]In one of his verses Al-BIrūn̄ bays Mapmūd did not oesse to loed hir with benefits; he may have oooupiod an official position as Astrologer; 2 but many of the twelve yearg between 408 and the completion of his seaond great work "India" (Te'rikh al-Hind) in 421/ 1030 must have been spent in travel and study in India, as well as in the extraordinery and enoyclopeedio i1terary aotivity, including the Tafhim in $420 / 1029$, Whioh may ba gathered frow his om bibliography of his rritings up to 427. contained in the Leiden LS. Goliua 133, printed gy Saohau in his Prefeoo, and iranslated by Hiedemann, with the appendix or Al-Chadanear (630692 A.H.) who $1 s$ responsible for the details on whioh the figure of Al-BIrunI's horoaoope $p$. 191 is rounded. 4

Mahmud, to whom the Indica would probably have been dedicated, died (421/1030) berore the work mas potueliy finished, so there is no dedication.

When Has rad guooeeded his father, Al-BIrDni composed his third principal work, the Canon mesudious, and was in reoelpt of a pension which enabled him to devote the rest of his life to bis, soientifio studies and his literary Fork. Yäqüt relatea that kes rūd sent him an elephant-load of silver ooin for the camon, but that $A l-B I r d n I$ returned it to the Treasury.
ue survived kes rud, dedicated a work on jewels to his successor kamdūd, and died et Ghaznah in 440/1048.

To return to Raypanah to whom the Taftim $1:$ dealoated; she muat have been carried off to ohaznah in $408 \mathrm{~A} . \mathrm{H}$. With the 5 est of Mahmuda's involuntary guepts. It has been suggested that she vas a alater of Abu'l-rabbis, but in such event she vould have been bint al-Ma'mun'not bint 41 -Haean.

Abu'l-Hesan is a oommon kunyth whioh does not neoossarily 1日ply the exdstence of a son Al-Hasan, otherned one might auapeot a relationship to
ADul-Fenan Fill 1bn Ha'mūn, Fhose only reoorded
 a fer monthe; or to Abu'l-pasan rall ibn Abi alFagl Al-Khasai to Whom, eooording to yajli Khalife (II, 385) an edition of the pefhlm was deaioated in 481 A.E. AI-Khàss was a Village near the anoient Capital of Khnlarizm, (Ta'rikh-1 Rashidi, p. 45) and Abi'1-Fasan mas evidently one of the exiles in Ghamiah.

Al-Bircuñ oooupied such a propinent position in Gurghaj, it is possible thet gaybänah ras a namesake (samy gyahi, daughter of some friend at ha'mun's oourt Whatever her oricin slie 1 a marked out among oriental women by her oravine for solentifio knowledge, and by the rare distinction of having a book dedicated to her.

[^1]176-185. Inolined orbits of Planets, their Nodes. Epicyole

The paragraphs (abwab) are referred to in the text by numbers aione.

## GEOMETRY

1-28. Deal with definitions and propositions of Euclid
29-32. Of Book II. 33-36. Of Books III and IV.
37. Ratio of diameter to ciroumference.

38-51 and 55. Definitions of B00K $\nabla$. 52-54. Of Book VI.
56-71. Definitions from Books XI and XII.

## ARITHMETIC

72-95. Names and properties of the various kinds of numbers.
96-108. Arithmetical Operations. Decimal Notation.
109-115. Algebre. 116-119. Representation of numbers by letters of the alphabet.

## ASTRONOMY

120-124. The Spheres. 125. Stars and Planets.
126.-131. Celestial Movements. Horizon. Meridian. Cardinal Points. Indian Circle.
132-137. Day and Night. Dawn and Twillght. Hours.
138-143. Equinoctial. Ecliptic. Parallels of Deciination and
of Latitude. Muqantarans, Equinoxes. Solstices.
44-145. Subdivision of the circumference of the circle.
146. Relation to it of the diameter
146. THE SIGNS. 147. Declination and Latitude of Sters

150-152. THE PLANBTS. Superior and Inferior. The Epicyole
153-154. Combustion and Conjunction with the Sun.
155-156. Wexing and Waning of the Moon. Pheses peculiar to the Moon?
157-162. The Fixed Sters. Their arrangement in Constellationa Zodiacel, Northern and Southern. Tables of these.
163-166. Star names. MANsiONS OF THE MOON. Their Ascension.
167-169. The Galaxy. Order of succession of Signs. Northern and Southern Signs and Mansions.
170-175. Mumaththal Orbit or Parecliptic. Apogee of Sun. Its Excentric Crbit. Its Mean Movement, Mean Argument and Equation. The amount of its movement in the Ecliptic.

Deferent; Equant. Apogee of zpicycle, Mean rate of planet, liean and True Anomaly. Yean and corrected Lonsitude. Equation of Anomaly. True position among the stars.
186-190. orbits of the Moon. Its Movements. Those of the
Planets. Revolution of the planets.
The Trepidation Theory. of the planets. oosition Latitude of the Moon and of the Planets of their Apogees and of their Nodes
197-188. Daily rate of movement of
199-201. Maqumat, Ribetat, Nitaqet.
202. Planets. Ascending and Descendine.
203. Inorease and Deorease of the Planets.
204. Forld-Days and World-Years. from the Earth. Size of

205-209. Size of Planets. Distanae from the Earth. size the Farth and surrounding Elements.
stribution of Land and Mater.
Posture.
Locality.
210-213. Posture. Longitude of Locality.
214-219. Latitu Amplitude. Day and J1cht. Diurnal arc.
225-224. Stars of Perpetual Apparition snd occultation.
225-226. Altitude and Zenith Distance.
227-229. Gnomon and Shadow.
250-235 Azimuth. Meridian Altitude and Shadow. Relation to azluath. Meriaian Altituth of Oiblah. Direction of Mecoca.

## GEOGRAPHY

236-240. The Seven Climates. Their Extent and Cnaracteristics. Qubbet al-ard. Other Methods of dividing the Earth
241. Cities in the Seven climates.

## ASTYONCMY

242. Co-ascensions of Equinoctial and Ecliptic.
243. 'Epooh' of Star with Latitude. Degree with which it rises, sets and crosses the lieridian.
244. Dä'ir. Arc of parallel of e star traversed from the horizon at a given time.
245-248. Ascendent. Houses. Cadent and Succeedent. Their
Angles.
250-254. Conjunction and opposition of loon. Phases (Fäsisãt) at which forecasts are made, Athazer (al-tasyirät). Eolipses of Moon. Eclipses of Sun. Parallaxis.


PRRSI AN

3. PP. Blbl. Not. Paris

ARABIC


The trenglation was oricinally ruade from PL, was aftermards collated with and amended from 10 and $A O^{\circ}$, While the
 repredeaunge stopylied from $\triangle O$ and $A O^{\circ}$.

## PL.

This MS. is unique in being preceded by a 11 at of the 530 paragraphs (abwab) lato whioh tae work is divided. This is more detalled than that given in the Bodleian catalague of Arabic MSS. II, 262-8. Further it is the only MS. In whioh are peragrang ere numbered, and in which there are 51 gures of the constellations.
mere are oertein leounge, $71 z$. 91-95, 193-206, 208-7, 476-481: all of these oan se supplied from PL except the last, which bJever, is in PP.
, whe soript is described in the catelogue as a fair nagkhi. The tebie in 453 has jeen substituted for the Arabio one as a specimen of the neat oalliaraphy. professor growne in a let ter to Dr. 3inger refers to the eranaic writiag; this ia chielly noilceeble in del belng written didel between vowels and $\varepsilon f t e r$ a $v$ mel ot the end of a ward, and in forms like ank and anch for anki and arohi ( V . horn, Neu-Persische Sprache, pr. E1 and 12!

The MS. 13 deted the beginning of Ramaḑan, 6 Bb h. H, weak (end of Ootober $1886 \mathrm{~A} . \mathrm{D}$.$) , and was written 'by the most$ hand of Al-Helig ion Ghuläm al-Qunāi. It is interesting that Ibn Ghulam is tile cooyist ( 692 A. F. ) of the Leiden lis. a collus 133 (Cat. II, 296) in which his aaster Al-hhedenrar a great ecmirer of the Tarhira, discusses the life and works af al-zirani. (Chron. T. XV.)

A note indioates that the ve., written in konia, was bought in Sives in 732 A.H.

## PL'

$\triangle$ MS. of the 19th oentury: complete eroept for absence of paragraphs 473-489 and 512-523. This IS. is referred to in the B.U. Catalogue, II, 451, and elsewhere as giving the date or writing (321) as $\$ 25$ A.H. Instead of 420 ks in other liss. but this is due to a wistake of the oopyigt as will he seen from the subjoined passage:-
"pas in rüz aih shambih ast $k 1$ bist $u$ panjum
ramadan ander sāl ohahärgad va bīat u penjum
az Rijea, va ham leftum az Tishri al-amal
andar sāj
(hazär va sípad va onibil yokum est
az Iakandar va rūz erdibahisht sivrum Abānmäh andar sā̀
sisad va nuvad va hashtum az Yazdipird" The words in brackets are omitted. The Calendgr ia the serce as in PL with osme ineocurealea.

PP.
ilthough this MS. Is complete (as is AO) it has meny dropped innes and other instakes. The soript is very legible; 15. 39 and 110-1 are by anothar and more elegant hand. It 1 a dated Monday 19th Ramadenn 668 A. H. (12.th Le日y 1270 A.D.) The
date of witing the TafhIm is as in PL, bistum asti for bist, date of Writing the Tarhim is as in PL, bistum asti for
f. G6r. M. Blaohet in speaking of this les. refers to on frabio edition, whioh he regards as probabiy the original.

## AL.

This is the WS. Whioh has been selected for reproduction on account of its legibility. A rew follos are lost which are copied from 10 and AO'. Trase are froll ho pp. 52-3, 60-62: from 10\%, 90, 115-9, 130-1, 139: from $40,219-22,240-3$. The colophon does not indioate the date or the name of the copy1at, but two owners have witten the dates on which the book came into their possession viz. Auhad b. As'ad b. Minrlar ellastewfi in the month of silah, Rajab the deat, 838 A.H.,
 (1484-5 A.D.)

## $\Delta B$

This is. is dated the lest day, gelkh, of Dhu el-oirdab
 omits 64-87, 150-185, 460-490.

This MS，1s dated B36 A． A ．（2257－8 A．D．）It begina Fith paregraph 120：I． 18 ahould come betwoon If． 10 and 11 ；If． 98－89 should follow 1 ．34．Parakraphs 2008－346 are omithea with exoeption of part of 321 on fP．60－61；350－372 are omlt－ ted；r． 113 should sollow r． 104.
$A P$
This Ms．is dated 9 Ramadēn 1035 A． H ．（ 4 June 1626 A．D．） 23 Ayy百 1938 is given as ooncordant date but is oquivelent to 2 June 1627 ，allowing ten deys for 0．S．

The text is praoeded by a oonfused and rambling account of the contents，whioh does not ooour in any other of the hiss． examined，and is certainly not attributable to Al－Eirüin，in the course of whioh the writer a日ys＂we have translated this into Arabion

Joseph Ascari summarising this introduction says $"$ the work bas been tranglated from the pergian by an anonymous author＂，and De Slane describing the NS ．refers to it as a translation of a persian work on the diements of Astronomy by Al－BIrdaI．I have not found in the Ms．any gtatement to the effect that this is a transiation from the persian by the suthor himself．

Naliino refers to this ks．I p．IXP，and later I．p． 239 to the passage on 5.28 wbere the position of the aujat of the planets in 420 A．F．is disoussed．（195）

The text，which ig imperfeot，agrees as far as it goes With the other arabio texts；it begins with paragraphs il6－ 119，oontinues with 147－300 and finishes with 304－359．

## $A O$ and $A O^{\circ}$

These Mss．are desoribed at length in jodi．cst．II， 262 Au＇is mentioned for the leglblilty of its script，fo．for its age and acouraoy，The aripts may be oompared in the paragraphe referred to under al above．

AO was written for his own use，by a cont，Abu Shakir Tuma，b．Abl al－Farah，a Caireno witer known as Ibn al－ ＇Ushana＇．It was Anjahed on a Monday being the Feest of the Apostles， 1 Id al－rusuj， $219 t$ RabI＇al－emmal B81 A．H．（2gth June 128í），or the 5th＇Eblb（EIIII） 898 ，Bra of the Martyrs， G．M．，and the 29th HezIrān， 1594 （should be 1593）of the Seleucid Era，S．E．，end the 2 bth Shehrir men， 651 of the Yaz－ digird Era，Y．E．，in Calro（Nigr al－mabrusah）at Qasr al－shom． ［qasr al－Shan＇remained a refuge for the Copts till after the Englisk ocoupetion of Egypt．（Enoyol．Islari）］
I The Feast，fixed one，is now celebratad on the lith Juiy， N．S．（Lane，：＇anners and Customs，Everyman Ed，p．547）mhe Greex and Gestern Churches have retalned old style．

This MS， 1 s undated but belonga to the 9 th or loth oen－ tury of the Elijra．In adaition to the usual title it has an elternetive rhymed one，epparently invented by one of its former owners．Yüsur ibn Ahmad ibn Ibrahym al－Nablāsi al－ ghafi＇I，bhion does not ocour elsewhere：－

Kitāb ingrat al－halak，fI sina＇at ilmi al－falak A book to lighten our darkness in the ert and science of the sphere．

It is ajmplete exoept for a lacuna includics paragraphs 380－643．Between $A O^{\prime}$ and AB＇there 1 g evidence of direct filiation，e．g．The substitution of the word murgghamah for mina amah， 483.

Nicoll in his account of AO＇explains that he gives e
 questions posed not only aerve to show the soope of the solences oultivated oy the arabs，but also furnish explen－ ations of many texms the meaning of which is not always ob－ vious．It 18 hoped that these have been adequately dealt with in the rollowing pages．

As there gre several places in tie Tafinm where dates other than A．H．are oited，the oonvergion of these ints A．$D$ ．让y be effectad by the following formulae：－

To．convert $E . M$ ．（D． 173 n ）into $A . D:-9 s$ lst mhoth， 1 E．M．$=89$ th Aug． 284 A．D．，add 283 years +240 days：－e． 5 ．
 2oth Jun 188R．

To oonvert s．E．（Alex．） $280^{n}$ ，into A．D．i－as lst Tishrin 1， 328 S． $\mathrm{F} .=18 t$ oot． 1 B．C．．deduot 311 if the day of the anth is in the last 9 months of S．E．（first 9 of A．D．）， 3.2 it in the firat 3 of S．E．（last 3 of A．D．）；e．g．（321） 7 th
 20th FazIritn 1595－311－29th June 1282.

To oonvert Y．B．（ $\mathrm{P}, 172 \mathrm{n}$ ）into $\mathrm{A}, \mathrm{D} .:-$ as the lst far－ FerdIn mit I Y．E． 16 th June 632 A．D．（ $631 y$＋167d），this has to be added to the Y．E．date to obtain A．D．，but，owirie to the fact that the Y．R．year is shorter by quarter of a dey than the aolar year，the number of leap－years has first to be de－ duoted from the 167：－o．8．（321）3rd Zbân nah 386 Y．E．（397y＊ 213d）＝7th Dot． 1028 A．D．，for，deducting $398 / 4$ fron the above 167 leaves 37 days and adding $631 y+67 d$ to the Y．E． date gives $1028 y+280 \mathrm{~d}=7 \mathrm{th}$ 0at． 1028 ．

Paragraphs (abrEb) are referred to by numbers alone; pages with a prefixed p. Paragraphs are numbered at top of page; pages at bottom.
With regard to transliteration $g$ is represented by 1 in the type-script and $\mathcal{E}$ by a slight modifioation thereor
P. $\quad \frac{1}{3} \quad$ The baslema and first paragraph from PL.
P. 11 The passage on proportion, $39-55$, translated by

Wiedemann, Beitrag, XIV
P. 30 Note 2. Wieleitner finds that $x$ is derived from an
P. 45 Note 1 ; in in is translation of Bar Hebraeus. "Livre

Note li in his translation o
Note 2 . Brenm's Thierleben.
Note 1, by Wiedemann.
Note 1 for 378 read 377.
Ideler, Ursprung u. Bedeutung d. Sternnsmen.
for hádi al-najm, the leader, read häā̈ al-najm, the driver
The diagram is modified from Manutius Pranslation of Ptolemy's Syntaxis, II p. 413.
P. 114 The Book of the Thousands (Kínb al-ulūf), v. note p. 320, deals among other things with the emergence of new religions. Astrologers commonly as soolate this with the entry of the vernal equinox into a new sign. $\nabla$. Dupuis, oricine de tous les oultes.
P. 134 Chauoer, v. Skeat p. 194 note 1.
P. 143 The Mountains of the Moon regarded now as applying only to the Ruvenzori. Fange.
P. 144 Note 9. v. De Goeje, De Murir Van Gog on Magog, Versi. d. Kon. Akad, Amsterdam. Let terk. 4 th series. ist Pert p. 87
160 Aocidentally omitted: see inserted silp.
268. Mä al-ayybim al-wusta al-mu'addalah. If the sun had no eastward movement and simply continuMEAN DAY ed revolving in virtue of the first movement
P. 177 and 195 a and $b$; umm has acquired an initial by mistake.
P. 178 The rule for finding Rester requires to be modified; if the number to be deduoted 1 s greater than 27 , Easter is four weeks later than the result arrived at.
P. 190-1

The figures placed here on account of aveslable space refer to o. 205.
The method adopted in constructing the rigure is as follows:- Two great ciroles, the meridian and a alrole of declination through the point of the ealiptio ascending divide the heavens into four quadrants. The two Eastern quadrants are unequal the XII, XII and $X$ houses are each made the arc of the ealiptic corresponding to one-third of the semi-diurnal arc of the ascendant, and the I, II and III houses to the aro corresponding to onethird of 1 ts semi-nocturnal arc. The houges of the Festern quadrants are the Nadirs of those of the Festern
P. 226
P. 228
P. 228
P. 253
P. 265
P. 279
P. 282
2. 286

Note, see figur
A convenient edition of the Tetrabiblos is contained in Junctinus' Speoulum Astrologiae.
Chaucer says; $V$. Skeat p. 194.
rext, last row, for haiyah read harbah and for tinin, thaläthin. Transiation, note, sisad is 300 although there is some excuse for $S$ teingass translating it 3000 ; Formeriy sisad.
Text "rd line; note arab transliteration of genitive of Astaratos with otiose alif.
note 2 , read 290 seq.
Madkhal Kablr, Abu Ma'ashar, Bodl. MS. Hyde $\because$
No. 51, for al-taqà read quttal, pl. of qātil, sillers, anaeretai, usually qawati", sing qéti" a highwayman (pl. in latter sense quttai). Qavati, in addition to its astrological meaning is also. used for inoisors and migratory birds in oontras to perennial residents (awibid). Qaja'a in the sense recorded by Dozy (awaid). Qata'a in the the Tafhlm, nor does he refer to the not occur in meaning of gāti, oes he refer to the astrological occur in $A$ and $P$.
The urjuzah is not the only arabic astrologioal poem, it consists of 372 verses; the Muqni of Al-süsi
see Not
See Not. et Extr. XXIII for two Byzantine poems, the one by Theodore prodromus in politioal metre, the other by John Kamatēros in twelve-syllable iambics; the latter contains references to two Babylonian Astrologers Selelk and Meslas or Lasbas not otherwise known. 1354 verses.
P. 328
P. 332

Numadhär, Vullers' 'repraesentans'.
Prol. The Yrolegmena of Ibn Khaldūn translated by

The Cbronology of Ancient Nations and the Indice of Al-Birunt, texts editad and translated by sachau, are indicated by chron. and India.

Dictionaries by the names of thair authors; Lane, Dozy, Steingass, Vullers; the NuhIt al-Kuhit appears as NuhIt, the Diotionery of Teahnioal Tarms ueed in the soienoes of the Rusalmans (Bibliotheos Indice) es Diot. Sci. Terms ind Barbier de Meynard's Diotionnaire Geographicue de la perse as dict. Geog. Pers.

Zoucbé-Leolaraq's, L'Astrologie Greoque appears in the notes as BL, Maretip al-"ulfm ao sit.

Nallino, when unspeodfied, rerers to his wagntfioent Al$3 a^{2} t a n f$.

Nau, to his translation of Bar-Trebraeus, "I'hscenaion de l'esprit."
pococke, Speolmen; for Specimen fistoriae hrabum.
Junotinus is for Junotinus. Speoulum is crologiae which together with the two following works give an adequate gecount of hrebio astrology.
dlbohazen-Helf is for Abu'l-qasar. 'ill b. Abill-Rijal. Hia Urjuzah appears in a reoent sumnary of Arajo astrology by Ghezti al-MūsanI. H1s 'De Juaiails Astrorime' and the 'Tractatus de Astronomia' of Bonatus (Guido Bonato) Fere both issued at Basilea 1571 and 1550 .
Tilson for Wilson's Diotionary of astrolagy which is referred to for definition of terms.

My thanks are due to Lesors. Percy Lund, kumpries \& 00. for the excellent manner in mhich they have reproduced the is. and type-script.

The Teaching of the Master, Abu'l-Rayhan Muhammad in Ahmad al-BIrlinf(May the Mercy of God be upon him) on the Elements of the art of Astrology by way of Introduction].

The comprehension of the structure of the universe, and of the nature of the form of the heavens and the earth and all that is between them, attained by rehearsing information received, is extremely advantageous in the art of Astrology, because thereby the listener acquires practice, he becomes accustomed to the terms current among astrologers, the apprehension of their meanings is facilitated, so that when he again meets them in his study of the various problems and demonstrations he brings to these a mind freed from having to deal with difficulties from both sides (the problem and its terms).

It is on this account that I have prepared, at her request, an aide-memoire for Raybenah [the Khwerizmian] daughter of al-Hasan, in the form of question and answer, which is not only elegant, but facilitates the formation of concepts.

I have begun with Geometry and proceeded to Arithmetic and the Science of Numbers, then to the structure of the Universe, and Finally to Judicial Astrology, for no one is worthy of the style and title of Astrologer ${ }^{2}$ who is not thoroughly conversant with these four sciences.

May God by His grace, and in the fullness of His mercy, favour accuracy of statement in the work. 3

## GEOMETRY

1. Al-handasah. Geometry is the science of dimensions and their relations to each other and the knowledge of the properties of the forms and figures
GEOMETRY found in solids. By it the science of numbbors is transferred from the particular to the universal, and astronomy removed from conjecture and opinion to a basis of truth.
lea ruiz shanidan va tagiId giriftan. 2l.simat al-munajdim; 3after saw bins. al-qawl fi'l-ramal bi manat wa sadat.

2. Ma al-j1sm. A solid body is that which can be felt by the sense of touch; standing by itself, it occupies only its own share of space but enTHE SOLID tirely fills that to the extent of its dimensions, so that no other solid substance can occupy its place at the same time.
3. Abrade al-makēn. The dimensions of space are three in number, length, breadth, and depth; these terms are not applied to the dimensions in themDIMENSIONS selves so as to be invariable, but relativeOF SPACE Dy, so that as soon as one of them is called length, that which crosses it is breadth, and the third, which traverses both, depth, but it is curtomary to call the longer of the first two, length, the shorter, breadth or width, and that which is extended downwards, depth[or thickness], while if its extension upwards is considered, height.
4. Al-j1hāt al-sitt. The boundaries of these three dimensions at both ends are known as the six sides, THE SIX front and back, of the breadth, as right and
SIDES left, and those of the depth as upper and lower.
5. Al-sath. The solid is necessarily terminated on each of its sides by a boundary; this is a surface:

THE Which like the roof of a house, is called
SURFACE bath, because of being on the top, or also on the solid. It possesses length and
breadth, but one dimension less than a solid, viz. thickness, because if it had that it would be a solid, and we have assumed it to be a boundary thereof. When a solid is of a deep opaque colour, it is the colour which is seen on the surface, because whatever there is below is concealed from vision. In this way it is easy to picture a surface to oneself, and still easier if you put oil and water in a glass and observe that they do not mix but are in intimate contact at a 'surface' between them. A surface is of two kinds, either plane or not[according to the solid].

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6. Al-Khatt. If a surface has boundaries, these are necessarily lines, and lines have length without breadth therefore one dimension less than the THE LINE surface, as that has one less than the solid;if it had breadth, it would be a surface, and we have assumed it to be the boundary of a surface. A line can be imagined by observing the oil and water at the side of the glass, or the line between sunshine and shadow, contiguous on the surface of the earth, or, also, it is possible to picture all that to oneself from a thin sheet of paper[although it has thickness], until the familiar sense-perception leads gradually to the intellectual concept.
7. Al-nuqtah. If a line is finite its extremities are points. Points have one dimension less than lines, Viz. length; they have neither length,
THE POINT breadth, nor thickness, and are indivisible. The point of a sharp needle may be taken as an illustration from the sensible world, but surface, in ne, and point, although they occur on the solids which bear them, apart from them cannot be apprehended except by the intellect.
8. Al-sath wall-khatt al-mustaqImãn. A plane surface is the shortest surface between two ines which are its boundaries, and a straight in e PLANE SUR- is the shortest line between two points which are its extremities. If on a surrespond to each other, 1 the surface is a plane surface; and similarly, if in a line the points are exactly opposite to each other it is a straight line.
9. Al-zāwiyah. An angle is the termination of a surface in a point at which two lines meet each other, but not in the same straight line. If both the lines are straight, the angle is a rectilinear angle, otherwise it is not.

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10. Kama anwàr al-zawảye. Such angles are of three kinds. When one straight line falls on another[like the tongue of a balance on the beamlif the resultant angles on either side are ANGIES equal, they are called right angles, quifimah, and the one inline is said to be perpendicular, ramada, to the other. If the angles are not equal, the line in question is not perpendicular; the larger angle is styled obtuse, munfarijah, and the smaller acute, hāddah.
ll. Al-shakl. A figure is that which is surrounded FIGURE by one or more lines.
12. Al-da'irah. A circle is a figure on a plane surface bounded by one line, the circumference, maple, dar. In the middle is a point, the centre markaz, from which all straight lines reaching the circumference are equal.
13. Al-qutr wall-watar. A straight line passing through the centre of a circle and reaching the circumference by its two ends is a diameter, DIAMETER Guar, which cuts the circle into two semiAND CHORD Circles. If such a line does not pass circles. If such a line does not pass which cuts the circle into two unequal parts, and the circumference into two arcs, daws, one larger than the other.
14. Al-sahm. A sagitta is the line between the middle of a chord and the middle of the corresponding

SAGITTA circle, and is longer than half the diameter if the arc is larger than a semicircie;shorter, if not.
15. Al-jaib al-arzam. The half-diameter of a cirTHE RADIUS ale is called a whole sine.

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16．Al－jaib al－mustawt．A natural sine is the half of the chord of a doubled arc，or if you prefer it，the NATURAL perpendicular dropped from one end of SINE the other end．If the expression jaib is used without qualification，it means a
natural sine．
17．Al－jaib al－ma runs．A versed sine is the sagit－ ta of the doubled arc or the line from one end of the arc to tie extremity of the sine opposite VERSED SIITS it．The greatest of all versed sines is is a radius．

18．Tamer al－gaws wa tambal－jaib．The complement of an arc is that which，when added to the arc，makes it
a complete quarter of a circle，and con－

COMPLEMENTS
SINE sequently when you subtract the arc from $90^{\circ}$ its complement remains．Also the complement of a sine is the amount re－ quired to be added to it to make a radius．

19．Anwã al－muthellathāt．Every triangle has three angles and opposite each is a straight line，the KINDS OF lative length of the sides the triangles TRIANGLES are either equilateral，mutasāwi al－adlar； isosceles，mutas⿷w⿳ al－sáqain，when two are alike and the third either longer or shorter；or scalene，mukhtalif al－adiar，when all differ in length；


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In accordance with the angles, either right-angled; gā'im al-zäwiyah, obtuse-angled, muntarij al-zāwiyah,or acute-angled, Lad al-zawaya.
20. ramū wa ga ridah. The perpendicular is the line proceeding from one of the angles of a triangle at right angles to one of the sides;and ar the base is the side on which the perv-
21. Masqit al-hajar. The place of fall of the stone is the point of the base which the perpendicular

WHERE THE reaches. Some people call by this name THE the smaller of the two parts into which STONE FALLS the base is thus divided, but such use is remote from what the word and its meaning require.
22. Asmā' al-adiar ghayr hadhihi. The side of a triangle opposite a right or obtuse angle is the longest side, if it is a right angle, the OTHER NAMES hypotenuse, quip or qatar. Of the FOR THE SIDES other sides, if they are different, one is designated the shorter of the short sides, the other the longer of these.



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 $\dot{L}$ بابتُنْ انـ
23. Dhaw figures, the first, murabbar, is the square in which all the sides are equal, and all the QUADRILATERAI angles right angles [like a tile] and FIGURES the diagonals joining opposite angles equal. The second is the oblong, mustatil, which is longer, has all the angles right angles, the diagonals equal, but only the opposite sides equal. The third is the rhombus, murayyan, [1.e., has chashma; by this expression $1 s$ meant that the diagonals are unequal just as chashma-yi tarazul means that one half of the beam of balance (stealyard) is longer than the other. ${ }^{2}$ It has all the sides equal, the diagonals different, and the opposite angles equal but not right angles. The fourth is the rhomboid, shabih bi'l-murayyan, which differs from the foregoing in having onif the opposite sides equal.
any other quadrilateral ilgure is called a
trapezium, munharaf. As to polygons, mudalla『āt, which have their sides and angles equal, these are named after the number (5,6,7,etc.) of the sides, mukhammas, musaddas, musabbar, etc.


[^5] the Persian version.

24. Al-khutū̀ al-mutawaziyah. Parallel lines are those on a plane surface, whose distance from each papal other remains constant, and which when produced continually in both directions do not meet.
25. Al-zaway al-mutagābileh. When two straight lines cross each other, four angles result, and the OPFOSITE ANGLES opposite angles are equal.
26. Al-zawaya al-mutabadilah. Then a straight line is drawn between two parallel straight lines, the angle which is at one side of one of ALTERNATE these two ines is said to be alterANGLES . nate to the angle at the other side angles are equal.
27. Zäwiyah khārijah min al-muthallath. When one side of a triangle is produced, there is formed an

## ANGLE EXTERIOR

 TO TRIANGLE angle called the exterior angle, and each of the two angles not adjacent to it is called an interior and opposits angle.| The distance | the same as |
| :---: | :---: |
| $※$ |  |
| here is | the distance here |


al-khārijah
min al-muthailath, $\qquad$ $\rightharpoonup$

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28. Zawiyah khärijah min al-khettain al-mutawäziyain. If the line drawn between two parallel lines be ANGIE EXTERIOR produced, there result, outside these TO PARALIEL which is equal to the interior and STRAIGHT IINES opposite angle on the same side of the line.
2. Mutawai al-ader. A parallelogram is a quadrilateral flgure of which the opposite sides are equal and parallel to each other, and the line which is drawn between opposite angles is called a diagonal, qutr-
30. Mutammān. When two parallelograms are constructed on the diagonal of a parallelogram in such a way that the extremity of the diag-
COMPLET:EENTS OF onal of one of the former is in conPARALIELOGRAM tact with that of the other, each of the two remaining parallelograms is called a complement, mutame.
31. ralam. The two complements with one of the parallelograms constitute a gnomon, ralam, which are show in the diagram by segments of


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32-36
32. Darb al-khatt fill-khatt. If of two lines an end of one is placed at right angles to an end of the other and caused to pass over it so as IINE $x$ LINE to describe a rectangular figure, the plane so described is a square if the lines are equal, an oblong, if unequal.
33. Mutamāssān. Tangency may occur between two circles, Internally if they are of different diameters, TANGENTS and externally whatever their relative dimensions; also between a line and a circle if the ine is straight and is in contact with the oircie, without the one cutting the other.
34. Shakl muhit bi'l-derirah. A reotilineal figure is said to be desoribed about a oircle when all its

FIGURE ABOUF sides are in contact with the
A CIRCLE circie.
35. Shakl muhit bihi al-dy'irah. A rectilineal figure is seld to be inscribed in a circle when

PIGURE WITBIN the latter passes through all the A CIRCLE angles of the former.
36. Zāwlyah allatti tagbaluha al-qaws. The angle which is recelved by an arc is the interval between two lines proceeding from the ends of the ANGIE IN A arc, and meeting in one point thereof, SEGMENT [and any equal angle is said to be accepted, pizrufta, by that arc].


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37. Daw al-dā'irah ida gutruhā wāhid. If the diameter of a circle is one (cubit or a span or any other measurement), the circumference RATIO DIAMETER- is approximately three and a seventh
-CIRCUMFERENCE times as much according to the in-
vestigations of Archimedes, who found that it is between two numbers, being a little less than the larger and a little more than the smaller. If half the diameter be multiplied by half the circumference, the result is the area of the circle, and in this example (diameter one) would be a half and two sevenths or 11/14.
38. Juz' wa amthāl. If one magnitude is used to measure another, and found to enter it several times AIIQUOT AND Without remainder, the former is

MULTIPLE called an aliquot part, jus', of the latter. The former is necessarily smaller than the latter, which is described as a multiple, amthel, ad at, of the former, because it contains it so many times.
39. Nisbah. Ratio is the relation between two things of the same kind, by which we know the measure of the one 0.3 compared with the other. Thus we call a man 'father' when we contrast him with his son, RATIO When we contrast him with his and the latter 'son' when comparing him with his which is double the former.
40. Tañsub. Proportion is the equality of two or more ratios between a series of terms, at least three in number, egg., the instil is onefifth of the second and the second one-fifth of the third, as 1 is to
5, as 5 is to 25.


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41. Adar mutanäsibah. When there are four terms, the ratio of the first to the second being the same as that of the third to the fourth, whether PROPORTIONAL the second and third are equal or no, MAGNITUDES then the first multiplied by the fourth is equal to the second multiplied by the third, also the third divided by the first is equal to the fourth divided by the second thus;

Multiplication between those which

42. Muqadaam wa taxi. of two terms between which there is ratio, that which is mentioned first is ANTECEDENT AND that which is mentioned second, and CONSEQUENT consequent, tali.
43. raks al-nisbah. Then there are four propertionals, and the second is to the first as the fourth

44. Ibdāl al-nisbah. When there are four proportionals, the first of which is to the third as the secPERMUTATION
and to the fourth, the proportion is
said to be by permutation; Our ex-
ample is one-third, es., $i$ : 5 :: 3 : 15.

$2!$


 Línéllob skol sinflilles, in -




45. Tarkib al-nisbah. When there are four proportlonals, and the sum of the first and second is to the COMPOSITION fourth is to the fourth, the proport ion is said to be by composition. Our example is a multiple and the fifth thereof, 5:1::15:3 6:7::18:3.
46. Tafoil al-nisbah. When there are four propr tionals, and the excess of the first over the second is to the second, as the excess of the third over the fourth is to the fourth, the proportion is said to be by divisDIVISION the proportion is said to be by divis ion or separation. As the first term in our example is oration can only occur after inversion, thus; 5:1::15:3 yielding 4:1::12:3.
47. Qalb al-nisbah. When there are four proportionals, and the iritis to its excess over the second, as the third is to its excess over the fourth, the proportion is said to be by conversion. Our example after inversion, 5:1::15:3, gives 5:4::15:12.
48. N1sbah al-musawot al-muntazimah. When the ratio of the inset to the second is the same as that of the third to the fourth, and that
PROPORTION BY of the second to the fifth the same ORDINATE EQUALITY as that of the fourth to the sixth, and so on for any number of properthionate terms, then the terminal numbers are also in proportion, 8 s in our example, the first $1 \mathrm{~s} 1 / 5$ of the second, and the second $1 / 4$ of the fifth, so the first is $1 / 20$ of the fifth, as is the third of the sixth.



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49. Nisbah al-musāwāt al-mudtaribah. then the ratio of the first to the second is the "same as that of the PROPORTION BY fourth to the sixth, and that of the

INORDINATE
EQUALITY third to the fourth the same as that of the second to the fifth, the miadie terms are not proportionate as in the last case, but the ratio of the first to the fifth is the same as that of the third to the sixth, then the proportion is said to be by inordingate equality, eeg.,

50. N1sbah muthannāh bi'I-takrir. When the same ratio is continued between a long series of terms in such a way that the ratio of the first to the second is the same as DUPLICATE RATIO first to the second is the same as that of the third to the fourth etc., then the ratio of the first to the third is said to be the duplicate, muthannah, ratio by repetition, takrir, of the ratio of the first to the second, and the ratio of the first to the fourth, the triplicate, muthallathah, ratio thereof,


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50-51.
and so on according to this analogy. Do you not see that if the ratio between these numbers is, for example, $1: 2$, then the first is $\frac{1}{2}$ of the second, and $\frac{1}{2}$ of $\frac{1}{2}$ of 1:2, then the first is $\frac{1}{2}$ of the second, and $\frac{1}{2}$ of $\frac{1}{2}$ of of the fourth, and $\frac{1}{2}$ of $\frac{1}{2}$ of $\frac{1}{2}$ of $\frac{1}{2}$ of the fifth, (the $\frac{1}{2}$ recurring four times).

The analogy is the same if you assume some other ratio, such as 1:3 or l:4, or any other fraction or multiple.

51. Nisbah miallafah. This ratio resembles the foregoing, the duplicate, except that in the latter the ratios between the terms are identic al, while in this, the ratios are different, such as $1: 4$, or $1: 5$. For instance, between two proportionate terms a third is interposed, and the ratio of the first to the third is said to be compounded of the ratio of the first to the second and that of the second to the third. Just as in the case of a road between two towns the distance

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is made up of the stretches between the various stages. Sometimes instead of the expression compound, tailif,it is described as duplicate, tathniyyah, it being said that the ratio of the first to the third is equal to the ratio of the first to the second multiplied by the ratio of the second to the third. But compound is presferable.

As an example of the compound ratio, let 2 and 12 be two terms and let 4 be interposed. The ratio between the first and the third, one sixth, is composed of the ratios between the first and second, and the second and third, viz., one half of one third; while if the proportion be inverted, the ratio between the third and first, viz., six times, is composed of the ratios between the third and second, three times, and the second and first, twice, viz., three multiplied by two.
52. Irtifar al-shakl The altitude of a figure is the greatest perpendicular from an angle ALTITUDE of the figure [internally] to its base, or OF FIGURE [externally] to its base produced.
53. Muthallathēt mutashābihah. Any triangle, the angles of which are severally equal to the angles SIMILAR of another triangle, is a IRIANGLES similar triangle, and the similar triangle, and nazäif, (which are opposite any two equal angles of the two triangles) have the same proportion to each other.

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54. Nisbah dhät wasat wa tarafain. Then a line is divided into two parts in such a way that the lesser is to the greater as is the greater to

DEAN AND
EXTREME RATIO號 the whole, the ratio is said to be cut in mean and extreme ratio.
55. Takāfi al-nisbah. This kind of proportion dipers from that dealt with in paragraph 41, in having the second and third terms on the same
THE STEELYARD side. It is well seen in the steelyard, garastün, 2 where the ratio of
the distance of the hook,
ragrab which carries the Bcale-chains, from the fulcrumrilāgah, is to that of the [adjustable] counterpoise, rummāna, from the fulcrum, as the weight of the counterpoise is to the weight of the load,thigl, which is being measured.

56. Quwwah wa tūl. A square is called a power, quwwah, bandits side, tull. When the power of a certain inge $\frac{15}{15}$ spoken of as equal to the PONER AND ROOT product of a certain line by a centain line, know that its square is equal to the rectangle designated by those two lines.
57. Al-muker mab. A cube is a solid body like the dice in nard, bounded by six squares disposed in the six relative directions so that its $A L-M U K A r_{A B}$ length, breadth, and height are equal.

[^10]
58. Al-manshūr. A prism has for its sides three surfaces, square or rectangular, and two triangles, one above and one below. Sometimes the squares THE PRISM may be replaced by rhombs and the rectangles by rhomboids.
59. Uatuwanah gáimah: a oylinder, ugtumanah, suturn ${ }^{P}$ is an elongated round body, bounded above and below by RIGHT equal and parallel circles, the centres of which are joined by the axis of the cylinder, which is the shortest line between these two points, while the side is the shortest line between their circumferences. It is generated by the rotation of a line perpendicular to the circumferences of the two circles.
60. Uatumenah mā'ilah. An oblique cylinder is one where the axis is not perpendicular to the ends. The top end bottom of a column need not OBLIQUE CYIINDER be circles, but may be any similar and equal figures, such as two triangles or two squares or other many-sided figure, mudallar.
61. Al-makhrūt. A cone is a solid whose base is a oircle or other figure, from which it diminishes to a point. It may be regarded as a cylinder THE CONE tapered from the base, the one end remaining as before, the other, the point,being the centre of the circle above. If the cylinder is a right cylinder the cone is a right cone, if oblique, oblique


A cone is always the third part of a cylinder [having the same base and altitude]. The aris, sahm, 1 of the cone is the straight line from the vertex to the centre of the base; and the side, the straight line from the vertex to the circumference of the base.
62. Qutūr al-makhrūt. ${ }^{2}$ [There are ifve different planes by hilch a cone may be cut into sections, as if by a saw], the first, through the vertex, the result being a rectilinear trianguler figure; the second, parallel CONIC SECTIONS to the base, producing a cirole, [smeliler than the base]; the third, parallel to a side, resuiting in a perabola, mukefi. If the plane of section, the fourth,is not perallel to the side of the cone, but meets the side within the cone toWards the base, and when produced emerges there, the section 1 s an ellipse, năqis; while 3 if 1t meets It towards the verter and emerges there, the section, the fifth,is a hyperbola, 2気1d.

These are the only sections of the cone, unless it is oblique, in which case the plane of section, although not parallel to the base may still produce a cirale if adjusted to the axis.
63. Al-kurah. A sphere is a rounded body bounded by one undivided surface; within it is a point, the centre,

THE SPHERF markaz, from which ali straight equal. If you imagine a circle rotating on 1 ts own diameter which remains stationary,

## 1 PL and $P P$ have $n \overline{i z}$ for tīr.

$2 P P$ has magrut throughout and drops a line describing the parabola.
3 should read:- while if,instead,it intersects the base and when produced towards the vertex reaches the side of the second cone (as in $P$ and above) it is a hyperbola etc.

on its own diameter which remains stationary, until the circle has come back to the point from which it started, a sphere has been described.
64. Bi kan shaky tuhitt al-kurah. How many figures (polyhedral) can be inscribed within a sphere? When the faces of the polyhedra are equilateral POLYHEDRA and equiangular and all equal and of one IN A SPHERE kind, only five [the five (Platonic) regular bodies]; and these five are related by resemblance to the four elements and the sphere. When, however, the faces are of various kinds, there is no limit to the number.

With regard to the five referred to; these are, first, the cube, bounded by six squares, called earthy; second, the icosahedron, by twenty equilateral friangles; it is the watery one; third, the octahedron, by eight equilateral triangles, the airy body; fourth, the tetrahedron, by four equilateral triangles, the prickly body, hassakI, fiery; and fifth, the dodecahedron, by twelve [equilateral and equiangular] pentagons, [the sphere]. ${ }^{1}$
65. Daw ait rizām wa sighär. The terms great and small circles are used only for those described on the surface of a sphere. The plane of a

GREAT AND
SMALL CIRCLES great oircle passes through the centre of the sphere and divides it into two hemispheres; it has two poles equidistant from the centre. If it is desired to draw a circle on a plane surface about a centre, the compass must be opened to the extent of a radius. 2 Similarly, to describe from a pole a great circle on a sphere, the compass must be opened to the extent of the side of a square inscribed in the circle.

The plane of a small circle, on the other hand, does not pass through the centre of the sphere; it divides the sphere into two unequal parts, and in consequence the distances from its centre to the poles of

[^11]
the sphere are unequal. All great circles on a sphere are of equal size, being the largest possible on the sphere. The dimensions of small circles, on the other hand, are not only less than those of great circles, but are unequal in size, and vary from what is just less than a great circle to the smallest possible size.

66. Khawass hadhihi al-dawaitir. Great circles on a sphere, in view of the fact that they are all of the same dimension, and cut the sphere $\begin{array}{ll} & \text { PROPERTIES OF } \\ \text { into two halves, necessarily intersect } \\ \text { THESE CIRCLES } & \text { each other because their being } \\ & \text { parallel or independent is absolutely }\end{array}$ parallel or independent a at two excluded. They cut each other into halves at two opposite points, and whenever one great circle passes through one of the poles of a second great circle, [it necessarily passes through its other pole] and 11 perpendicular to it, cuts it at right angles; likewise the second passes through the poles of the first.

The area of a great circle is quarter of the area of the sphere on which it is described, and in accordance therewith, when the diameter is multiplied into the circumference, the area of the surface of the sphere results.

With regard to small circles on a sphere, in view of the fact that their dimensions are less than those of great circles, and that they offer an uninterrupted sequence in decrease of size from these, they may be parallel to each other and to great circles, and may be cut into halves or unequal divisions by other circles great or small. They cannot be described by opening a compass to the side of an inscribed square, as in the case of great circles, but by different measures.
67. Qutb wa mihwar. We have already referred to the poles of a sphere from the point of view of drawing a great circle thereon; the pole
POIE AND AXIS represents here the centre of a circle drawn on a plane surface. But we also speak of the poles of a sphere from the point of view

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of its movement, for then if it moves in its own place, revolving by itself, there are two points opposite each other which are obliged to remain stationary as in a turner's wheel, shah al-kharratin. 1 The line joining these points, the axis, is also stationary wile the sphere is revolving.
68. Mintagat al-harakah. The equator of a sphere is the great olrcle hallway between the two poles of the movement of the sphere. On this EQUATOR OF account it is called mintagah, as reMOVFMENT sembling a girdle; this girdle revolves itself but its plane is not marked externally. Other great circles, however, are then marked externally on the sphere, or sections of it like the hoop of a tambourine, shankar al-daff. 2
69. Madērāt. Small circles on the surface of a sphere parallel to each other are called PARALIELS madërät.
70. Quasi. mutashābihah. Similar arcs on a plane surface are those which are intercepted between two

## SIMILAR

ARCS straight lines proceeding from the centre the largest of these. On the surface of a sphere, however, they are the portions of parallel circles intercepted between two great circles passing through the pole of these. Similar arcs are either all arcs of small circles or one may be an arc of a great circle; they are said to be similar because they are the same proportionate parts of the circles of which they are parts, whether on a sphere or on a plane surface. [If, for example, one is a third of its own circle, all the others are thirds of theirs.]

1 charkh-i huqqagarän. $P$. Charkh is the ordinary Persian word for a wheel, and occasionally appears as jarkh in Arabic; $\nabla$. Bocthor, Dict. Fr.-Arab. Vulg. under 'roue', while 'tour' is as usual mikhratah. Shahr (or jahr) is' an unusual word for a lathe, but is noted by Dozy; here by mistake, sam.
2 Arabic form of chanbar P. Meaning of last sentence obscure.


71. Shakl al-qutār. A spherical transversel figure results, when of four arcs of great circles intersecting each other, each two unite in one point;as when the points of the middle fingers of each hand are in
'SECANT FIGURE' contact, and the points of of the opposite middle fingers, as in the diagram.

In view of the fact that geometrical propositions make use of Arithmetic in the sciences of Astronomy and Astrology, we shall proceed in the first place to desoribe the properties of numbers.

> ARITHMETIC
72. Wähia. 'One' is thet to which the term Unity is applied. Complete in itself it does not admit of being added to or subtracted from, nor is it altered
ONE in substance from its original condition by multiplication or division. It has the powers of all numbers and all the properties pertaining to these, and has in addition a special technical function to discharge with regard to things which are numbered. In this sense it occupies on intermediate position between the higher numbers, wich result from the continuous addition of units, and the lower fractions into which it may be divided, and differs from both in that it does not alter by being multiplied or divided by itself, whereas the former are respectively

[^12]
respectively increased or diminished, and the latter diminished or increased by these processes while'one' occupies its own position between the two.
73. Kaif yatajaza'a al-wạhid wa ila kan juz ${ }^{\dagger}$. Although Pone is in reality indivisible, nevertheless

SUBDIVISION
OF ONE the unit employed in dealing with sense-objects, whether by weighing, measuring by bulk, or length or number, or merely in thought, is obviously ${ }^{1}$ capable of sub-division, tajzī'ah, for as a technical expression one only means unity, wapdaniyyah. In the science of Astronomy the unit employed is the degree, darajah, it is divided into sixty parts, smaller, adage, than the first and these are called minutes, dagEig, on this account. This method of division is customary in dealing with money, the dirham is divided into sixty fuluss, 2 and in mensuration, the jarib3 has sixty rashir. Again these minutes are divided into sixty seconds, (the second time of division) and the second into sixty thirds and the thirds into sixty fourths, and so on for the whole series of natural numbers as far as the arithmetician desires in any particular case.
74. Faded. A number is defined as a sum of units: one is therefore excluded from the category of numbers NUMBER and is not called a number.
75. Al-radād al-tablyyah. The natural series of numbers results from the successive addition of a unit to one and is, therefore also known as mutawali $., ~ c o n s e c u t i v e, ~ l i k e ~ l, ~$ $2,3,4,5$.

[^13]
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76. Zawi. Even numbers are those which are divisbible into equal parts, i.e., halves; the first of these EVEN $4,6,8,10$, etc.
77. Fard. Odd numbers are those not so divisible, except by making use of a fraction; the first is three and the successive odd numbers $3,5,7,9,11$, ODD etc.
78. Zap al-zamj. Evenly-even numbers are those which can be divided into halves, and each half into halves, and so repeatedly until the quotient is one.
79. Zap; al-fard. Unevenly-even numbers are those which admit once of division by two yielding an odd number as quotient, not one, like UNRVENLY-EVEN ten.
80. Zawj al-zawj wail-fard. Evenly-even-odd numbbens are those which admit of being divided into halves more than once, but the division EVENLY-EVEN-ODD does not extend so far as to yield a quotient of one, like twelve.
81. Fard al-fard. Oddly-oda numbers are those which are divisible by an odd number with an odd number as quotient; such as aline, into which ODDLY -ODD three enters thrice, or fifteen, into which five enters thrice and three five
82. Mā al-radad al-awwal. A prime number is that Tho has no other factor than unity, and no fraction except that resulting from division by PRINE NUMBER itself and called after itself, like five, in which one is contained five times, and of which fifths are the only fractions; or like seven, of which one is the seventh part, sevenths the only fractions, and into which no other number enterse without remainder.
83. 俉 al-radad al-murakkab. A composite number









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has more than one factor, and has fractions other than those bearing the same name, like six, in which one is contained six times, two three times, and three twice, the corresponding fractions being a sixth, a third and a half.
84. Mar al-radad al-musattah. A plane, musattah, number is that which results from the multiplication of PLANE NUMBER $\quad$ numbers are the same the result is numbers are the same the result is
a square, murabbar, and one of the two numbers multiplied, its root, jldhr. For example, if three be multiplied by three the product, nine, is a square, the root of which is three. If the two numbers differ by one, the plane number is said to be altered, ghayri; this is the case with twelve which is the product of three and four, while if they differ by more than one the result is a rectangular number, mustatil.

Twelve is also an example of a rectangular number, for it is the product of two and six, a difference of four between them, and so from one, point of view it is ghayri, and from another mustatil. ${ }^{1}$
85. Ma al-radad al-mutanmam. When the root of a square number is multiplied by the root of another COMPLETE NUMBER $\begin{aligned} & \text { square number, the product is a } \\ & \text { complete number, mutammam, because }\end{aligned}$
 twice the complete number yield another square number, whose root is the sum of the two roots in question.

For example six is a complete number, being the product of two by three, the roots of four and nine, and twelve added to the sum of these squares gives twenty-five, whose root is five, the sum of two and three.

[^14]
86. Mä ala rdāa al-mushtarakah. These are numbers like 15,25,30, which share (sharaka) a common factor other than one, for each of them is aiNUMBERS TIMH visible by five without remainder, and COM LON FACTORS shares in having the fraction called after five viz. a fifth. And these fifths have a definite relation to each other and to the numbers themselves, for the fifth of fifteen is three-fifths of the fifth of twenty-five, and the fifth of twenty-five is five-sixths of the fifth of thirty. The number which is shared by them, the common factor, is called wafd, and when they have all been divided by it, the quotients are styled matwiyyat.
87. Me ala rad al-mutabāyinah. These are numbers like seven and ten, which have no common factor other than one, and do not share in other SEPARATE NUMBERS particulars. They are therefore spoken of as separate numbers.
88. ME al-radad al-tāmm. A perfect number, tam, is one the aliquot parts of which being added together yield the number in question, like PERFECT NUGBER six; for half of six is three and a third two, and a sixth one, all of which being added together make six.
89. Max al-radad al-nāqieq wa al-zĒ'id. A deficient number, nagis, is one the fractions of which added togather amount to a sum less than the DEFICIENT AND number in question, like eight; for ABUNDANT NUNBERS its half, four; and its fourth, two; and its eighth, one; amount to seven, less than the eight itself.

[^15]














90. Ma awardEd al-mutahabbah. These are any two numbers, the fractions of one of which being added toAMICABLE NUMBERS Der One of each such pair is alrays abundant, the other deficient An example of such a pair is furnished by 220 and 284. The former is an abundant number; its fractions are:a half, 110 ; a quarter, 55 ; a fifth, 44; a tenth, 22; a twentieth, 11; a hundred and tenth, 2; a twenty-fifth, 4; a forty-fourth, 5; a twenty-second, 10; an eleventh, 20; and a two hundred and twentieth, 1; which numbers being added together make 284.

The other number of the pair is a deficient number; its fractions are:- a half, l42; a quarter, 71; a hundred and forty-second, 2 ; and a two hundred and eighty-fourth, 1. These add up to 220, and the numbers of this pair are therefore called amicable numbers.
81. Ma al-ardad al-mufassamah. These so-called solid numbers result from the multiplication of one number by another and the product SOLID NUMBERS by a third. If the three numbers are all alike, the product is a cube, mukarrab and one of the three, the cube-root, ka m. Sometimes this name is given to the cube itself, In which case the root is spoken of as a side, dill.

For example, if three is multiplied by itself and the product again by three, the result is 27 . This is the cube, mukerrb, and the cube-root, karo, 3; or the cube, ka rb and its side gilt, 3. If two of the three numbers are alike, and the third smaller, the result 18





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91-92
like a brick, libniy. For example; I multiply the three by three and the product, 9 , by two, the resultant eighteen is a libniy number. On the other hand if the third number is larger, the result is known as tiriy resembling ir, the main beam of a house, $P$ or judhu, the trunks of trees.

For example; I multiply the three by three and the product by four, the result is thirty-six, a tiriy number. Should all the numbers be different the result is a lauhiy number, [lakh, a table;] for example; I multiply" the three by four and the product by five making sixty; this is a lauhiy number.
92. Ma al-a rad al-muthallathah al-mutamäliyeh. Successive triangular numbers result rom the summation of consecutive natural numbers
TRIANGULAR NUMBERS beginning with one. They are called by the Hindus gankalita. One which has the powers of all the numbers, is the first triangle; one added to two makes three, the second triangle; the third triangle, six, is formed by the addition of one, two and three; while the fourth, ten, is the sum of one, two, three and four; and so further on this analogy. The figure is intended to show the relation of the triangles.


29











93. Mā alta rdād al-murabbarah al-mutawāliyah. Successive square numbers are arrived at by the summa-

SQUARE NUMBERS with the addition of three yields four, the second square, the product of two by two. By adding five to four we have the third square, nine, the square of three, which with the addition of seven gives sixteen the fourth square, four by four.

The figure verifies the foregoing.
94. Ma al-ardäd al-makhrūtiyyah. Conical numbers are obtained by the summation $\delta \bar{f}$ successive triangular CONICAL NUMBERS numbers; is one, to whion the second friangular number three being added gives four, the second conical number. With the addition of six, the third triangular number, we have ten, the third conical number, [and by adding ten, the fourth triangular numbber, we have twenty the fourth conical number].

The figure ${ }^{l}$ facilitates the conception of these.



[^16] has the numbers $1,3,5,7$ instead of $1,3,6,10$.

95. Mā al-arā̄d al-ahrāmiyyah. Pyramidal numbers are piled up like the arrangement of the weights of a balance, one above the other, the

PYRAMIDAL
NUMBERS smaller uppermost, like steps and stairs. When the steps have the same height like successive squares, as $1,4,9,{ }_{16}, 25$, the sum is called by the Hindus vara ${ }^{2}$ sankalita; when different, like successive cubes, ghana sankalita, $1,8,27,64$.

The properties of numbers and the technioal terms applied to them seem to be interminable just as numbers are; we shall, therefore, proceed to mention some of the processes in which they are used.
96. Ma al-hisāb. Arithmetic is the treatment of numbers and their properties in solving problems by way of addition end subtraction, 1.e.
ARITHMETIC increases and decreases.
97. Max al-darb. Multiplication is the taking one of two numbers and adding together so many fold ${ }^{3}$ of itself as there are units in the other number. For example, if we wish to MOLTIPLICATION number. For example, if we wish to equivalent to adding seven fives, the sum of which is thirty-five; similarly the addition of five sevens gives the same result; for the meaning of our expression five by seven is the amount of five taken seven times or seven taken five times.
98. Me El-q1smah. Division is the ascertaining of
 DIVISION dividend, al-maqsūm, which has to be DIYISION divided into a certain number of parts by the divisor, al-maqsūm ralaini. Such share is called the quotient, ism.

For example, I have to divide thirty-five, the dividend, by seven the divisor. Let us call the dividend

[^17]م缃















## 99-101

a sum of money, mall, and the divisor a number of men, the share of each man will be five and this is the quotient.
89. Ma al-tamwil wa'l-tajdhir. When a number is multiplied by the same number the product is the square, mel, of that number, the operation, squaring, being called tamil. For example, if seven be multiplied by seven the product, forty-nine, is the
SQUARE AND
SQUARE-ROOT
Tajahir on the other hand, is the square of seven. Tajdhir on the other hand, is the ascertaining give the square in question, in this case the number seven. This is ailed the root, jidhr or asl, because the side of the square, dill, is the original dimension to which it is related.
100. Ma al-j1dhr al-muntaq wa'l-aserm. There are rational, muntag, and irrational or surd, sam, roots; the former, known also as mantua bini, SURD ROOTS pressed in whole numbers, like three in relation to nine, or four in relation to sixteen, but the latter cannot be so expressed. It is impossible, for instance, to find a number which multiplied by itself will yield ten, and the effort to do so merely ends in a surd root, called sam, because there does not exist any method of arriving at it except approximately.
101. Mem al-takrib wal-tadiI! Cubing a number
take 1 ib , is multiplying it by itself and the product by
the original number; 3 the result is a
CUBF AND cube, mukarrab. For example, three
CUBE-ROOT multiplied by three gives nine, and
nine multiplied by three gives twenty-
seven. The extraction of the cuberroot, taif, is the
finding of the number which after being so treated

## 1 delete sittah

2 MS has aldan.
3 PI mithini is omitted.







 لتّ"عشٌ




 المكفت منوّن
gives the cube in question, in this case the three whose cube is twenty-seven. This number is called the side of the cube, dill. Sometimes it is called karo, but by the people generally the cube itself is known as ka'p for short, so we are constrained to name the root ail' instead of ka rb to avoid ambiguity.
102. Me al-takhatti. The method of trial and error, takhatti, is used in extracting the square or cube root.

TRIAL AND
ERROR

You neglect one or more ciphers, and [assume an approximate value for the unknown quantity] saying in the case of the square root, yakūn, IE yakut, yakūn, [it is, it is not, it is;] and in that of the cube root, yakūn, 1 ㅌ yakūn, la yakūn, yakūn. Some people instead of yakun say yarti - it will give (the answer) - until the last position is arrived at, Which satisfies all the ciphers.
103. ME al-mukhraj. ${ }^{1}$ The denominator of a fraction is the number of the parts into which the integer is divided, and the fraction is less than DENOMINATOR that number. Take for instance, the three of a third, for the latter is one part of the integer if that is divided into three parts So also two-thirds are two of these parts. Similarly four stands in the same relation to a fourth, as does five to a fifth. The denominator should always be the smallest in which the fraction can be expressed, for thotenths and three-firteenths are each of them one-fifth, and while there is no limit to higher terms, there is to the lowest, wherefore the latter are preferable.
104. Mäal-tajnls. In order to make integers and fractions homogeneous, tajnis, the integer must be multiplied by the denominator of the sum, so that the whole is now of one kind. For example, three and a quarter may be expressed as three wholes and one of four parts of a whole; to make them homogeneous we must multiply the wholes by the denominator, four, making twelve fourths to which

I So vocalized in Elias ${ }^{(1)}$ Eng. -Arab. Dict. Madam is the usual expression for denominator, as is bast for numerator, and mukhraj really refers to the lowest terms in which a fraction can be expressed. $\nabla$. Dict. Sci. Terms.

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there has to be added one fourth in all $13 / 4$. Or if there are two different fractions such as $2 / 7$ and $3 / 5$, and you desire to add them, then the denominators must be multiplied, $7 \times 5=35$ which becomes the denominator for both fractions. Now $2 / 7$ of 35 is 10 and $3 / 5$ of 35 is il, so that when these are added the combined fractions rendered homogeneous become $31 / 35$.

In the case of fractions in the sexagesimal sale used in Astronomy, such as minutes and seconds, thawanj, and whatever fractions are beyond these, when It is desired to me them homogeneous, the highest denomination must be multiplied by sixty, the next lower must be added to the product, and the operation repeated until the lowest is reached, and all are of the same denomination. [manzil. pl. manāzil]

For example, we have to make homogeneous three minutes, four seconds and five thirds, thawalith, then $3^{\circ} \times 60^{\prime}=180^{n}+4^{11}=184^{n} \times 60=11040^{m}+5^{m}=$ $11045^{\prime \prime}=$
105. Ka raf al-radad. Then we have a number in one of the denominations of the sexagesimal system, more than sixty, we raise it to the next ASCENDING higher denomination by dividing it by REDUCTION sixty, and this operation is repeated until we have if possible only whole

## degrees.

For instance we have 11045 seconds which it is proposed to raise to a higher denomination. Divided by sixty we have 184 minutes and $f 1$ ie seconds, and when this is repeated the result is $3^{\circ} 4^{\prime \prime} 5^{\prime \prime}$.

[^18]














106. M自 al-tayy. ${ }^{1}$ This is the reduction, tagline, to their lowest terms of two numbers which share a

REDUCTION TO LOWEST TERMS common factor, by dividing each of them by their highest common factor, wafd. For example if we have the two numbers seventy two and three hundred and sixty, seventy two is the wafd between them, divided by which, they yield one and five their lowest terms, and $1 / 5$ is equal to $72 / 360$.
107. Ma al-marātib al-tabīriyyah. When one is miltiplied by any other number and the product multiplied repeatedly by the same number, there

NATURAL SERIES POWERS results a series of proportional numbers the so-called powers of that product. The first power, martaban, after the one posited, is called the root; the second, the square; the third, the cube; the fourth, the square of the square; the fifth, the square of the cube; and the sixth, the cube of the cube; and so further on this analogy. The ratio of the one, with which we begin, to the root is the same as that of the root to the square, and of the square to the cube, and of the cube to the square of the square etc.

The example shows the first to the sixth powers of two and three.

| Names <br> of <br> powers | One | Root <br> lehr | Ind <br> Square <br> man | 3rd <br> Cube <br> garb | fth <br> Square <br> $\times$ <br> Square | fth <br> Square <br> $\times$ <br> Cube | Eth <br> Cube <br> $\times$ <br> Cube |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $1 \times 2$ | 1 | 2 | 4 | 8 | 16 | 32 | 64 |
| $1 \times 3$ | 1 | 3 | 9 | 27 | 81 | 243 | 729 |

[^19]








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 الهالمال وكنْبّة مالالالالى ألز

108. Man al-maratib al-wad riyyah. The conventional grouping of numbers, depending on their relative posiion, used in the operations of arithmetic, is one of the methods DECIMAL NOTATION arithmetic, is one or the methods in multiplication and division. It is a decimal between the various groups is based on the number ten.

The first group is that of the units from one to nine, advancing by one; the second, the tens, from ten to ninety, by ten; the third, the hundreds, from one hundred to nine hundred, by a hundred; and the fourth the thousands, from one to nine thousands.

This fourth group in so far takes the place of the units that the tens of thousands follow it in the same way as the tens follow the units, and the only difference between them is that the increment is by thousands.

Again when the actual position of a number in a particular group is established, it is invariably onetenth of the number occupying the same position in the succeeding group.

Should any group lack a number, a sign is used to indicate the vacancy. We employ for this purpose a small circle,o, and call it a cipher, sift, or zerol but the Hindus use a point,...

The accompanying figure illustrates numbers in their respective groups, indicated by the separate columns.

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If we desire to write this sum or to express it by word of mouth, we say nine thousand thousand thousand thousand and eight thousand thousand thousand, and six hundred and seventy-ifve thousand thousand, and thirtyfour thousand and one hundred and two.
[Nine billion eight thousand six hundred and seven-ty-five million, thirty-four thousand one hundred and two.]
109. Ma al-jabr wall-muqēbalah. If things of different nature in the scales of $a$ balance are in equilibrium, the scales remain parallel, the
ALGEBRA tongue vertical and the beam level. It is obvious that if you take anything from one of the scales of one kind you must remove the like from the other both in kind and amount so as to preserve the equilibrium and the previous condition. Similarly, if equilibrium and the previous condition. Similarly,
you add anything to one scale you must add a like you add anything to

Should there be a minus quantity on ope side it is necessary to remove it and to restore the equilibrium by adding a like amount to the other side. This is the operation of jabs; for example, if we have on one side 100 dirhams minus 14 dinars and on the other 13 staters

1 jabara; cr. Mujabbir, A bone-setter and Spanish Algebrista, Fl que profess la álgebra, $\delta$ arte de concertar los huesos dislocados. (Cañes, Dict. Esp. Arab.)




 ك ,

statersl of iron plus 12 dirhams, the operation of jabs eliminates the minus quantity and completes the 100 dirhams so that we have

100 dirhams $=13$ stators -12 dirhams +14 dinars and if the same operation be carried out on the other side we have

112 dirhams $=13$ staters +14 dinars
When the operation of jabs has been concluded, we turn to that of muquabalah which consists in comparing things of the same nature, majanasat, which may be on opposite sides, and then deducting the smaller of these from both sides. For example:- if we have

112 dirhams $=13$ starters +12 dirhams
by deducting the last item we have

$$
100 \text { dirhams }=13 \text { staters }
$$

110. Mä al-mufradāt al-mutarädilah. Algebra deals With three elements: if a simple number unrelated to the others; 2/ another number so related, $\begin{array}{cl}\text { SIMPLE } & \text { mudāf, the root of a square number; and } \\ \text { EQUATIONS } & 3 / \text { the square number itself. In simple } \\ & \text { equations mufradät, these are associated }\end{array}$ in three different pairs: $1 /$ roots equal to number; 2/ squares equal to number; $3 /$ squares equal to roots. 2

1 Gr. oraríp, A.istar, P.sitIr. The stater $=4 \frac{1}{2}$
mithqais or dinars, and the dinar $=13 / 7$ dirhams. The stater, therefore, is $63 / 7$ dirhams. The equations above come out 7 and 7, 7 respectively. For Arabic weights, see Wiedemann's account of these from Mr t, Beitr.XXII,304.

$$
2 \text { egg. } 4 x=16 ; 4 x^{2}=64 ; x^{2}=4 x
$$








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111．Ma a．l－muqtaranat al－mutaradilah．${ }^{1}$ These aqua－ ions of the second degree result from the association， mugtarinah，of a third term，either
COMPOSITE $\frac{\text { squares，} \bar{T}}{\text { spots，}}$ or number with the two of EQUATIONS each of the foregoing simple equations． The first of the three resultant equations is SQUARES＋ROOTS＝NOMBER，which means that one or more squares associated with one or more roots are equal to such and such a number．For example：－a square plus ten of the root is equal to thirty－nine；the square is nine and the root three．

The second maqriln is SQUARES＋NUNBER＝ROOTS． This particular form in some cases admits of two ans－ wers eeg．，a square plus thirty is equal to thirteen roots and this is satisfied either by a hundred with root ten or nine with root three．

The third maqrün is ROOTS＋NUMBER＝SQUARES eng．， six plus ten of the roots is equal to the square；the square is thirty－six and the root six．

112．Max al－shai ${ }^{2}$ ．This is a technical term for an unknown quantity；it means＇thing＇；and corresponds to＇$x$＇in modern algebra．When multiplied ＇x＇by itself it gives shay＇square．

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113. Kaif dare al-shai'. Shay' when multiplied by a number $n$ gives n shat, when multiplied by minus $x^{2} \quad$ ( $\frac{111 \bar{Z}, \text { camp }}{}$ ) shad' gives a minus square, multiplied by a number the result is minus n shay', and when minus shaft is multiplied by itself a positive square, mil zäld results, because the minus sign, istithné', is not abolished except by multiplicatron by itself.
114. Mä hisāb al-dirhem wall dinär. This is a method of reckoning derived from Algebra. As there are sometimes more unknown quantities than
$$
\text { y. } z \text { one, it becomes necessary to have names }
$$ for them. Some people call them dinars, dirhams and fucus, while others adopt the Hindu method of naming the ashy' black, yellow and gray. 1
115. Ma hisāb al-khatārain. A number is assumed which appears to be suitable for solving the problem; RULE OF if a test indicates its accuracy, it is $T$ TO ERRORS it has led to en error, the amount of that must be noted and the process repetted after the unsuccessful guess, when either you hit upon the correct answer or else you have a second error. Then the answer can be deduced from the two erross by $a$ method which is known [to Arithmeticians].?
116. Kaif ithbāt al-a rdäd bi huruf al- arab. The notation of numbers by arabic letters is a matter of agreement and convention; for it ARABIC IBTTERS would have been possible to use the
FOR NUMERALS letters in the ordinary order of the
alphabet, $a$, $b$, th, etc., because there are nine units, nine tens, nine hundreds, which, Th a sign for a thousand, are provided for by the twenty-eight letters.

[^22] ©



However, people selected the order of the huruf aljummal because this was widely diffused among people of the Book before the time of the Arabs. The mode in which the letters are apportioned to the several numbers is shown in the accompanying table.

117. Hal ikhtiläf final. The object in using these letters is economy of space and ease of writing MOROCCAN USAGE numbers especially in astronomical tables. Among astronomers there is no disagreement as to their use, but there are perverse people outside the profession who put sa' 'fad for sa'fas, thus making $s 60$, and $d 90$, and qarasát for qarashat, basing their objections, some on linguistic, others on religious grounds; but this is all nonsense. Were it not that a general agreement has

[^23]
been arrived at as to this order by its users, their objection might be allowed, but it would constitute a departure from an established custom.
118. Kaif yakūn tarkibhä. Certain rules have to be observed in combining these letters. Of the units, tens

COMBINATION and hundreds, the hundreds come first,
OF LETTERS 115 is written $\overline{q y h}$, and [when written in black]P must have a line over it to show that it is not a word. So 105 is written qh , and 42 mb , and 1002 ghb . On the other hand 2000 is written bgh, the smaller number coming first to distinguish it from gib, and to show what is intended.

The customary way of writing these letters is that jim 3, is written without a tail to distinguish it from hah: 8 ; little attention need be given to khat 600, as astronomical calculations are concerned with numbers less than 360; [it is pointed without a tail]. YE' must have its tall drawn backwards, in ouse it should be wistaken for a nun with its point. Kaif must be written horizontally, so as not to resemble lam, and nūn must be written larger_than $z \bar{a}$, and pointed, for $z \bar{a}$, also is pointed, and ram' unjointed. Shin 300, must be pointed to distinguish it from sin 60, and attention must be paid to other pointed letters.

When nūn or yah' are combined with units, IF 51 , $\overline{\mathrm{ya}}$ ll, nun must be pointed, and indeed the jat also should have its points.

When zero, sift, hes to be written in places lacking a number, its circle must have a line over it, $\gamma$ touching, to distinguish it from hal, but in the Indian notation this line is unnecessary, for there, there is no resemblance to hā'.

Generally the right end of the line in question is continued downwards to the left to join a very small coircleo $\quad$, or the circle has two horns, $\gamma$; compare $\gamma$ and $\mathrm{h} \overline{\mathrm{a}}$. in future tables.




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119. Hal tustarmal hadhihi '1-huruf ii ghayr ala ${ }^{\text {abd. The same letters are used for another purpose, }}$ namely, for designating the signs of the zodiac as in the following table:-

## FURTHER USE OF IFTTIERS

Names of Signs. Symbols


The foregoing amount of arithmetic will suffice for anyone who desires an introduction to it.

Now, however, we must proceed to the description of the form of the heavens.

## ASTRONOMY

120. Ma al-falak. The celestial sphere is a body like a ball revolving in its own place; it contains within its interior objects whose moveTHE CELESTIAL ments are different from those of the SPHERE sphere itself, and we are in the centre of it. It is celled falak on account of its circular movement like that of the whirl of a spindie, and its name, athir, (ether) is current among philosophers.
121. A huwa wēnid au akthar. There are eight such spheres enclosed the one Within the other, like the skins of an onion; the smallest sphere MORE SPHERES is that which is nearest to us, Within THAN ONE ? which the moon is always traveling alone, rising and setting, within its limits. To each sphere there is a certain amount of space between the outer and inner boundaries so that the planet to which it belongs has two distances, the one further, the other nearer. The second sphere above that of the moon belongs to Mercury, the third to Venus,

the fourth to the Sun, the Fifth to Mars, the sixth to Jupiter, the seventh to Saturn. These seven spheres belong to the planets, but above them all is the sphere known as that of the fixed (or desert)P stars. The accompanying diagram represents them.

122. Nah allah $\overline{1}$ warā' al-falak al-thāmin. A number of people consider that beyond the eighth sphere there is a ninth entirely quiescent; it is this which the Hindus cell in their language brahmana, $1 . e .$, the egg of Barāham, because the prime

[^24] , بابْ


mover must not be moved, and it is on this account that they describe it as motionless. But it is possible that it is not a body like the other spheres, otherwise its existence could be demonstrated, and that to apply this name to $1 t$ is an error. Many of our ancestors considered that beyond the eight spheres there is an infinite empty space, others, a boundless quiescent substance, while according to Aristotle there is neither substance nor void beyond the revolving bodies. ${ }^{1}$
123. Mex al-samá'. The word same' refers to anything which is above you or covers you. In a restricted sense it refers to the clouds or the
THE HEAVENS roofs of the houses, but when used without qualification it corresponds to the
 the spheres of which we have been speaking. The word āsmān, i.e. like a millstone, ( $\bar{a} s$ manand ${ }^{P}$ ) shabih billrahăc refers to the circular movement.
124. Ma alladhi ii hashw falak al-qamar. In the centre of the sphere of the moon is the earth, and this centre is in reality the lowest part

## CONTENTS OF

MOON'S SPHERE (and this is a real centre, because all heavy things gravitate towards it) The earth is, as a whole, globular, and in detail is rough-gurfaced on account of the mountains projecting from it and the depressions on its surface, but when considered as a whole it does not depart from the spherical form, for the highest mountains are very small in comparison with the whole globe. Do you not see that a ball of a gard or two in diameter, covered with millet seeds and pitted with depressions of similear size, would still satisfy the definition of a sphere. If the surface of the earth were not so uneven, water coming from all sides would not be retained by $1 t$, and would certainly submerge $1 t$, so that it would no longer be visible. For water while it shares with earth in

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having a certain weight, and in falling as low as possible in air, is nevertheless lighter than earth, which therefore settles in water sinking in the form of sedimeat to the bottom. Moreover water, although it does not penetrate earth itseLf, sinks into the interstices thereof, and there becomes mixed with air, and as a resuit of the intimate contact becomes suspended in the air. When the air escapes to the outside, the water regains its natural state in the same way as rain falls from the clouds. On account of the various irregularities projecting from the surface, water tends to collect in the deepest places ${ }^{l}$ giving rise to streams.

The earth and the waters together form the one globe, surrounded on all sides by the arias much of the latter as is in contact with the sphere of the moon becomes heated in consequence of the movement and the friction of the parts in contact. Thus is produced the fire which surrounds the air, less in amount in the proximity of the poles owing to the slackening of the movement there.

125. Max al-kawảkib al-thābitah wa 11-saiyārah. The fixed stars are those which stud the whole heaven, whose distance from each other is fixed STARS AND PLANETS to all eternity, so that they neither approach each other nor separate from each other. In Persian they are called the desert stars blyābānㄹ, for finding the right way through deserts depends on them.

The planets, on the other hand, seven in number, each moving in its own sphere, continually alter their distance from each other and from the fixed stars, sometimes being near and sometimes opposite, in virtue of the ifference in the rapidity and character of their movements.

[^26]2 124 is quoted by Yaqutin the Geographical Dictionary. V. Wiedemann, Arch. Gesch. Naturw. U. Technic, I, 26: and cf. Chron. p. 247.

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126. Mä al-harakat al-ūià al-gharbiyyah. Everyone sees that the sun, the moon and stars are engaged in a 1rst or westward movement; they rise MOVEMENT course, and then descend little by litcourse, and then descend lithle by returning to the place where they rose. 1 It is owing to the heavenly bodies that this movement is perceived; it is well-known to animals as they disperse in search of food, more so indeed than to man, for there are animals whose movements correspond with it like the chameleon, 2 which facing the sun turns with it, as do the leaves of many plants, notably, vetch, mäsh, and liquorice, stis. 3

It is called the first movement es it is this movement of the heavenly bodies which first attracts our attention, and gharbiyyah, because the goal of the course reached by them is setting in the west.
127. Më al-harakat al-thäniyyah al-sharkiyyah. The second or eastward movement of all planets is towards the quarter where they arose; but
SECOND EASTERLY
MOVEITENT the movement of the fixed stars is very small, and on account of the fact that the distance between them remains the same, they are called fixed, whereas the motion of the planets is much greater, more obvious, and also of varied nature.

It is most obvious in the case of the moon on account of its rapid movement, for, from the time when the moon appears in the west,it moves further away from the sun and any star which is between it and the sun, and ap-

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approaches any star which is on the other side of the sum from it. When it occults one of these, it does so with its eastern border and clears it with the western.

This second movement is common to all the planets; it is an inverted replica of the first, but is not an exact counterpart, for it deviates from it slightly. It is called second, because it is different in amount for each planet, while the first is uniform and prevails over all the second movements, although in the opposite diraction. It is like the movement of a ship whose passengers may walk in the direction of the current, while they are all being carried up stream by the ship; the uniform movement prevails over the contrary one by reason of greater efficiency. 1

The second movement is not obvious like the first, but requires some consideration and reasoning based on observation. It is called sharqI, eastward, on account of its direction towards the rising of the sun.
128. Ma al-ufq. Only about half of the vault of heaven is visible to the observer; it is like a dome placed over the earth, its margin
THE HORIZON forming a circle round about him. Whatever is above this circle, known as the horizon, is visible to him.

There are two kinds of horizon, the one sensible or visible, hiss, the other true or astronomical, haqigi. The sensible horizon is that already referred to, which we always see when on the surface of the earth, and which divides the celestial sphere into two parts, an upper smaller one, and a lower invisible to us.

The true horizon is parallel to the other, but on a plane passing through the centre of the earth and cutting the celestial sphere into two equal parts. That which is between the two horizons is small in amount so as not to be obvious when the sphere is large [the cellostia sphere] but large when the sphere is small [the earth].

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129. Méalak niff al-nahēr. Everywhere in the world day is caused by the track of the sun from its rising to its setting; its course is called the arc of day, and the circle which passes through the zenith and everywhere divides the day into two halves is called the meridian. Every point in the celestial sphere which becomes visibile rises towards this circle, reaches it, and then begins to sink till it disappears towards the west.
1.30. Ma jihät al-rālam. The cardinal points are the places, mahabb, from which blow the four familiar winds. The zephyr, which comes ry om the east, is called paba and gabul,
CARDINAL POINTS the east, is called paba and gabul the karbah; the dabur comes from the west from behind the karbah; and the north wind, al-shamal, from the direction of the pole, 1.e., from the left hand, shimal, of any one facing east; it is called jirbiya. in Syriac (a name which is familiar although not of our language).P

The south wind, al-janūb, blows from the opposite pole, from the right, yamin, of one facing east; it is on this account that this region is called janus and yamen, and in syriac, tayamnä.

The names of the intermediate quarters are not very current (except among the Hindus, where they often conflict with each other), but any wind blowing from one of these is called a side-wind, nakbä.
131. Fa kaif istikhrāj hadhini al-1ihāt. In order to establish exactly the direction of these four quartors, level a piece of ground as far as possible, until you get it in such a condition that water poured on $1 t$
INDIAN CIRCLE haphazard flows evenly in ali directions, without any and is levelled then draw a ofrole on it of diameter, and fix in the centre a sharp-pointed stick diameter, and fix in the centre a sharp-pointed stick the length of half the radius. This must be perpendi passing from the point to the centre of the circle.

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Then watch the shadow in the first half of the day as it extends to the west and gradually shortens, and when it enters the circle, mark that point of the oircumference; similarly, in the afternoon, when it lengthens and passes out of the circle, that second point. Join these two points of entrance and exit by means of a cord or rule, bisect the line so obtained and join the middle point to the centre of the circle by a straight line which cen be produced to the north and south points of the circumference. This is the meridian which divides the circle into east and west halves, the quarters of the rising and setting of the sun. Then divide each of these halves into two by a straight line at right angles to the meridian passing through the centre of the circle, and mark the east and west points. This is the east and west line or khat t alirtidal, while the meridional line is known as khat y Ql-zawn. By these two the circle is divided into four quadrants, called after the adjacent cardinal points, south-east, south-Fest, northeast, and north-west, as in the diagram.


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132. $M \bar{a}$ al-yaum wa man al-nahār wa mā al-lail. The nychthemeron, shabanah-raz ${ }^{\text {, }}$ civil day, yaum, is DAY AND NIGHP leaving one half of a great circle by the first movement and returning to
the same half in the course of completing its revolution; the most obvious of such circles are the horizon and the meridian.

Day, manger, is that space of time during which the sun is visible above the horizon, and night, jail, that in which it is hidden under the earth.

The Arabic word, yam, is sometimes used for nyohthemeron and sometimes for day, if, therefore, it is intended to use it in the former sense, say, to make sure, the day and the night, al-yaum bilailatihi.

There is no ster nor point in the heavens where there is no nyohthemeron and no night and dey. When these are mentioned in connection with something unspecified it is the sun which is referred to.
133. Mā al-f゚ajr wa ma al-shafaq. Night in reality consists in our being in the darkness of the earth's shadow. When the sun is still hidden DANN AND from us under the horizon, but is apTWIIIGHT proaching, we first see the emergence of proaching, we first see the emergence of
those rays which surround the shadow, the advance -guard of the sun, forming the dawn, fair, sapidah ${ }^{\text {P }}$, in the east, and when the sun has set, the twilight, shafag, in the west, its rear-guard. 2

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In the east the first light which succeeds the daybreak, sahar, is a long thin whiteness directed upwards. ${ }^{1} \overline{I t}^{\circ}{ }^{\frac{1}{s}}$ called the false dawn, al-subh al-k元dhib, subh-1 duragh?, during which no religious observances are enjoined. It is compared to a wolf's tail, dhanab al-sirhan, on account of its length, slenderness 2 and erectness, 3 and it persists for some time. Then comes the horizontally diffused light of the true dawn, the time of the morning prayer, 4 and fasting (for those keeping a fast ${ }^{P}$ ). Thereafter the horizon becomes red owing to the proximity of the sun and the diffusion of its rays through the impurities, kudūrāt, tJrakhāp, in the vicinity of the earth (which consist of vapour and dust)P.

The same phenomena occur in inverted order in the west on the setting of the sun, first the red horizon persists for some time, then the red disappears and the white diffused light, the nadir of the dawn follows, both of which determine the time for the sunset and evening prayers. 4 Thereafter the white light fades away and the long and high light appears, which oresponds to the false dam, and lasts for a part of the night.

The Hindus call dawn and twilight sand (samadhi) ${ }^{5}$ and do not reckon them as parts of the day and of the alight respectively, but some of them (who see the absurdity of that) do not recognise such an intermediate period between night and day, and speak of sand as that time when the centre of the sun is on the horizon.

Islam, III. Heft $1 / 2$, where this paragraph is translated tälki for bairiki P. [and the light regarded as zodiscal. AO' has intisaff for intisab.
4 Şalàt al-fajr. The other prayers are; salät al-zuhr the time for it begins shortly after noon; salatal-rasr when the sun is midway to setting; galata al-maghrib, sunset; selāt al-Tishä, early night prayer. cf. Wiedemann and Frank, Sita. Erlangen, Vol. 58, p.29. Die Gebetszeiten in Islam.
5 India, I, 364.

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134．Max mubdā＇al－yaum wa＇I－nahār wa＇l－lail．It is permissible to select any time you please for the be－ ginning of the nyohthemeron，but the

## BEGINNING OF

DAY AND NIGHT the of the sun at the horizon and for this ian are the inost convenient the meridian to the horizon，as easier for carrying out some of their operations，some selecting the upper part （midday），others the lower（midnight）．Few pay aten－ tron to the horizon except the astrologers，who do，on account of the rising and setting of the sun，both of which are more obvious phenomena than the arrival of the sun at the meridian．Those who place the night be－ fore the day（the People of the Book and Muslims）al－ ways regard the setting of the sun as the beginning of the civil day；other sects who give precedence to the day over the night regard sunrise as its beginning．

There is no conflict of opinion as to the begin－ ring of the night，which is always considered to be sunset．So also the beginning of the day（nahar）is by general consent regarded to be sunrise，except by Mus－ lime；whose theologians of all sects are agreed that it is a fundamental principle of the law（furū al－figh） that dawn should be regarded as the beginning of the new day，following in this the custom of the people of the present day，and their rule as to this and as to fasting at the appointed time．With us the period of the fast is the whole day with a certain limited par－ tion of the previous night joined on to the beginning of it．

155．Ma al－sā̄̄̄̄t wa anwā rhā．Hours are of two kinds，equal and unequal．The former，mustawiyyeh，are each the twenty－fourth part of the HOURS civil day，and are all equal in length． At the equinoxes there are twelve equal hours in the day and $t$ twelve in the night，but as soon as the day or the night is longer，the equal hours are unequally divided between day and night，the surplus in the one being equal to the shortage in the other．

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The unequal, 'crooked', marwajjah, hours are in each case the twelfth pert of the day or night, of whatever length these may be. An hour of a long day is, therefore, longer than an hour of a short day, and excent at the equinoxes, the day hours differ in length from the night hours.

The equal hours, however, although their number in the day may be different from that in the night, are always equal in length, while the unequal hours differ in length but agree in number. The equal hours are also called murtadilah, even, and the unequal hours zamäniyyah, temporal.
136. Ilä kan juz' tuqsamu al-sārah. The hour, as well as everything which can be measured in length, or bulk, or weight, is divided into sixty minDIVISION utes and each minute into sixty seconds. OF HOUR The Jews divide the hour into 1080 tract ions, called in Hebrew halaq, but they make no smaller division than perhaps half a halag. ${ }^{1}$
137. Kaif hāl al-sārāt rind al-hind. The Hindus recognise the hour, but call it half a sign of the

OF HOUR fur astrological purposes, while the people generally divide the civil day into sixty parts celled chari, (twenty-four minutes) and the gnarl into sixty parts_called by some hassah and hamah, and by others biyari; ${ }^{2}$ these again into six prenas, which unit coincides with the average respireatory rhythm of a healthy man. The gharis, like equal hours, are a fixed quantity, and, unless day and night are equal, the number of gharis in a dey is different from that in the night. To convert gharis into equal

I PL jilaq; PL',AO',hilaq; AO khalid. $\mathrm{V}^{\prime}$ Chron. p. 64, and 387 note, where 1 regear equals $1 / 76$ of a helaq; but of. Jewish Encycl. III,503, for a different subdivision of the hour, and another value for the regar. cashaka, vinādi, India, 337. PL jashah, habkah, banazi. PP jashshah, hakkah, banäzi. AO bashah, hakah, banäri. AO', nasa, hakah, bizäri.
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hours it is necessary to multiply by two and divide by five, 1 (and hours into g'haris, to multiply by two and a half).

Another unit is also employed by the Hindus, the muhurta, which is equal to two gharis. If day and night are equal, each hes fifteen equal muhurtas; if they differ in length, the muhurtas also differ in the same way as do the crooked hours. ${ }^{2}$
138. Ma muraddil al-nahär. The pole and circle on the surface of a sphere have already been discussed. For the movement of the sphere there are EQUINOCTIAL necessarily two poles and a great circle between them; one of the two poles of the first movement is visible to people in the north while the other towards the south is concealed from them. Since the globe moves on an axis between these two poles, the movement is most rapid at the circle intermediate between them, and slackens at circles parallel thereto in proportion to their distance therefrom. This great circle is compared to a girdle and is known as the equinoctial or girdle of the first movemont.
139. Ma mintaqat al-burūj. The zodiac girdle or ecliptic is that great circle which is the girdle, nitteg or mintagah, of the second moveECLIPTIC mont; it is also known as the circle or sphere of the signs, falak al-buruj, to which the sun in its eastward movement adheres and does not leave. It is inclined to the equinoctial and intersects $1 t$ et two points opposite to each other, so that one half or it is north and the other south of the equinoctial; the poles, therefore, of the two

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movements are distant from one another by the extent of this inclination (the obliquity of the ecliptic) both in the north and in the south. The great circle, (the solstitial colure) which passes through all four poles receives its name, al-marrah rale al-aqtab al-arbarah, from this circumstance.
140. M $\bar{a}$ al-madärāt al-yaumiyyah. Circles parallel to the equinoctial towards the north and south are known as day-circles, (determining the length PARALLELS OF of day). They cut or touch points of DHCLINATION the zodiac, or other stars or points in the sphere to which they are related as parallels in which they keep revolving.
141. Max madērēt al-rard. Circles parallel to the ecliptic north and south are called parallels of (celestial) latitude.

## PARALLELS OF

LATITUDE
142. Ma al-muqantarāt. These are circles parallel to the horizon; those towards the zenith are muqantarehs of altitude, 1rtifar, those towards the antipodes, muqentarahs of depression, inhit느․
 circle approaches another on a sphere till they meet
and intersect at two points diametrically
POINTS opposite l to each other, and at the same time attain their greatest distance from each other at two other opposite points. It is thus that the ecliptic and the equinootial intersect each other at two opposite points and separate as far as possible at two others. The points of intersection are known as the equinoctial points, because when the sun arrives at them there is equality, $i^{r} t i d \bar{a}$, of day and night all over the world; that which the sun leaves on its journey over the northern half of the ecliptic is the vernal equinox, nugtah

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Ql-irtidā al-rabirin, [bahari $\bar{i}^{P}$ ] and the opposite one Where it enters the southern half, the autumnal
 For equality, istiwe is used as well as irtidal.

The midde points of the northern and southern halves, the most distant from the equinoctial (the summer and winter solstices) are known as the turningpoints, inqilāb, munqalib, the first al-inqilab alsaifi (tabistani) P, the second al-inqilab al-shatwi (zamistanj), because the sun turns from the latter northwards towards its ascent, surūd, and from the former southwards towards its descent, hubut after its ascent. 1
144. Bikam tuqsamu munitāt al-dawāin. Astronomers have agreed to divide the ciroumference of circles, whether great or smell, into 360 equal parts; those of DIVISION OF CIRCLE into 360 equal parts; those of aman, units of time, because its revolution and time run together like two horses running a race, so that time, zamān, is called after these divisions, and is indeed counted by them. 2 Those of the ecliptic are named degrees, darajah, because the sun on the two sides of its course ascends and descends among them as by the steps of a ladder; in other oircles they are simply oalled divisions (ajzā ).
145. Bikam tuqsamu aqtār al-dawāir. Our ancestors believed the diameter of a circle to be one-third of its circumference, but

## RATIO DIAMETER <br> TO CIRCUMFERENCE

 Archimedes and others showed that it is nearly a seventh more, so that if the circumrerence had 360 divisions the diameter pould bave $1146 / 11$ in accord ance with the statement of Arohimedes. On account of this fraction and its unsuitableness for reckoning with, for really it is like a surd root, Astronomers abandonThe ecliptic is divided into ascending and descending halves by the solstices; cf. 378. 2 azman is the pl. of zeman, time.

## 145-146

1t and employ instead some other number which they select deliberately and properly so, for they cannot dispense with some approximate number which wili allow them to study the ratios of the chords to each other. That which Ptolemy chose wes 120 , and that which we find in the tables of the Sindhind in our possession is fivel divisions. [less?]
146. Mā al-burūj. If the ecliptic be divided into twelve equal parts beginning with the vermal equinox, SIGNS OF THE and great circles be drawn through each ZODIAC division-point, the six circles intersect each other at the two poles of the eoliptic with the result that the sphere is divided into twelve seotions, 2 like a melon with twelve grooves. These sections are the signs of the zodiac, burj, pl. burū. which are $30^{\circ}$ long measured along the ecliptic, and $90^{\circ}$ broad, north and south from the ecliptic to its poles. The annexed diagram represents these signs on one half of the sphere, because it is impossible to show the whole sphere on a Elat surface.


N,S. North and South Poles of 1 of Equinoctial Eq. 1-6 signs, 7 Vernal Equinox. 8.9. Summer and Winter Solstices

[^34]147. Máal-mail wa max Fard al-kawākib. The distance of a star from the equinoctial north or south is called mail, declination, and is measured on the great circle passing through it and the poles, while the divergence from the ecliptic towards the north or south is called rard,latitude, and is measured on great circles passing through the poles of the zodiac sphere. If the expression mail is used alone it refers to the sun or the degrees of the ecliptic which it does not leave, but if it refers to the moon or a planet or a fixed star that must be definitely stated. The expression ard is never used alone, but always associated with the moon or a star.

In consequence of the fact that the ecliptic and the equinoctial diverge from each other, it is possible that e star should be north of both or south of both, or north of one ${ }^{3}$ and south of the other, 4 or distant from the one and near the other, so as to have a certain declination and no latitude, 5 or no declination and a certain latitude ${ }^{6}$ as indicated in the figure.


The copyist remarks that he found this circle empty on his original. AOl and PP also deficient.











151. Kaif tatruku harakathā ma tarjir ran wujhathā Each planet has a small orbit known as an epicycle, falak al-tadwir, ; the earth is not within it but the orbit is entirely above us. On the circumference of this THE EPICYCLE epicycle the planet moves, when on the upper part towards the east in accordance with the succession of the signs, and when on the lower towards the west; during such movement it completes its revolution and adheres closely to the circle.

But the epicycle itself is also constantly moving eastward, when, therefore, the planet is on its upper half the movements of the epicycle and of the planet coincide and the planet moves quickly on the direct path, but when the planet is on the lower half, the direction of the two movements is contrary, that of the epicycle being towards the east and carrying the planet with it, while that of the planet is visibly towards the west. If it is less than that or the epcycle the planet's movement is slowed, if more, it is necessarily retrograde, and if equal, the planet stands muqim, and this occurs at the beginning of the retrograde movement, rujūr, and at 1 ts end, the begining of the direct movement, istigamah, as represented in the figure.



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152．Ma al－rulwiyyah min al－kawakib wa＇l－sufliyyah minna．Saturn，Jupiter and Mars are superior planets，

SUPERIOR AND INFERIOR PLANETS while venus and Mercury are inferior as is the moon；but the moon is not to be reckoned with the other planets．The expressions superior and inferior refer to the position relative to the sun． They say that the Arabic word for the sun，shams， （which also means a collar）refers to the fact that the position of the sun among the planets is as if it were surrounded by a necklace，qiladah［P has shamsah．］All the conditions of the planets are certainly referable to the sun，especially the luminosity of the moon and the retrograde movement of the planets．

The difference between the inferior and superior planets is that the distance of the former from the sun s restricted and never exceeds a certain maximum elongation either in the East or in the west．When they precede the sun（are east of it）they leave it so far behind that they become visible after sunset in the eve－ lings．Their visibility increases with the distance from the sun until the greatest eastern elongation is reached．Thereafter their movement becomes slower，and they again begin to approach the sun，when their slow movement comes to a complete stop．This is the stop before retrograding，the muqim 11l－rujur．After this stop，igamah，they turn beck and their retrograde move－ pent becomes more rapid until，at inferior conjunction， they become invisible in the rays of the sun，their evening occultation，ghaibah bill－rashiyyat．After which，emerging on the other side of the sun，they move more slowly on their retrograde course，and begin to rise before the sun，so as to be visible when they have escaped from its rays，；this is called their matutine apparition，zuhur birl－ghadawat；then the retrograde movement becomes still slower till the planets reach the second stationary period，the mugim l11－1sti－ qāmat，before entering on their direct course．Then they soon reach their greatest distance from the sun， their western elongation，and proceed on their direct path till they again approach it，and，at superior con－ junction，become invisible in its rays，their matutine occultation，ghaibah bi＇l－ghadawat．Thereafter，passing through the rays，they again become visible in the west n the evening，the zuhur bill－rashiyyet，thus returning to the sequence of the events described．

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But the distance of the superior planets from the sun is not thus restricted; the sun moves quicker and outstrips then so that they escape from its rays and become visible in the east in the morning, their tashrig or orientality. 48l. Every day their dislance from the sun is increased as they proceed on their direct course, until at sunrise they arrive at a point in the heavens, which, if the sun were there, would indicate a time between the early and late afternoon prayers. They then attain the stationary point before retrograding, after which, their distance from the sun increasing every day, they reach the middle point of that course, they are in opposition to the sun, and have thus attained the greatest distance possible within their spheres. They then begin to rise in the east at sunset like the full moon at the fourteenth night of the month. Thereafter, the distance between them and the sun begins to decrease till a point is reached at sunset, which, if the sun were there, would indicate the forenoon. That time corresponds to the stationary period before beginning the direct course; thereafter the sun gradally approaches them till they come within its rays, and they become invisible in the rest, a condition described as their taghrib, occidentailty.

The difference, therefore, between the inferior and the superior planets is this, that the former are never further from the sun than the sixth of a circle, and in the middle of their retrograde course are occultated, their apparition and occultation occur both in the east and the west; while the latter attain the greatest possible distance from the sun within their spheres, are not concealed at the middle of their retrograde course but are there in opposition to the sun. Their apparition is only in the east, and their occultation is restricted to the west.

153. Mar al-intiräq. A planet is said to be combust, muhteriq, men it comes into conjunction with the sun, the expression being due to the comparison of the sun with fire, and the nonappearance of the planet when it enters the sun's rays, suggesting its combustion or destructron. This phenomenon is common to all the planets, and occurs when they are at the summit or apogee, dhirwah, of the epicycle. The superior planets differ from the inferior ones in that the latter show the same phenomenon at its lowest point or perigee, hadid, whereas the former do not, but are then in opposition to the sun.
154. Kaif dhälika fill-qamar. The moon exhibits the same appearance, but this $\frac{1 s}{}$ described as its conjunction, i.jtimar. After its first


OF MOON appearance in the west as a slender crescent in the evening at the beginning of the month, the illuminated surface grows with the increasing distance from the sun, till on the seventh evening, halfway between east and west it looks like a half-circie. When the moon has travelled $180^{\circ}$ from the sun by the fourteenth evening, it rises at sunset and the whole surface is illuminated. Thereafter as the distance decreases, the bright surface diminishes, so that by the twenty-second evening the dark part 18 again equal to the bright part; after which the dark part gains on the bright till the crescent shape like that of the new moon is attained, visible in the east in the morning. In ail phases the luminosity of the moon comes from that surface which is towards the sun, consequently when it enters the rays of the sun, it is concealed, sarär,
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mun $q$, till after two days it again appears new in the WE F .

During these two days it is in conjunction with the sun, close union, ittisEl, as Ptolemy describes it in the lajisti, and so it has come about to speak of this as companionship, muqaranah, rather than as combustion, ihtiraq.

The opposite position of the moon, full moon, bade, imtilg', when it confronts the sun, $1 s$ known as istiqbă.
155. Kaif ziyādah nūr al-qamar wa nuqsānuhu. The moon is a non-luminous globular body and its brightness is due to the rays of the sum ND which fall upon it as they do upon the WANING earth, mountains, walls or the like, OF MOON the other sides of which are not illuminated. When the moon is in conjunction with the sun, it is between us and the sun, because it is lower and the rays fall on that surface which is towards the sun, while we see only the surface facing us, and are unable to distinguish the dark mass of the moon from the blued of the sky on account of the dazzling light of the sun, until the moon moves a little further away from it. Then a small part of the illuminated surface comes into view if the evening twilight is not too bright, and we have the new moon.

## Owing to the spherical form of the moon, the

 margin of the sun's rays which fall upon it is necesernlily circular, and so much of the illuminated half as comes into view is also bounded by part of a circle[^35]










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so as a result of the intersection of these two circles on the spherical surface, the interval between them is at first crescentic like the slice of a melon. As the distance from the sun increases, the illuminated surface grows until it equals the dark part, and this is called the first quarter, tarbir, because the sun and moon are distent from each other by quarter of a circle. This equality of the bright and dark parts occurs also at the second quartar. At full moon, when occurs also at the second quarter. At full moon, when it is separated from the sun by half a cirale, the
whole of the surface illuminated by the sun is visible to us, as may be seen from the diagram.l


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156. Lam ikhtāss al-qamar min bain al-kawäkib biziyādah nuqgen ein nur. Opinions of intelilgent people differ as to why this
PHASES PECULTAR wailig and waning of the moon is TO MOON? not shared by the other planets, and as to whether the planets are selfluminous like the sun, or merely illuminated by the rays of the sun falling on them.

Many assert that light is exclusively the property of the sun, that all the stars are destitute of it, and that since the movements of the planets are obviously dependent on those of the sun, it may be essumed by analogy that their light is in the same position.

But others believe that all the planets are luminous by nature with the exception of the moon, and that its special peculiarities are its paleness and absence of brililancy. This opinion is more in accord with the truth (as long as there is no evidence to the contrary) and that their concealment under the rays of the sun is just ilke their non-visibility in diffused daylight, which by its intensity so affects our vision, that we are unable to perceive them. But any one who looks out from the bottom of a deep pit by day may see a planet wifch happens to pass over the zenith, because his vision is relieved from the intensity of light by the surrounding darkness and strengthened by it, for black concentrates and strengthens vision, while white dissipates and weakens it.

Whether the higher planets are self-luminous or not, they are always to be seen in the same condition. For if the moon were above the sun, it would cease to present the phenomena of waning, inthilām, and would always appear as full moon.

The situation, however, with regard to Venus and Meroury is this, that if they are not luminous, there would be a difference in the amount of their light when at their greatest distance from the sun, and when approaching their disappearance in its rays at conjunction, for indeed they are lower than the sun, and no such difference is observable.

It $1 s$ therefore preferable to regard the planets as self－luminous，while the special characteristics of the moon and the variety of the phases of its light are due to［three things，its captivity（by the sun， conjunction），bastagI，giriftagI，P］its pale colour and absence of brilliance，and Its position below the sun．

157．Kan al－kawakib al－thabitah．The fixed stars in the heavens are so multitudinous that it is impossible to enumerate them，yet those FIXED STARS diligent investigators who have
endeavoured to recognize them and to determine their positions in longitude in the signs， and their latitude north and south of the ecliptic， observed that they differ in size and have consequently established a scale of magnitudes gads，rump，to the two first degrees of which astrologers give the name of glory，gharaf．Of the first magnitude there are fifteen stems，of the second，forty－five，of the third， two hundred and eight，of the four th，four hundred and seventy－four，and of the fifth，fifty－eight．

Among the stars of the sixth magnitude there are nine stars which Ptolemy described as＇dark＇，muzim， apart from three others not counted with them，which together are called dhü＇ābah and dafirah，the tresses， （Coma Berenices），grsu－dErP，the iock－wearer．

Stars which are smaller then the sixth magnitude cannot be separately distinguished by our vision，or If they are can only with difficulty be kept under observation．
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Apart from these there are five stars of the character of the milky Fay, like fragments of cloud latkhat, Which are called nebulae. With them the number or stars registered is one thousand and twenty-two in all.
158. Fa kaif marrifah hadhihi al-thawabit. It would have been possible that a separate name should have been invented and given to each of

HOW TO
KNOW THEM length of the task, and the diffioulty of keeping them in memory; but all nations, especially the Arabs, Hindus and Turks, have imagined them grouped into figures, with wich they have associated various romances and fables.

The Greeks also have imagined lines round these groups, and out of them have constructed constellations, so as to make it easier to point them out when discussing their import or references to them in books, or when two people, familiar with the outline of the constellations, refer to the position of a ster as in the hand or foot of such and such a figure.

Of such constellations there are twelve in the zodiac belt, twenty-one north thereof, and fifteen towardis the south. Associated with some of them are certain stars, which are described as 'outside'.
159. Mä al-suwar allati rala mintaqat al-burūj. The constellations in the zodiac belt are those after ZODIACAL which the signs of the zodiac are CONSTELLATIONS equinox they are:-

1. ARIES, al-hamal; barrah, l represented in the form of a ram half"-recumbent, but looking backwards with the mouth resting on the back.
2. TAURUS, al-thaur $\mathrm{gav}^{\mathrm{ab}}$, in the form of the forepart of a bull, cutin two at the navel, and with the head bent down as if about to gore.

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3. G standing erect, one of them has his arm round the other's shoulder;
4. CANCER, al-saratEn; kharchang, like a crab.
5. LEO, al- EGad; sir,
6. VIRGO, al-radhrít' dushiza ba khūshs, in the form of a maid with two wings and a flowing skirt, (in her hand an ear or two of com directed to the bottom of her skirt lp.
7. LIBRA, Ql-mIzān; tar āzū, like a balance with scales;
8. SCORPIUS, al-raqrab; kazhdum, ; as a scorpion;
9. SAGITTARIUS, al-ramí; tir-andáa, in the form of a horse as far as the base of the neck, from which there projects half of a man from the region of the loins upwards; he has long tresses, is fitting an arrow to his bow, which he has stretched to its utmost. 10. CAPRICORNUS, al-jadI; buz-gh㗐la, the front half like a kid, the hinder like a fish to the end of the tail,
11. AQUARIUS, sEaqib al-mE: rizanda ab, a man with both hands outstretched, in one of them a pitcher which he has turned upside down, and from which water is flowing towards his feet and runs down from them.
12. PISCES, samakah; meh, represented by two fishes whose tails are Joined together by a thread called the thread of linen, khait al-kittan.

Although the Arabic name for Aries is al-hamal, a lamb, kabsh would be more correct, because It is more like a ram on account of its horns; similarly Capricorn, in Arabic judi, a kid, should really be called tais, a goat, on account of 1 ts head; the Hindus call it magar, (mugger or crocodile) which is the name of a marine animal.

The common people call Gemini al-jauza' instead of al-tau'aman; Virgo, al-sunbula instead of al-radhre'; Sagittarius al-qaus for al-rami; Aquarius, al-dalw instead of sahib alma'; and Pisces, al-hūt for al-samakah, but the names given in the first place are the correct ones.


160．Me al－suwar al－shamëliyyah．The following are the Northern Constellations．I．URSA MTNOR， al－dubb al－apghar；khirs kuchak． NORTHERN
2．URSA MAJOR，al－dubb al－akber； CONSTELLATIONS whirs buzurg．Both are pictured stretched．3．DRACO，al－tinnin；AzhdahE，is repro－ sente as a very long serpent with many convolutions； it is coiled round the north pole of the ecliptic． 4．CEPHEUS，qifǟus or fiqā̄̃，is a man with a conical hat galansuwah，and is resting on one knee．He has both hands outstretched，as is the case with 5. BOOTES，al－「awwa＇，the shouter，pho is erect．6． CORONA BOREALIS，al－fakkah，al－iklil al－shamāli，
 know as the beggars dish．7．ENRCUIES，al－jathi Tala rukbataih；zänü nishastah，is represented as a man kneeling．8．IYRA，lure，al－sanj；chang rump，as a Greek lyre，but $1 t$ is sometimes called a tortoise， sulhaf而h．9．CYGNUS，al－dajEjah；mākiyăn，is like a duck with neck and wings outstretched in the act of flying．10．CASSIOPEIA，Ghat al－kursi；khudawand－i kursi，the lady of the throne，is seated on a kind of pulpit．11．PERSEUS，barshāūs，hēmil ra＇s al－ghūl； burandah ser－1 div，who is represented erect，holding In one hand the hideous head of the decapitated
ghoul．22．AURIGA，mumsik al－ranan；girandah ranān， is a man with a whip in one hand and holding the reins in the other．13．SERPEINTARIUS，al－haww̄̄＇；mar afsäy， the serpent－charmer，standing over a serpent， 14. al－hayyah；mär，the head and tail of which he holds aloft above his head．
15．SAGITTA，al－sahm；tire，also called al－bulah ${ }^{\perp}$ and al－nauk；because it is a long thing of indefinite form，and bears many names suggested by its resemblance （to an arrow i？．16．AQUILA，al－rugab is an eagle seated on the arrow．

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17．DELPHINUS，al－dulfin，a marine animal like an inflated water－skin；itt is friendly to man，accompanies boats，rescues the drowned，alive or dead，（and plays about in groups of ten）？．18．EQUULEUS，ai－faras al－ awnal，pictured as the head and neck of a horse，and therefore referred to as gitrat al－faras． 19. PEGASUS，al－faras al－thäni，the fore part of a horse with two wings；there is no man with it，for it is cut in two at the navel，like Taurus above described． 20．ANDRONEDA，andrumida，she is the woman who has never seen a husband，cal－marat al lati lam tara barman， also al－musalsalah；man be zanjix，the chained woman， Tho stands erect，and according to Abut al－Husain al－ Süfi this chain $1 s$ around her feet，while Arātus， 3 who described these constellations，placed the chains on her hands，so that she is as it were suspended by them． 21．TRIANGULUM，al－muthallath；sinh sur，its figure corresponds with its name．

161．Ma al－suwar al－janubiyyah．The southern constellations are fifteen in number．1．CETUS，

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\begin{aligned}
& \text { Situs, this is a sea-monster with two } \\
& \text { SOUTHERN } 1 \text { fest and a tail like a bird's. }
\end{aligned}
$$ CONSTEITATIONS ORION，al－jabbär，jauzä＇，the tyrant al－nahr；jüi，like a river with many bends．4．IEPUS， al－arnab；khargūsh，the hare．5．CANIS MAJOR，al－kalb al－akbar；sag buzurg．6．CANIS MINOR，al－kalb al－ asghar also al－muqaddam；sag pishīn．7．HYDRA，al－ shujá a serpent long and slender．8．ARGO，al－ saiInah；kashti，the ship．9．CRATER，al－kais，al－ betiyah；paiyala，the cup．10．CORVUS，al－ghurab； kulagh．All of the above are figured as their names suggest．11．CENTAURUS，gantaurus，like Sagittarius is represented as half man and half horse l just as the Centaur is described in the Greek books）．P 12．LUPUS， al－sabur；shiv．This is a id beast which the Centaur has seized by the feet，and holds aloft．13．ARA，al－ mi jmarah，an incense－burner．14．CORONA AUSTRALIS， al－1KliI al－janubI；afar．15．PISCIS AUSTRALIS，al－ hut al－janubi；mali．

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The translation of the matter on the opposite page is to be found at the top of p .73.

161-162
The last two constellations must not be confused With those of similar names (Corone borealis and Pisces in the northern and zodiacal constellations.
162. Fa kam kawkab fi kulli sūrah. There are differences of opinion as to the number of sters in each constellation, both es to number and NUMBER magnitude, also as to whether a particular OF STARS star should be regarded as outside or not. The following tables present a catalogue oonvenient for referenoe and study.


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| 5 | 3 | - | $\cdots$ | - | $\tau$ | 2 | g | 4 | الرمُسا |
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The total number of stars in the northern constellations is therefore 360 , of these 3 are of the first magnitude, 18 of the second, 81 of the third, 177 of the fourth, 58 of the fifth, 22 of the sixth including the dark ones, and 1 of the cloudy category. 1

The MS has 28 and 167 in this Summary for 18 and 177.

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## Southern



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163. Fa hal turraf hadhihi al-thabitah bi ama' ukhar. All peoples, especially desert-dwellers, have given names to the stars in accordance With resemblances mich they suggest. Those which are best known in our day are names given to them by the Arabs, accordingly $I$ shall mention those which are most current.

In Ursa minor at the tip of the tail there is a bright star of the third magnitude called the kid, judaic, (the pole star) the significance of which is great as it is regarded as occupying the place of the north pole; in our times there is no bright star nearer it. On account of this position it is of great service to any one directing himself to the qibla [or for orientation, ${ }^{P}$ ] because it does not sensibly alter its position.

On the fore part of the body are two bright stars of the second and third magnitude, al-fargadan, (the two calves) and between them ${ }^{2}$ and the tall a group of inconspicuous stars confronting them disposed in the form of a myrobalan, halfiaji. Some people call it a fish, and others the mill-stone, fa's al-raha, (Erica P) on account of their belief that the pole is in the midst of the group, [and that these stars are revolving round it].?

All of the stars of Ursa minor are sometimes called the smaller children ${ }^{3}$ of the bier, banāt marsh al-sughra, owing to the similarity of their disposition to stars of like name in Ursa major, bant marsh al-kubra. On account of the closeness of the north pole to these banät, it is sometimes called the pole of the bent marsh.

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The larger banāt al-narsh of Ursa major are seven bright stars (called in Persian haft varang) four of which disposed in a quadrangle form the nap sh or bier While the other three on the tail are the banal (or mourners). That on the tip of the tall, furthest away from the bier, is called al-gaiid, the one in the middle al-"anăq, 1 close to which is a small star just within the limits of vision al-suha, while that at the root of the tall is called al-jaun.

Below the bent marsh on the legs of the bear are a number of small stars in pairs which are called garret al-zibE', leaps of gazelles, jastan-1 ahwan $P$, and are likened to their hool-prints. In front of the bier 18 a semicircular group of stars named the tank, baud.

The four stars on the head of Draco are called rawaidid, (camels which have recently foaled) and sometimes the falling cross, al-gelib al-wãir, and between them and the farqadan are two bright stars, al-rauhagen ${ }^{2}$ and al-dhibān ${ }^{3}$ bulls or wolves.

On the left foot of cepheus there is a star called a shepherd, al-rati, another between the feet, his dog, and a number in the body, his sheep.

Outside Bootes there is a star opposite the band t called al-simak al-ramih, (the high spear-bearer Arcturus); his spear is formed by two stars from Hercules. It is called simāk on account of its high altitude. In a line with it towards the south is another star large and bright, al-simak al-arzal, (the high unarmed one), because there 18 no other star near it to serve as a weapon. (Spica virginis.) Arcturus is sometimes called the guardian of the northern heavens paris al-shimal.

Stars which are on the breast and arm of Hercules form the nor thorn row, al-naseq al-shami, while some on the forepart of the Serpent of Serpentarius make the southern row, al-nasag al-yamänI. Between the two rows is the garden, al-rawdah.

1 usually translated "kid", but according to Tallgren "Las nombres de las estrelias" p. 664 rannă embracing' (the little Suhá? ह́pwrúlos v. Boll, Sphere p. 81) For legends regarding the two stars, cf. H.H. Alien,
Star Names p. 446. 3 for dhi'bēn or dhu'bān.

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The bright star in Lyra, al-nasr al-mäqir, (Vega) called the falling or the sitting vulture, because its wings are folded, two small stars, which together with Vega resemble a trivet, uthflyyah, dig-pāyah ${ }^{P}$. Vega and the heart of Scorpius, alb al-ragrab, are called alharraran, ${ }^{l}$ [dogs barking on account of the cold], [because they are so clearly visible in winter ${ }^{P}$.]

The stars on the breast and wings of cygnus are called the horsemen, al-fawaris, and the bright one on the tail, the follower or pillion-rider, al-ridf.

A bright star on the chair of Cassiopeia is known as al-kaff al-khadib, or the henna-stained hand of thuralya, the Pleiades, the nebula of Perseus being the Wrist: It is also called the camel's hump, santa, by the Arabs who make a camel out of the stars of Cassiopella and others.

Capella, the large bright star on the shoulder of Auriga, is called al-relyug, the smaller one lower down, al-ranz, the she-goat, and the two further down the goatiskids, al-jadian: it is on this account that they call capella the goat-herd, al-rannaz. ${ }^{3}$

Altair, the bright star on the wing of Aquila, is called the flying vulture, al-nasr al-ta'ir, and the four stars (like a rhomb on the head) of the Dolphin are know as the flying cross, al-salib al-täir.

The four great stars forming the body of Pegasus are called the bucket, al-dalw, and between them and the Fish there is the fox's den, baldat al-tharlab. Now this fish is not Pisces but one which the Arabs picture to themselves out of some stars of Andharumidha end others. Two of the stars of Triangulum are called the companions, al-anisain.

The Arabs do not picture the constellations of the zodiac in the way described; there is no trace of them except in three cases. The first is Aries where the two stars on the horns are called neath and natick, which is an indication that they were thinking of a ram butting. The second is Scorpius which is conceived entirely in the Greek ray. The third is Leo: but their lion is fashioned

1 P. hazaran, AO huwaran;Al-harrarEn, v. Lane under hera: also the cold Syrian months Kansan I \& II, Dec. \& Jan. 2 P. buz, buzghalagen, buzvän and buzbEn:
3 usually read rinăz, she-goats or A0 ranaq, but see Dozy and Tallgren p.675 - matron is more usual than rannaz, for a'goat-herd.Qezwini (Ideler p.90) "they call capella and the kids rināz". In my copy of $Q$. Pita.

out of some five constellations, only the eyes, forehead, neck and shoulders, and the teil-turt belong to Leo, while they make one fore-leg out of the heads of Cemini, the other out or Can1s minor, the nose out of Cancer and the hind-legs of the two bimaks.

The Pleiades, thuraiya, parvinp, they set down as a head with two hands, one of wian is the khadib which was mentioned in Cassiopeia, whose ringer-tips, anamil, are stained with henna; if we proceed from these towards the Pleiades we find a series of stars which represent the wrist, the elbow, the shoulder, and the shoulder-joint, ratig. ${ }^{1}$ The other hand is the katI aljadhme' from stars 1n the head of Cetus; it is called jadhma', amputated, beoause the row of stars wich extends to it from the pleiades is shorter.

Al-dabarin is oalled fania, a big male camel; round him are a number of young females, gala'ia, like the young of the old females, nūq, while the two small stars, his dogs, are near each other in the narrow gap, qaigah, between him and the Pleiados, (whoh brings misery and ill-luck)².

They call the heads of Geminl the extended arm, dhirar al-mabsūfah, of their lion, and the two stars of canis minór, procyon, al-shirrá ai-shamiyyah, and its companion, mirzam, the contraoted arm, dhirar almaqbüah.

Stars in the body of Cetus are spoken of as ostriches naramat, 2 and cows, baqar, while the large one in the tail together with that in the mouth of the Southern Fish, Fomalhaut, fam al-hüt, are the two frogs difdarān.

Orion is called jauza' instead of Al-jabbar, and his belt a string of pearls, nizam, or a row of maida, jawari; out of some of the stars of Eridanus ${ }^{3}$ they make a cheir for him, and of some from Lepus a throne. The large bright star (Sirius) in the mouth or Orion's dog, Canis major, is named al-ahirré al-yamaniyyah, and the pesser over, al-rablr, for they relate4that (both of
I That part of the shoulder on whioh ride' a oloak or a shoulder-belt rests.
2 shuturmurghenp, 'camel-birds'; nerim, the species ostrioh, narman, a single ostrích pharel neremit; it has another plural nararim. naram, pasturing oattle including camels or camels alone, plural, anarim. 3 PL has haww' by mistake for nahr, PP, jū. マ. Pooocke, Specimen, p. 136.

the dog-stars are sisters of Canopus, suhail, and that) ${ }^{P}$ the greater dog-star crossed over the milky-way to the south with Canopus, while the lesser remained on the Syrian side and became blear-eyed, ghumaisar'.

Among other stars of cants major there are two known as the oath-takers and oath-breakers, muhilfain and muhnithain, because any one who does not know Canopus well, mistakes these stars when they arise for canopus and its mirzam, [and takes oath to this effect; when Canopus really appears he is perjured.] They are known as the two stars.

In the nook of Hydra there is a star known as al fard, the solitary one; stars of corvus form the Arab tent', khiba', and the throne of the simak; those of Crater, [a manger, marlaf; ] and those in the body of Hydra are the ribs, sharasif, and within them horses and foals khalid ${ }^{2}$ wa orle'. The stars of Centaurus and Lupus are known as bunches of grapes, shamarikh, while those of corona australis are regarded as a cupola or as on ostrich's nest, udhiyy al-naram, that 18 the place where it lays its eggs.

F1 th regard to other star-names we have not brought them forward, either because there is much disagreement about them or beoause we have not heard them sufficiently distinctly.
164. Fa ma manäzil al-gamar. As the zodiac, the course of the sun in a year, is divided into twelve equal signs, so also the path of the MANSIONS OF moon among the fixed stars is divided THE MOON into daily stations, the mansions of the moon. Of these there are twenty-seven according to the Hindus and trenty-eight according to the Arabs. Just as the signs are called after the constellations, so the mansions are called after the fixed stars in which the moon is stationed for the night. They begin as in the case of the sun at the vernal equinox.

1. al-sharatain, (two signals), the first mansion, is marked by two bright stars on the horns, saraganP, f Aries; they are disposed in a north and south In ne, the apparent distance between them, about a fathom, being the same as that between the southern one and a third smaller star. Also called the butters, nate.
I The translator into Persian was unfamiliar with this word; he translates it the Champion's head sari asir ai sar-1 pahlayan (asif, a skilled swordsman). 2 misspell. 3 read iftidāl.
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2．al－butain，three stars from the tail of Aries disposed in a triangle．Diminutive of bating，belly， because smaller than bat al－hūt，No．$\overline{28}:$

3．al－thuraiya，parvinP，Six stars from the shoulder of Taurus grouped like a bunch of grapes． Generally，and especially by poets，the number is sup－ posed to be seven，but this is a mistake．Although the term najm is applicable to every star，thuraiya alone is specially distinguished as＇al－najm＇．

4．Al－dabaran is a large shining red star in the easterly eye of Taurus．The head of Taurus is shaped ilke a bowl with its mouth to the north，（while the muffle l of the bull（mouth and lips）are directed south．）${ }^{P}$ Aldebaran，${ }^{2}$ the＇follower＇of the Pleiades is also called tabor al－najm．

5．Al－haqra is formed by three small stars from the head of orion arranged like a trivet，so close together that they look like one．On this account Ptolemy regarded them as a single nebula．

6．Al－hanra，two small stars from the feet of Gemini，the one smaller，the other somenat brighter．

7．Al－dhirar，the extended foreleg of the Arab lion，for the contracted one is formed by procyon and its mirzam（a mirzam is a small star，coupled to another bright one）．Al－dhirar is formed by two bright stars from the heads of Gemini，distant from each other as much as the distance between Al－sheratain．

8．Al－nathrah，the nose of the 110n，formed of two small stars of Cancer which are interpreted as the nostrils．Between them＇is a nebula which some call the lion＇s uvula，lahEt，malazah，P，but the Greeks call the stars the two asses，himarain and the nebula，the manger，marlaf，（Praesepe）．

9．Al－tari，the eyes of the lion；these are two bright stars，one from Leo，the other from outside it， apparently about a cubit from each other．

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10. Al-jabhah, or jabhat al-asad, the lion's forehead, is formed by four bright stars, not in a straight line from north to south. The largest, and brightest and most southerly is the heart of Leo. galba al-asad, or al-malakj (Regulus).

Il. Al-zubrah, the mane of the Arab lion, formed by two stars from the hind-quarters of Leo, distant more than a cubit. Also known as al-kharātã. 1
12. Al-sarfah is a bright star at the tip of the tail of Leo, but according to the Arabs on the tail itself, (and is regarded by them and the astrologers as the scrotum.P) Al-dafirah (Coma astrologers as the scrotum. P) Al-dariran (coma Pleiades forming the tuft of hair, hulbah, at the tip of the tail.
13. Al-rawwe four stars running (from north to south) $P$ and curving at last like the letter lam; they are from the breast and wings of Virgo, and the Arabs speak of them as dogs barking behind the lion.
14. Al-simak, the unarmed one of the two considered by the Arabs to be the hind legs of their lion, but according to the Greeks al-razal is an ear of corn, cráxus, in the hand of virgo which the translators have rendered by sunbulah, (Spica). It is sunbulah by which the sixth sign is so well-known. It occupies a similar position to that of al-dafirah (in its relation to Leo.)
15. Al-ghatr is formed by two small stars on the train, dhail, of Virgo, quite inconspicuous; the name is derived from their concealment.
16. Al-zubanas, the claws of the scorpion, two stars from the scales of Libra, which are at a spear's length 2 from each other.
17. Al-iklil or the crown, three bright stars from the Forehead of Scorpius, arranged in a slightly curved line from north to south.

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18. Al-qalb, 1.e. qaib al-raqrab, the heart of scorpius, Antares, is a red and trembling star mich astrologers describe as having the nature of Mars; in front of it 1 s another star, and behind it a third, the three being disposed in a curve.
19. Al-shaulah, the sting of Scorpius, which is turned forwards over the joints of the tail; two stars bright, but not large, separated by about a span from each other.
other. 80 . Ai-narāim, ${ }^{1}$ the ostriches, four bright stars from the bow, arrow and foreleg of the horse of Sagittarius forming a quadrangle. The Arabs compare the milky way to a river, and these stars to ostriches going to the river, nara waridah al-nahr, while there are four others which they speak of as naramsēdirah, returning from watering.

2l. Al-baldah, an area of the heavens behind Sagittarius, devoid of stars, and compared to a desert or to a gap (between the eyebrows) P. The stars which border $1 t$ (on the rest) $P$ from the tresses of Sagittarius are called al-qilädah, the necklace.
22. Sard al-dhabih, the sacrificer; here are two stars, not bright, disposed horizontally with more than a cubit between them; both are on the horn of Capricorn. Near them is a third star which the Arabs call a sheep about to be sacrificed.
23. Sara bular', the glutton, marked by two stars on the left t hand of Aquarius, between them is a third about to be devoured by the glutton.
24. Sard al-surud, three stars in a row from north to south From the tail of Capricornis and the shoulder of Aquarius.

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[^44]25. Sard al-akhbiyah is marked by four stars on the right hand of Aquarius; the outing of the group resembles a duck's foot; three of the stars form a triangle which conceals in its interior the fourth, the lucky one. According to the Arabs these are not the only fortunate stars, for there are many outside the mansions of the moon whin are.

26 and 27. Al-fargh al-ewwal and al-thēnI or muqaddam and mu'akhkhar, are each marked by two stars, situated a spear's length from each other, and all from Pegasus. The arabs compare the four stars to a bucket dalw, but the eleventh sign of the zodiac is so known; fargh really means the place for pouring out the water, but these are often interpreted as the upper and lower handles, rarquwatan.
28. Bath al-hat is marked by two bright stars from the head of Andromeda, near to mich is a group of small stars in a curved'ine, out of wish the Arabs make a fish, and these stars are falling into the wide-open mouth of the fish, whence the name belly. Others call this mansion rishi', comparing the fish to a rope, so that the bucket in Pegasus should not lack a rope.
165. Fa kaif al-tariq ila marrifah hadhihi almanäzil. Al-thuraiyah, the pleiades, is the most

HOW TO KNO noticeable and the best known
THE MANSIONS of all the mansions of the moon it is therefore a convenient starting point for their study; although any other point which is familiar on the path of the moon will serve. Proceeding from thuraiyah, however, seek first Aldebaran a spear's length towards the east,

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a spearis length towards the east, and sharaţān two spears' length towards the west, then halfway between shareț̄n and the Pleiades look out for buţain. The distance between the other mansions is approximately the same as ascertained for these three, so that they can easily be recognized by this procedure. It will be necessary to incline slightly to the north or south so as to include all the stars mentioned.
166. Ha yurna bitulur al-mandzil. The expression ascension of the mansions does not mean their rising above the horizon, which occurs once above the horizon, which occurs once
every dey, but this ascension is like every day, but this ascension is like which we considered in connection with
ASCENSION OF THE MANSIONS for planets. Because when the sun 1 s the three superior planets. Because when the of the fixed stars it conceals it by its radiance; the star rises by day and sets before the disappearance of the twilight. This condition is described as its ghaibah, time of invisibility in the west. This persists until the sun moves away somewhat, so that when the star rises before the sun, the pale light of the dawn is not sufficient to overcome it. The beginning of visibility in the east in the morning, this is the real ascension (heliacal rising) and is known as nav' as if the star were rising with and is know as nu as if the star were rising with. Just about the time we have described when the mansion has arisen, its nadir, the fourteenth from it, sets. This nadir is also calíed ragib, and its setting suqūt. Between the ascension of two adjacent mansions there is an interval of approximately thirteen

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days, not exactly, because of the difference in magnitude of the stars concerned and their divergence to the north or south.

The term anyway' is associated with the rains, because the times of their occurrence are related to the setting of the mansions in the morning in the west, while that of bawarih refers to the winds and is related to other times of rain on the ascent of a mansion escaping from beneath the rays in the morning.

What has been said with regard to rain and other atmospherioal phenomena refers to Arabia, for these differ very much in places distant from each other, indeed, in places quite near if their situation with regard to heat, low-lying or elevated ground, alkaline desert (or bodies of water)P, differs.
167. Ma al-majarrah. The milky way, kahkashān, $P$ is a collection of counties fragments of the nature of nebulous stars. They form a nearly complete great circle which passes beTHE GALAXI complete great circle which passes be-
tween Gemini and Sagittarius, the stars thers, the way sometimes narrow, sometimes broad, and occasionally breaking up into three or four branches. Aristotle considered that it 1 s formed by an enormous assemblage of stars screened by smoky vapours in front of them, and compared it to haloes and nebulae.
168. M $\overline{9}$ al-tawāII wa ghayr al-taw $\vec{Q} 11$. The proper order of succession of the signs of the zodiac and of the mansions of the moon is from one to SUCCESSION that which lies east of it, for example OF SIGNS from Aries to Taurus then to Gemini and then to Cancer; or in the case of the mansions from Sharatean to Butain, then to the Pleiades and then to Aldebaran. But if one proceeds from Aries to Pisces then to Aquarius and then to Capricorn, or from Sharatān to Baton al-hūt then to Fargh al-mu'akhkhar and then to Faugh al-muqaddam,


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this reverse direction is described as contrary to succession．Now the proper order of succession is in accordance with the second or easterly movement，but when a planet is described as in advance of or behind another this refers to the first or westerly movement， contrary to the order of succession；so the planet in advance is towards the west and that behind further east．

169．M $\bar{a}$ al－bur̄̄$j$ wa al－manāzil al－shamā11yyah wa al－janubiyyah．SIx of the 51 gins are northern，viz． NORTH N Aries，Taurus，Gemini，Cancer，Leo SOUTHERN SIGNS running through them is north of the equinoctial；the six others are the southern signs．With regard to the mansions，fourteen of them are northern，namely those from Sheratan to Simāk which fall within the northern signs，while the fourteen from Ghafr to Bath al－hūt are southern．

170．Ma al－falak al－mumeththal．The plane of the ecliptic cuts the spheres of all the planets，describing a circle in each concentric with the ec－ PARECLIPTIC liptic．This is the falak al－mumatinthal， assimilated orbit of the planet（the parecliptic of Nallino）．It is called assimilated，be－ cause its centre，plane，and divisions are the same as those of the eoliptio，of which it is a counterpart．

177．Aujal－shams ma huwa．The aud or the sun is the highest point which it attains in its orbit：the circumstance that there is a highest point is explained by the fact that it does not travel on the circumference APOGEE OF SUN of its own mumaththal orbit，but rather on the circumference of another orbit in the same plano but with a different centre．This is its exoentric orbit al－falak al－aud．The earth is inside this orbit， consequently there is one point where it is nearest to the earth，and another opposite to that，furthest from the earth．The latter is know as the aud in the Indian language on account of its height，and in Greek as afojIyün（apogee）on account of its distance from the

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earth. It is the summit dh1rwah of this exocentric orbit. The nearest point, on the other hand, is called in Greek afrijiyū (perigee) and, as the lowest point of the orbit, 18 known as al-hadid.

Necessarily there are two points opposite each other in this orbit where the distance from the earth is the mean of the greatest and least distances; 2 this is the bur al-ausat, the mid-distance, as may be seen from the annexed figure.

2. mid-đistance. 3. mean rate of movement. 4. point on excentrio opposite Y.5. sun: 6. its corrected position. 7. line $\mathrm{C}-5$ produced. A-5. mean argument. 8. its angle. 9. angle of corrected argument. 6-7. equation of sup. 10 . its angles.
172. Wasat al-shams me huwa. The rate of movement of the sun varies, sometimes it is quicker and some-

MFAN MOVFMENT the quick and the ne cessarily between OF SUN the quick and the slow, there is a mean rate ascertainable by measuring its progress in relation to time. This movement takes place on the circumference of the

## 1 misspent in MS.

2 Those points of the exocentric to which equal lines $C-2, C^{-2}$ proceed from the centre of the excentric and the centre of the world.



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excentric orbit, and that arc thereof which extends from a point in the mumaththal orbit answering to the beginning of Aries to the sun's position there is known as the mean movement of the sun wast al-shams. (4-5 In figure last page).
173. KB al-hissah al-Fustá lilshams. The mean argument of the sun in its exocentric orbit is its distance from the apogee, and consequently

MEAN ARGUMENT
OF SUN 11 you subtract the distance between the apogee and the beginning of Aries from the mean movement of the sun there remains the mean argument.
174. Tardily al-shams me huwa. If the sun is situated at the apogee or at the perigee, lines drawn to it from the centre of the world and that of the excentric orbit practically coincide. That is not the case, howEQUATION OF SUN ever, at any other point of the orbit, for then the two lines meet at the sun but diverge so that the one reaches one point of the mumaththal orbit, and the other another, the arc of the mumaththal between the two is the equation of the sun tardily al-shams. This is an approximate way of expressing the equation so as to get an idea of it, but a more accurate way is dependent on the proposition of Geometry that angles at the centre of a circle are proportionate to the arcs opposite them. Therefore we genorally employ the angles instead of the arcs, and as the progress of the sun on the circumference of the exocentric orbit is equal in equal times, those angles which subtend such stages of progress are also equal. It is therefore the same if we describe the mean motion of the sun as its distance on the excentric orbit from a point opposite the beginning of Aries, or as the angle at the centre of that orbit between a line going to Aries and another to the sun. Similarly the mean argument is described as the angle between a line going to the apogee from the centre of the excentric orbit and another to the sun, and the corrected argument hissah al-muqawwamah, as the angle at the centre of the world between a line to the apogee and one to the sun. The two arguments being thus understood, the difference is the equation of the sun, and its angle is that between lines from the two centres joining at the san.
175. Fa migäair al-harakah ii kurat al-shams kan hiya. The sun by its mean movement travels every twenty-fur

hours, fifty nine minutes, eight seconds, twenty thirds in the order of the succession of the signs. When it has traversed all of these and has arrived back at a starting point, 365 days, 5 hours and 47 minutes have elapsed. Such a period is a solar year. The apogee also moves in the same direction, one degree in every 66 solar years as modern observers have found, but this differs from the estimate of our predecessors in the matter.

The ratio of the distance between the centre of the world and that of the excentric orbit to the radius of the latter is as $2 ; 60$.
176. Mâ al-falak al-mā'il. Like the sun the six planets travel along the ecliptic, but deviate from it sometimes to the north, sometimes to the
INCLINED south, because they revolve in planes which ORBITS are inclined thereto, just as the ecliptic is inclined to the equinoctial. Their orbits therefore are inclined orbits, which have different amounts of inclination, as well as different points of greatest incilnation and of intersection with the ecliptic.

The centres of the mumaththal orbits and of the inclined orbits are identical, viz., the centre of the worla.
177. Mā al-jauzahar. The se orbits being inclined to the ecilptic as described, there ere necessarily two opposite points of intersection, just as THE PIANETS In the case of the ecliptic and the distinguished from each other, the one from which the planet moves to the north is called the ascending node, ra's, and the other point of intersection where it moves to the south, dunb, the tail.

Although the nodes or points of intersection or passage of the planet from north to south on its inclined orbit are called majaz from the root, jaza, jawaza, the word jauzahar is not related: it refers to the moon where the nodes are of particular interest: it is an Arabic form of P. gaviz'har. "In the Mah Yasht the moon is invoked by the epithet gaochithra, cow-faced." Haug, Sacred Language of the Parsees, p. 200. In the case of the moon the nodes are known as the head and tail of the dragon.


If used without any qualificetion these expressions refer to the moon; otherwise the planet must be specified. The nodes are also calied ruqdah, knot, (P. girih) and majEz, point of crossing so that ra's is called mejāz al-shamāl, or al-ruqdah al-shamaliyyah ond the dunb, majaz al-jenūb or al-ruqdah al-janübiyyah. Annexed is a diagram (although it is difficult to represent the inclination on a flat surface $P$ )

M.mumaththal, I.inclined Orbits. C. Their common centre, AIB Northern half of inclined orbit. $A B$ North and South Nodes.

A. Centre of worid, B.of deferent, C. of epicycle, DE apogeo and perige of dererent Mammathtol
178. Falak al-tadwIr mā huwa. An epicycle, tadwir, is a smail orbit which does not surround the earth, but is entirely outside it. The planet moves EPICYCLE on its circumference with the motion peculiar to it. 151.
179. Mā el-falak al-hāmil. The centre of the epioycle travels continuously in the direction of succession of the signs on the circumference of an orbit called the deferent, DEFERENT ference of an orbit called the defer
hemil, wich is in the plane of the
信 inclined orbit, but like the excentric, has a different centre from the centre of the world.



180．Ma al－falak al－muraddil lilmasir．If the centre of the epicycle traversed equal arcs of the de－ ferent in equal times，then the mean THE EQUANT rate of the progress of the planet would be on the deferent，and the angles
opposite these arcs would also be equal；the angles of the arcs，however，traversed by the centre of the epicycle in equal times are not equal，but are so at a point as far from the centre
of the deferent as that is from the centre of the world This point is the centre of equal progress，the equant， and is the same for Venus and the three superior planets．All three points are in the same straight line．It is necessary to regard this point as the centre of an orbit like the deferent，and to calculate the progress of the planet on its circum－ ference from the position of the centre of the epicycle which may be done by lines drawn to this point（without drawing the orbit）？


A，Centre of world． B．CD，of deferent，equant and epicycle． E F，apogee and Perigee of deferent；E＇F＇，of equant．

181．Ma al－dhirwah al－wusta wa＇l－mariiyyah．The term dhirwah，summit，is used to indicate the apogee

$$
\begin{aligned}
& \text { APOGEE OF that of the excentric orbit; opposite } \\
& \text { EPICYCLE } \quad \text { it is the perigee, gadid. But there }
\end{aligned}
$$ must be distinguished the dhirwah al－ mariiyyah i．e．the summit as seen from the centre of the world，corresponding to the line drawn from the centre of the world through the centre of the epicycle to its upper part，and the dinirwah al－wustá corresponding to a line from the centre of the equent in the manner indicated in the diagram on next page．

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A, Centre of world.
B, Centre of deferent.
C, Centre of equant.
$D$, Centre of epicycle.
E, Apogee of deferent. F, Perigee of deferent.
G, Apogee of epicycle from centre of world
H, from centre of equant.
182. Wast al-kawkab ina huwa. The mean rate of progress of a planet is the distance of the centre of

## epicycle from a point on the equal

 measure of the distance is the angle at the centre of this orbit formed by a line to the beginning of Aries and another to the centre of the epicycle.183. Ma al-khāssah al-wustá wa'l-muradalah. The distance of a planet on the orbit of the epicycle from the dhirwah al-wustá is known as the khāssah al-wuste, argumentum
MEAN AND
TRUE ANOMALY medium, mean anomaly, and that from the dhirwah al-mar'iyyah as the knāssah al-muraddelah, argumentum verum, true anomaly, while the difference be tween the two khassish is called the tardily al-khāpsah al-ulá, 1 equatio argument 1. The measure of the two last is the angle at the centre of the epicycle between the lines pro at the centre of the epicycle between the ines pro-
ceding to the two dhirwah, equation of the centre.

I In Al-Battani, basşah, portion, but as Nallino observes II, 329, for the most part other astronomers call this portion the proper motion, khassah, of the planet.
The motion in longitude of a planet is that of the centre of the epicycle on the deferent; its movement on the circumference of the epicycle is anomaly.


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184. Ma al-tūl al-ausat warl-muraddal. Mean longitide is the $\operatorname{size}$ of the angle bounded by two lines, the

$$
\begin{array}{ll}
\text { MEAN AND } & \text { one proceeding from the centre of } \\
\text { the equant to } 1 \text { ts apogee, and the }
\end{array}
$$ CORRECTHD LONGITUDE the equant to 1 ts apogee, and the other to the centre of the apioyole. Corrected longitude, on the other hand, is the size of the angle between lines, the one proceeding from the centre of the world to the ogee of the equant and the other to the centre of the epicycle. The difference between these two angles is the size of the angle formed at the centre of the epicycle by the two lines in question; sometimes it is called the longitude of the centre.


A. Centre of world, B. of deferent, $C$. of equant, $D$. of epicycle. E. apogee, F. perigee of deferent. G. true, H. mean apogee of epicycle. K. planet. $G^{\prime} H^{\prime} K^{\prime}$, continued to ecliptic, Ec. G H, equation of centre, 1 , the corresponding angle. G $K$, true, H K mean anomaly, 2 , angle of mean, 3, of true longitude. 4, of position of planet in ecliptic. $G K$, equation of anomaly.


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The other letters refer to paragraph 203.

184a. Mä tardily al-hissah al-thäniyyah. The second correction of the argument, the equation of the anomaly, is the size of the angle at EQUATION OF the centre of the world, which is THE ANOMALY formed by lines proceeding thence to the centre of the epicycle and the
planet respectively.
185. Ma taqwim al-kawkab. This is the point of the mumathtial orbit which a line reaches drawn from TRUE POSITION body of the planet. This is its true OF PLANET body of the planet. This is its true
position in which it is seen among the stars.
186. Kaif arlāk al-qamax. The following are the various orbits of the moon:- the mumaththal or
pareciliptic, the inclined orbit associated $\begin{array}{ll}\text { ORBITS OF With } 1 t, \text { and the excentric or deferent } \\ \text { THE NOON } & \\ & \text { which carries the epicycle, on the circum- } \\ \text { ference of which the moon itself revolves. }\end{array}$
187. Kaif al-harakāt if kuratihi wa maqādrhä. The two voles of the moon's inclined orbit are always turning in the direction contrary to MOTIONS OF the succession of the signs round the THE MOON poles of the mumaththal orbit; they thus move the ascending and descending nodes $3 '$ every day in that direction.

The moon itself revolves on the circumference of its epicycle; as soon as it begins to move towards the west from the summit thereof it travels contrary to succession every day 130 14', while the centre of the epicycle turns in the order of succession on the circumference of the deferent every day $24^{\circ} 23^{\circ}$; this is twice as much as the moon becomes distant from the sum in a day, and therefore the movement of the centre of the epicycle is spoken of as the 'double distance'.

Then the centre of the deferent is always turning in the contrary direction to succession of the signs; its apogee moves back $11^{\circ} 9$ : every day,

Moreover the dhirwah al-mar'iyyah of the epicycle is always opposite a point, the distance of which from





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$A$, centre of universe and of inclined orbit, $F \cdot B$, centre of deferent; $B C$, circle on which it moves. C, point opposite the apogee of the epicycle, D. DE, diameter of epicycle opposite C. GH, 12 $\frac{1}{2} ; \mathrm{HI}, 5 \frac{5}{4} ; \mathrm{GJ}, 60$. world towards the perigee of the deferent is the same as the distance between the centre of the deferent and the centre of the world.

## This distance

is to the radius of the deferent as 12立: 60, while the radius of the epicycle is st : 60.

188. Fa kaif hadhihi al-ahwel wa'l-maqadir fillkawakib. AI I the planets are constantly revolving on the circumference of their episTHESE CONDITIONS cycles; beginning from their IN THE PLANETS summits they travel towards the east in the direction of succession, and therefore in the opposite direction to the moon, which travels westward and contrary to succession from its summit.

The daily movement of the planets on their episcycles ere as follows: -Saturn, 57', Jupiter, 54\%, Mars, $28^{\circ}$, Venus, $37^{\circ}$, Mercury, $3^{\circ} 6^{\prime}$; while the eastward movement of the centres of the epicycles



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(i)
themselves in their mean movement relative to the centre of the equant is for Saturn dally $2^{\prime}$, Jupiter, 5', liars 31', Venus, as much as the sun, 59' and Mercury twice as much, viz:- $1058^{+}$. Moreover, the distance of the centre of tine equent from the centre of the world taking the radius of the deferent as 60 , is for Saturn $63 / 4$, Jupiter $51 / 2$, Mars le, Venus 2 l/l2, and the centre of the deferent is halfway between these two points. Again in the same proportion the radius of the epicycle is for saturn, $61 / 2$, Jupiter, $111 / 2$, Liars, $391 / 2$, Venus, $431 / 6$, Mercury, $221 / 2$.
189. Fa kaif yanfasil rutārid minhā. Mercury requires to be separately treated because the centre How lercury of its deferent elways turns on the DIFFERS Whose radius is equal to the distance between the centre of the equant and the centre of the world. The centre of the equant is halfway between the centre of the small circle and the centre of the world, and all three are in a straight in ne, so that the distance of the centre of the deferent

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from tine centre of the world is not uniform, the greatest distance being to the least as $91 / 2: 31 / 6$. As the centre of the deferent turns on this circle, its apogee moves in the reverse direction to succession of the signs dad ll as much as the movement of the sun, 59'. From this it follows that the centre of Mercury's epicycle and that apogee meet twice every year, just as the moon's epicyole-centre and the apogee of its deferent meet twice a month. Also from the amount of the movement it becomes necessary that the epicyclecentres of Mercury and Venus are always with the sun on the same diameter of the world, whence it follows that they are combust on the summits of their direct courses as well as on the lowest points of their retrograde courses. The superior planets are only combust when on the summits of their epicycles, because the centres of these move more slowly than the sun, remain behind it, and are only beside it when the planets have arrived at the summits. The diagram shows the orbit of Mercury.

A. centre of universe. $B$ of the equant. $C$ of the small circle on which the centre of the deferent travels. D the greatest distance of the centre of the deferent from the deferent from the centre of the universe, $E$ the deferent. $F$ the inclined orbit. G Copyist's lettering must be neglected.

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190. Fa f $\bar{i}$ kara tatimm adware hadhihi al-harakät. It hes already been mentioned that the sun takes $365 \pi$ RFYOIUTTON OF traverse the is the solar year, and it is by it that other complete revolutions are measured. The movements of the planets are more complex, being compounded of that on the circumference of the epicyole, and that on the deferent, accordingly there are two kinds of revolution to consider. As regards that on the epicycle the complete revolution in the case of Saturn occupies a solar year and twelve days; of Jupiter, a year, a month and three days; of Mars, two years, a month and eighteen days; of venus, year, seven months and five days; of Mercury, three months and twenty-four days; and of the moon, twentyseven days, thirteen hours and eighteen minutes.

The revolution of the epicycle on the deferent, on the other hand, throughout the whole zodiac takes in the case of Saturn twenty-nine years, four months and eleven days; of Jupiter, eleven years, ten months and four days; of Mars, a year, ten months and seventeen days; of Venus and Mercury', each a solar year; and of the moon, twenty-seven days, seven hours and fortythree minutes. The nodes of the moon make a complete revolution in eighteen years, seven months and nine days,

while each of the fixed stars and the apogees of the planets take according to the calculations of our ancestors thirty-aix thousand years, but to those of our own time twenty-three thousand seven hundred and sixty years (viz. $1^{\circ}$ in 66 years).
191. Fa ma harakat al-falak. Theon of Alexandrie disoussed the movement of the orbitl which he derived TREPIDATION estrom those mesters of the horosoope, the estrologers of Babylon of ancient times [Who were regarded by the people generally as sorcerers.] They were of
opinion that the orbit (the $8^{\text {th }}$ sphere) moved eight degrees in the direction of the signs at the rate of one degree in 80 solar years, and then as much in the reverse direction; [so that multiplying 8 by 80 gives 640 years for the onward movement and i280 for that and the return.] When the movement is in the direction of the signs, iqbäl, that of all the stars and planets is accelerated, and in calaulating their positions, it is necessary to add this amount, while similarly, when in the opposite direction, idbër, all move more slowly and the amount of this movement must be deduoted. Whether these statements are true or false it has not been possible for any observer to devote the time necessary for investigating them.
192. Fa kaif rard al-gamar. The inclination to the ecliptic of the inclined orbit of the moon is constant
ls maximum is 5 north and an equal
THE MOON amount south. This is the greatest latitude of the moon; the epicycle is not affected thereby, because its plane is in the same plane as the inclined orbit. As the ascending and descending nodes move in the direotion contrary to the signs, the greatest amount of latitude or indeed any latitude which may be determined is not at one point therein, as is the case with the decilnation of the sun, which is constant at every point of its course, its maximum declination being always at the first points of capricorn and cancer.

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## 193.

193. Fa Kaif rarūd al-Kawakib alrulwiyyah. Each of the three superior planets has an inclined orbit, the amount of the inclination of LATITUDE OF THE which is constant: their apogees SUPERIOR PLANETS are in the northern halves of the orbits. The planes of the episcycles, however, are not in the same plane as the incline orbits, as is the case with the moon, but in one inclined thereto, in such a way that the perigee of the epicycle is always inclined in the same direction as the inclined orbit is from the ecliptic, that is to say, that if the place which the epicycle-centre occupies in the inclined orbit is north of the ecliptic, then the epicycle-perigee is also north, and if south, then south. This inclination of the epicycle is in the diameter which passes from the summit to the perigee, and this for purposes of definition is called the first diameter, while that diameter which is perpendicular to it is called the second. Now this second diameter is always parallel to the plane of the ecliptic. So it is obvious that when the centre of the epicycle arrives at ne of the nodes of the inclined orbit, the plane of the epicycle coincides with that of the ecliptic, and the first diameter comes into that plane; then when the centre of the epicycle passes beyond the node, the first diameter begins to incline in the opposite diraction and arrives at the maximum inclination at a point midway between the two nodes, there where the excreme inclination of the inclined orbit is also situated. So it results from what we have said that the superior planets have two divergences from the ecliptic, one due to the inclined orbit celled the first or mean, dependent on relation to points of the ecliptic, and a second, due to the epicycle and dependent on dislance from the sun.


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With regard to the latitude of the excentric orbit, if the centre of the epicycle is situated in one of the nodes of the inclined orbit, the plane of the latter is coincident with that of the ecliptic, while if it moves into one of the halves of the inclined orbit, that half begins to incline in the case of Venus to the north and of Mercury to the south, and reaches its extreme point with the arrival of the centre of the epicycle at half-way between the nodes, i.e. at the apogee and perigee.

With regard to the latitude of the epicycle dependent on the first diameter, when the centre of the episcycle is at the apogee its summit in the case of venus begins to move towards the north, and of mercury towards the south, while if it is at the perigee the converse is the case.


The deflected latitude dependent on the second diameter begins with the arrival of the centre of the epicycle at a node of the inclined orbit，when it moves into that half in which is the apogee of the excentric orbit，the eastern side inclines in the case of Venus to the north and of Mercury to the south，and the west－ er side in the opposite direction．On the other hand if the centre of the epicycle moves from a node into that half in which is the perigee of the excentric orbit， the eastern side inclines in the case of Venus to the south and of Mercury to the north．The inclination continues to increase until the centre of the epicycle reaches the apogee or perigee of the excentric．

The latitude of the epicycle and the deflected latitude are continuous from beginning to end，and the result of our observations is that the centre of the epicycle of Venus is always to the north of the eclip－ tic，and that of Mercury to the south．

195．Aujät al－Kawäkib ain hiya．The movement of the apogees of the planets in the direction of sue－ cession of the signs makes it impossible
APOGFSS OF to specify their position except for a PLANETS definite date，although the movement is so slow that it takes 66 years to trap－ erse one degree．At the present time， 420 A．H．，l＇their situations in comparison with the results obtained by INumamad bin Jābir al－Battäni are as follows：－

| Sun in Gemini | $24^{\circ}$ | $32^{\prime}$ |
| :--- | ---: | :--- |
| Saturn in Sagittarius | $6^{\circ}$ | $48^{\prime}$ |
| Jupiter in Virgo | $16^{\circ}$ | $43^{\prime}$ |
| Mars in Leo | $8^{\circ}$ | $33^{\prime}$ |
| Venus in Gemini | $24^{\circ}$ | $39^{\prime}$ |
| Mercury in Libra | $23^{\circ}$ | $43^{\prime}$ |

1 There are two other paragraphs in why．the date of this work is mentioned viz． 321 and 460.
2 The above figures correspond with those in $A O^{\circ}, A B$ ， $A B^{\prime}$ ，except that Saturn has $60.48^{\prime}$ as has $A O$ ，corrected on margin to $6^{\circ} 43^{\prime}$－Nallino I． 239 ，who translates this para－ graph from AP，points out that the difference from Al－ Battēni＇s list should be $2^{\circ} 15^{\prime \prime}$ ，which requirement is satisfied by the above except for Saturn and Venus which should be $24^{\circ}$ ． $29^{\circ}$（and is so in PP）．The confusion of 3 and $8>2$ and 20 and $30 y$ has been referred to in 118.

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196. Jauzaharāt al-Kawäkib ain hiya. The nodes of the planets according to the observations of the westearn peoples (the Greeks of Rum ${ }^{\text {P }}$ ) move in

NODES OF THE PLANETS the direction of the signs at a rate equal to that of the apogees and the fixed stars. This is due to the circumstance that the movement of the ecliptic orbit is towards the east as is that of all the orbits. The ascending node of Saturn, the distance of which from the apogee is $80^{\circ}$, is at the present time in $26^{\circ} 43^{\circ}$ of aquarius, that of Jupiter, $70^{\circ}$ from its apogee in $26^{\circ} 43^{\prime}$ of Scorpius.

Those of Mars, Venus and Mercury, each $90^{\circ}$ from their apogees, are respectively in $8^{\circ} 33^{\prime}$ of scorpius, $24^{\circ} 29^{\circ}$ of Virgo and $23^{\circ} 43^{\circ}$ of Capricorn. But the ideas of the Hindus [and Persians] as to this matter are that their movements are different from each other and contrary to succession like the nodes of the moon as to which there is no conflict; according to their ideas, in our time the ascending node of Saturn is at $23^{\circ} 13^{\prime}$ of Gemini, of Jupiter at $12^{\circ} 1^{\prime}$ of Cancer, of Mars at $21^{\circ} 55^{\circ}$ of. Aries, of Venus at $29048^{\circ}$ of Taurus, of Mercury at $21^{\delta}$ 11, of Aries. In conequince of the rapid movement of the ascending node of the moon it is impossible to determine its exact place without calculation.
197. Ma al-buht. This is a Hindu word for the daily progress of a planet; they pronounce it bhukt1.1 Our associates always apply it to the DAILY MOTION corrected rate, but the Hindus disOF PLANET tinguish between the mean and corrected rates, (bhakti miyena and bhakti taqwim ${ }^{2}$ ).

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We have already discussed the mean progress， 182 ，but It is impossible to determine the corrected rate，there being no definite limits in which to estimate it，for sometimes the movement is rapid and the bunt high，and sometimes slow，and the bunt low，and again it ceases entirely when there is no bunt or retrogrades when the bunt becomes a minus quantity．

198．ME al－buht al－muradial．This is the difference between the daily progress of the sun and moon or of two planets moving in the same direction but at different
DIFFERENCE BETWEEN know the time of meeting of two objects travelling in the same direction，one of which is quicker than the other，you cannot arrive at a solu－ lion without knowing this difference，be cause the changing distance between them is proportionate to it． The difference is also called hissat al－masir（argumentum motüs）and by the Hindus bhuktyantara． 1 Sometimes in place of the foregoing it is necessary to employ the sum of the two rates of movement，when the planets are moving in opposite directions one of them being on the direct and the other on the retrograde path；this is called by the Hindus bhakti 10 g, combined rate－（but we have no special name for it．）

199．Magämat． 2 are numbers（of corrected anomaly） applied to a planet at all points of its excentric orbit， such that when its distance from the apogee of the epicycle is equal to the A TRUE ANOMALY apogee of the epicycle is equal to the
number，the planet stops and makes no progress in the zodiac．it is called［the first maqum，after which the planet becomes retrograde，but if more then six signs，$]^{3}$ the second maqäm after which it enters on the direct path．Whenever either of these stations is known it is only necessary to subtract from $360^{\circ}$ to find the other．

## 1 India II 195.

2 The paragraph refers to Ptolemy＇s Tables，Almagest，Bk． KII．Cap．8．In which are given these distances at the various positions of the epicycle on the deferent．cf． also Nellino II 138－9．The Dict．Sci．Terms p．1228，says Maq而m has two meanings l．the place of the station on the epicycle（as here），and 2．the stoppage itself for which iqamah is preferable（as often in the Tafinim）． 3 Line dropped in MS．
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200. Ribātāt. This is another name for these stop-ping-places but among our predecessors there were those who considered the above described conditions to be apparent not actual. As they knew that the movements of the planets were related to the movements of the planets were related to were suspended to the sun by connecting bands ribattat, 1 Which were sometimes slack so as to allow of movement when near the sun, and sometimes taut, when the planets were distant from the sun so as to prevent movement and cause retrogression. This is a foolish idea to which no attention should be paid, since there is no advantage to be derived nor results obtainable from it.
201. Nit詔āt. ${ }^{2}$ Zones or sectors of the orbits are of two kinds, those of the deferent and those of the epicycle. The first are formed SECTORS OF THE ORBITS by two lines which divide the


A centre of universe. B of the deferent. C apogee and D perigee of deferent. E points of maximum equation and mean movement. 1-4 list to 4 th nițaqs of deferent. orbit into four parts; one of these lines connects the apsides where the rate of movement is at its maximum inequality, being slowest at the apogee and quickest at the perigee: at these points there is no equation and the mean and corrected positrons of the planet are equal. The other line is at right angles to this and passes through the centre of the world; at its ends the equation is at its maximum and the rate of movement the mean rate.
I In addition to the original meaning of halters, ribēāt were fortified frontier stations, afterwards convents, in Morocco in which murabitūn, Marabouts, lived, whence AlmonerFides.Occasi anally also applied to lunar stations. Comanp.3n. 2 Ni faq means both ceinture and enceinte. See New p.62, who supposes this expression to be used for the first time by BarHebraeus.

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Of these four nitaqus the first extends from the apogee in the order of succession to the point of maximum equation, the second as far as the perigee, the third from that point to the of maximum equation and the fourth to the apogee as in the figure.

As to the extent of these areas if regard be had to the centre of the deferent, then the first begins at the apogee, and the others at intervals of 80\%: if on the other hand from the midadistance, li, which they call the unequal centre, then the beginnings of the nitēqs are shown in the table.


The second kind of niţaq is that which divides the opioyclel into four parts also in this case by

[^49] $360^{\circ}$.

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three lines one of which passes from the centre of the deferent through the apsides of the epicycle, and two others from the same point which are tangents to the epicycle. The conditiona as to equation and movement are the same at the apsides of the epicycle as in those are the same at the apsices of of contect is anew the of the deferent, and the place of contact is anew point of maximum equation. These four sectors are therefore niṭagat; the first being at the upper epsis,
on the side of the


A centre of deferent. B of epi-
 cycle of planets. 1'-4' $19 \mathrm{t}_{-4}$ of moon.
C. Points reached by tengents from centre of deferent.

## direction of

movement of the planets proper in the order or succession of the signs, and in that of the moon contrary thereto trary thereto. in the order dear cribed for deferent ab represented in the figure. The extent of these zones if the tangents are arawn from the centre of the world or that of the equant are different in amount but if drawn from but if drawn the dererent

they do not depart from the figures in the accompanying table. When these are compared with the argument of the planet it becomes obvious in which quadrant it is.

202. Max al-sārid wa al-hăbit. The expressions asending and descending are used in various ways: (1) A planet ascends in the north to the ASCENDING AND A planet ascends in the north to t DESCENDING limit of its latitude, then it descends in the north when its latitude begins to diminish. When it passes beyon the node and gets into the southern half of its inclined orbit, as its latitude increases, it descends in the south until it reaches its extreme point, after which the latitude begins to diminish as it ascends in the south.
(2) A second use is from the point of view of the earth, planet being described as descending when in the first and second nifeqs, and ascending in the third and fourth. (3) Some referring to the mid-distance call it descending when in the second and third, and ascending when in the first and fourth sectors. (4) again, a planet is said to be ascending when between the first point of Capricorn and the last of Gemini, and descending
I Note MS. has Moon 13.09 for 103.09.
49.

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When between the first point of Cancer and the last of Sagittarius. (5) Finally when described from the point of view of the meridian as ascending when in the east and descending when in the west.
203. Max al-ziyādah we'l-nuqsān. Increase and Decrease are of two kinds, one with reference to places on the deferent and epicycle, and the
INCREASE AND other to situation relative to the horDECREASE izon. Of the former there are various sorts. 1. Increase of rate or movement, when the planet moves quicker than its mean rate; this is called zEta fill-masir; when slower, näqis fillmasir. 2. Increase in number. 1 The equations of the planets are set down in tables ${ }^{2}$ opposite numbers ${ }^{3}$ in two (vertical) rows, one of which continues to increase up to six signs, and the other continues to decrease from the twelfth sign. ${ }^{4}$ Then you wish to introduce an argument number of a planet into these two rows with the object of ascertaining the equation, if it falls in the first row, it is called zāid fi'l-radad, and in the second naris fi'l-radad.
3. Increase in equation. If the equation is increased by the addition of the portion, hispanic, belonging to it, it is said to be aid firi-tardij, this will be in the list and 3 rad nitaqus, but if diminished in the others. 5
1 Reihänah must have found this kind of increase as well as 3 and 4 incomprehensible without further explanation. Tables of equations of planets, such as Ptolemy, Heyberg II 436; Ptolemy, Manutius II 261; Al-Battani, Naildino II 108.
3 Common argument numbers of mean longitude.
$4_{\text {When both are read down. } P \text { In } A \text { they are read up. }}$
$1^{\circ} 360^{\circ}$ The argument numbers are so arranged because the equation is the same for equal distances from the apogee or perigee; egg. $180^{\circ} \quad 180^{\circ} 135$ and 225 have the same equation. The first column corresponds to the last and and nitaqs, the second to the 3rd and th.
$5^{5}$ ptolemy's Brad column contains the equations calculated as if the centre of the epicycle were on the equant; the fth, the difference due to the fact that it is on the deferent; this difference has to be added in the list and 4th nita, above the nodes of the two excentrios, and deducted in the and and ard. See figure in 184. The angle D"AZ has to be added to the equation of the centre $A D C$ above the node to obtain its position on the equant; D'AZ deducted below. See Manitius II 413

4. Increase by calculation. This occurs when the equation of the anomaly has to be added to the true longitude of the centre to obtain the true position of the planet in the ecliptic; it is called zaiid fijIhisabi, if it has to be deducted, then nader fili-hisab. This increase occurs in the 3rd and th nitaqs of the deferent, and list and and of the epicycle.
5. There is also increase and decrease in luminosity and magnitude, zā"id $1 \overline{1} \cdot 1-n u r$ wailful, due to nearness or distance from the earth. Some people refer to the increase as dependent on the constant approach to the earth from the apogee to the perigee of the apicole, and the decrease, näqis filinnü, to the increaseing distance as the planet moves from the perigee towards the apogee. Others speak of the increase as being from the perigee of the deferent as far as the mid-dislance, and the decrease from that towards the apogee; that is to say, that the mean is at the mid-distance, decreases towards the apogee and increases towards the perigee. Consideration compels the view that position on the epioyole is chiefly responsible for the differonce, but the custom of astronomers is to restrict it to the zones of the deferent. In the case of the moon, however it is the distance from the sun which counts, so from the lat to the middle of the month, they speak of it as being on the increase, while others use the expression aid fi'l-nur for the time when it is larger than half $1, e$. from the 7 th to the and of the month.
6. The other kind of increase and decrease which is referred to the horizon is that the eastern quarter between the east horizon and the meridian, and the quai ter opposite to $1 t$, its nadir, are spoken of as in excess, because both day and night respectively are on the increase in these, and on the decrease in the remaining quarters.

[^50]
204. Mā ayyam al-r̄̄las. Horld-days are those persods in which the planets with their apogees and their nodes take to make a complete revolution WORLD-DAYS (without remainder)P; and indeed every nation has endeavoured to elicit them with the object of keeping in mind the movements (and situations) $P$ of the planets, in accordance with what their observations have taught them as to their movements, but the measure which is best known is that of the Hindu kalpa, the days of which are called kalpaharganl and are known to us muslims as sind-hind ${ }^{2}$ days, but improperly so, for in their language the word is Sadhānd (Siddhanta), a name with is given to all their important astronomical works, and which means accuracy Without crookedness. According to their books there are five siddhenta, the first called after suras, (the sun), the second after Vashpasta, the third after Pulisa, the fourth after Rum, and the fifth after Barchan.

These days are called world-days because the Hindus believe that two kappas constitute a nychthemeron of Beraham, i.e. nature, 4 one being a day and the other a night. The beginning of such a day is when the planets set out from the first point of Aries, on a Sunday, and when this kalpa is finished, 5 the night kalpa comes on during which all things which were moving become quiescent, and so a night end day in the ilo of Barkham are completed. 6 His life is a hundred years.

The complete exposition of this question is a very long matter which we have dealt with in another place. A table is annexed in which the number of revolutions of the planets in a kalpa are given according to Hindu notions, not according to our astronomical tables. Side by side with these figures, are the data of those "thousands" which Abut Marshar has recorded from Persian sources.

1 So in PL; A, aharki; PP, hare kin; India, I 368, each kalpa equal to $4,320,000,000$ solar years.
${ }_{3}$ So in PL. A, Sindhad. PP. Hind u Sind. India I 153.
3 Surya, Vasishţa, Paulisa, Romaka, Brahma, l.c.
4 India I 84.
5 When all are again in conjunction in $0^{\circ}$ aries.
6 India I 331. 360 times two salpas making a year.



1 v．India，II， 16.
2 The number of years multiplied by 365,258 ．
3 A smaller world－year is that of 36000 yearg，derived from the assumption that the vernal equinox in conse－ quence of precession is shifted through the whole zodiac in that period；the＇predecessors＇，l75，estimated a de－ gree in 100 years，Hipparohus in 72，a sign in 2160 ，and the Whole zodiac in 25920 ．The Vernal Equinox entered Aries about 2200 B．C．and Pisces about 100 B．C．Jeremias，Altor－ ientalische Geisteskultur 1929，p．242．He draws attention， p．303，to the similarity of the Indian and Babylonian world－years，and believes thet these reached India from the Greeks and that the Greeks had them from Babylon through Berossus．

Has 14 by mistake．There is a lacuna in this MS．from paragraph 205 to middle of 209 supplied from ff．36－38 AO＇．

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205
205．Hal yurraf maqädir ajrām al－kawākib．The diameter of the moon is known in terms of the radius of the earth；Ptolemy determined this by the differences of his point of view（parallax） ikhtilāf al－manzar．He also determined the diameter of the sun in the same ratio
SIZE OF
THE STARS from eclipses in book planets and fixed stars to that of the diameter of the plane is obvious to the eye．What these are is ex－ planned in the Book of the Nanshürāt 2 and we have record－ od them in the accompanying table，in accordance with the opinion and results of Ptolemy since no other has hitherto established itself with us．


1 PP ．zir百ki ta aknuin kasi－ra bander in sukhun va john kardan nayāftIm va nah andisha kashlaan．Because up to this time we have not found any other person working at this topic．
＿cf．Nallino，Al－BattānI I 289 and II，XXVI and delete na in iss．

准

206. Fa hal kulluhā marlümät il gadr ka qutr alPard. The distance of the sun and moon from the centre

DISTANCE AND SIZE OF PLANETS of the earth in terms of the earth's radius is also made clear in the fifth Book of the wajisti; astronomers are agreed that the furthest distance of any planet is the nearest of that which is immediately above it, and thus the ratio between the nearest and furthest distances is known in the case of each planet.

When one of these distances is known, all are known, as well as the distance of all stars from the earth in terms of the earth's radius, their diameters, and the ratio of their volumes to that of the earth. The annexed table contains the results of Ptolemy, of the accuracy of which we are assured.


[^51]




3

|  | 206 |  |  |
| :---: | :---: | :---: | :---: |
|  | Nearest distance in parasangs compared with radius of earth lo8l, 19'21" | Diameter in parasangs as compared with diameter of earth 2163, 7:,11" | Volume as compared with volume of earth 166744242 , 14'33" cubic parasangs. |
| Moon | 36395 | 639,28' | 4168606 |
| Mercury | 69416,4*23" | 45,29 | 19-96 ${ }^{2}$ |
| Venus | 183656,2* $3^{\prime \prime}$ | 642,29' | 4353877,26 |
| Sun | 1254638,7'11" | 11936,03' | 27901869897, $42^{*}$ |
| Mars | 1363361 | 2452,07' | 241779151,30' |
| Jupiter | 9919443,1'3 ${ }^{\prime \prime}$ | 9880,36* | 15879610019,28 ${ }^{\circ}$ |
| Saturn | 17914241,2'33" | 9772,25' | 15362702867,59' |

Fixed stars 22974394,06

| Ist Magnitude | 10241,13' | $1768322690817{ }^{\prime \prime}$ |
| :---: | :---: | :---: |
| 2nd Magnitude | 10096,57 ${ }^{\text {\% }}$ | $16946773170,57^{\text {* }}$ |
| 3rd Magnitude | 9375,45 ${ }^{\text {' }}$ | 1690230803948 ' |
| 4th Magnitude | 8546,21* | 10254770908,37* |
| 5th Magnitude | 7464,32' | 6847630221,55 |
| 6th Magnitude | 5697,34* | $304586149449^{*}$ |

[^52]
207. ham miqdar al- ard. Measurements of the sters can only be made by taking the earth as a unit, just as we use the cubit or other weights and SIZE OF THE measures. Now the figures for the earth EARTH are as follows:

| Diameter | 2163 | $1 / 3$ parasangs |
| :--- | ---: | :--- |
| Circumference | 6800 | $1 / 4$ |
| Surface | 14712720 | $1 / 4$ square |
| Volume | 166744242 | $1 / 5$ cuble |

Consequently to determine the distance of a star from the earth in parasangs, all that is necessary is to multiply its nearest distance by the number of parasangs in the radius of the earth, wile the comparative dimensions may be translated into parasangs by using the above figures, as set down in the table on the preceding page.

Similarly the dimensions of the ecliptio can be expressed in parasangs as in the subjoined

## Table of Zodiac Girdle

| Diameter | 44964005 | $13 / 30$ | parasangs |
| :--- | ---: | ---: | ---: |
| Ciroumference | 141315446 | $2 / 3$ | " |
| Length of a sign | 11776287 | $21 / 80$ | $"$ |
| Length of a degree | 392542 | $9 / 10$ | $"$ |
| Length of a minute | 6542 | $23 / 60$ |  |

208. Hal 1khtalaf IF migdär al-ard. It is inevitable that there should be controversies regarding the dimensions of the earth for it is one DISPUTES AS TO of those matters which must be based SIZE OF EARTH on experiment at a alstance and on reports on observations. All nations have recorded their observations in the measures employed in their own countries, e.g. the stadium of the Greeks and the jauzhan (yojana) of the Hinars. When Greoks and the jauzhan (Yojana) of the Hinas. When therefore their books were translated into Arab

then the Caliph Mremun son of Harün al-Raschid commanded an investigation to be undertaken anew, 1 and with this object a number of the savants of that time, (such as Khalid Marrūar, ${ }^{2}$ Bül-Buhturi ${ }^{3}$ the geometrician ${ }^{4}$ and All b. 'IrE the astrolabe-maker') were ordered to proceed to the desert of Sinjar and take the matter in hand. They found the value of one degree of a great circle on the earth to be 56 and $2 / 3 \mathrm{miles}$, and multiplying this by 360 arrived at 20400 miles for the circumference of the earth. Each mile is a third of a parasang or 4000 black cubits; the trade cubit is well known in 'Iraq, and is used in Baghdad for land-surveying; it measures 24 finger-breadths (isar). 6 I have investigated the matter in Hindustan by another method? and have found no discrepancy with the figures cited above.
209. Agtā̀ atranāsir al-arbarah hal hiya. Is it possible to state the dimensions of the four elements in these terms? The earth with the
DIMENSIONS OF THE FOUR ELEMENTS mountains projecting from it like teeth is solid, and the water surrounds it occupying the hollows, but these two elements form the one globe, whose dimensions have been above stated. Now when the radius of the earth is deducted from the distance of the moon at perigee, the remainder is the distance between the surface of the earth and the moon's orbit occopied by the air, viz. $352131 / 10$ parasangs. Then the
${ }^{1}$ Suter, Abl. Gesch. Math. Miss. X p 209., and Not. et Extr. VII P 94. The history or the determination of a degree of the meridian has been given by Nallino, cosmos di Guido Cora, XI 1892. He concludes that the Arabic mile had $1973,2 \mathrm{~m}$. corresponding to a cubit of $493,2 \mathrm{~mm}$.

Sauvaire, Jour. Asiat. 1886 p. 479 seq. discusses the various cubits in use by the Arabs. Two of them seem to have been inherited from the Persians; the royal cubit of 32 digits (igber) and the common, legal or commercian cubit of 24 digits. The last named dirt altijarat is the equivalent of the Persian arsh-1 saida which may account for the Arabic name of 'black' cubit: the story that it was taken from the arm of a black










measurement of the volume of the earth, viz. $5,305,498$, 589 4/5 cubic parasangs is deducted from that of the sphere whose radius is the nearest distance of the moon from the centre of the earth, viz. 200,356,658,322,333 $1 / 31$ parasangs there remain $200,351,352,823,7438 / 15$ parasangs. This is the dimension of air and fire togather, but it is impossible to determine the amount of these elements separately. Above the air in the moist vapours occur the various phenomena of wind, cloud, snow and rain, also thunder, lightning, thunderbolts, rainbows, haloes and the like. Above it likewise in the dry smoky vapours are the stars with tails and locks, shooting stars see.
210. Kaif wad al-ma mirth. The plane of the equinoctial cuts the earth at a circle called the equator khattu'l-istiwa into two parts, northern and southern hemispheres. A great circle drawn through the poles great circle dram through the poles
divides these into four quadrants, two
eunuch by Al-Rashid or Al-Ma 'mun is not convincing. Probably the neo-babylonian cubit of 496 mm . (Jour. Asian. XIII 1909 p. 98,24 digits of $20,66 \mathrm{~mm} .$, the measure of six barley-corns) persisted in r iraq with slight modification and was employed for this survey.

Occasionally the digit was measured by grains set on edge instead of lying flat, in which case 192 were assigned to the cubit instead of 144 (Sauvaire p. 504). The sawed cubic used by Omar for surveying the black lands of rirāq (Sawed) is sometimes confused with the 'black' cubit, and is supposed to have been the royal cubit. Idrisi ( 6 th climate, 9 th sect.) gives the measuregents of the Great Wall" in sawed cubits. According to Sedillot (Sci. Math. Arab. II 755) Al-Quami reckoned 4000 cubits (al-sawwa?) to the mile.
2 for Marwarmüdif v. Dict. Geog. de la Perse p. 525. No names in Arabic version.
3 Bū'l-Bubturi rAll ion al-Buhturí v. Suer.
4 Al-massity, the surveyor.
5 rAll b. 「Isā - Asturlāb-Kun PL, Asfurläbí PP. 6 Six English barley-corns average 21 mm .
7 Al-Biruni determined the height of a mountain in India, measured the angle of depression of the horizon from the top and cal culated from them the radius of the earth 1 These figures are written out in words in PL and AO' two hundred thousand thousand thousand thousand etc. in Ar $200,356,658,322,333$.
















210-211
northern and two southern. Those who have investigated the matter find that the dry land does not extend beHond one or the northern quadrants; this is therefore were an island surrounded by the sea. In this quarter Which men are constantly traversing, they find seas, islands, mountains, rivers and deserts, also towns and is reached of excessive cold, where snows are heaped on snows. 1
 shores are Tangier and Spain, is called the surrounding sea, the ocean of the OF SEA Greeks. Whoever ventures therein does
not go far from the coast, (on account
the roughness, darkness and tracklessiess of the of the roughness, dione. P) Beyond the countries mentioned, the sea passes by the lands of the Slavs, and a northern section of it penetrates into the land until lime. This is the Varangian Sea, and these Varangiens are very virile people, and have their chief town,
the Turks to the east; between Turkestan and the ocean to the north the country is unknown, full of desolate mountains; no one penetrates there.

From Tangiers southwards the ocean passed by the country of the Western Negroes, and then turns to the loft so as to get to the other aide of the Mountains reaches Sofala al-Zanj.) ${ }^{p}$ Ships do not enter this sea, if they do, they do not escape into safety.
1 208-I0 are quoted by Wiedemann, Arch. Gesch. Nature. u. Technik. III.253, while in his Beitrag XXII he has graphical interest in 211-2, 214-5, 220, 236-9, 241 . Z The passage quoted by Nailino I. 170 from al-Kharaqi closely resembles this paragraph except that it is supplemented by the dimensions of the seas.
PL Paid; Badland PP may be Poland - Nuzhat al-qulūb. Trans. P. 230 and 249 n : Not mentioned in A. merely "these are people on the shore".

 سشتل













Following the ocean from the north to the east pest the limits of the Chinese Empire (chin va machine) it is found to be trackless and dangerous, and no one goes there. At the southern extremity, however, there is a gulf which is the beginning of those seas called after the adjacent countries, of which the first is the Chinese sea and the next the Indian Ocean. From the latter there are gulfs penetrating into the land, forming as it were separate seas, like the Persian Gull the eastern shore of which extends from Basra to Makrifn;opposite the latter is the port furdat A bargahP of rumen Leaving "Oman and proceeding south the Arabian shore (shahr) is reached whence frankincense Kundrū, Iubān comes, and then Aden. Thence two great gulfs project. one of these (the Red Sea) is well known at Qulzum, and passes by the country of the Arabs, which is in fact an island between this sea and the Persian Gulf. As the Abyssinian are opposite Yemen, the sea is here called both the Sea of Yemen and the Abyssinian Sea, while near the Hejaz it is known as the sea of Qulzum. This is a city seated on the shore of the sea where it ends towards Syria, so that the traveller must turn here leaving Syria behind and sailing along the coast of Egypt and the Beja territory.

The other gulf is that which begins at a point, Res Berbera, opposite Aden and is called the Berbera Sea, find this great Sea goes as far as Sofala above referred to. No ship passes this point on account of the dangers of navigation; beyond is the Western Ocean (but the nature of the connection therewith is unknown.) $P$

In the eastern part of this sea are numerous islands, first those of zibijP al-zanj A al-zanj then the DIva DIbajāt A and Qumair ${ }^{2}$ groups, (small in size, some of them arising anew out of the water, others as a result of erosion, becoming invisible). P'3 Then there are the islands

1 of. India I. 210. "The gold-islands zabij are in the East, those of the Zany in the West and the Diva and aumair groups in the middle" - the association of the Qumeir With the Diva group (Laceadives \&c) points to the comoro Islands and Madagascar - of. De Vic pays does Zen. Ferrand, Jour. Asiat. 1910 and Storbeck, Mitch. Orient. Seminar Berlin KVII, 1914. In these MSS. there is the usual confusion between Zany, Zānij and Zābij.
2 AO' and AB' have Qushmir.
3 Cf. India I. 233 and II. 106.















of Zangistañ al-zanj $A, P$ and $A$ maps al-zānj, large and celebrated islands like serandib (Ceylon) known to the Hindus as Sangaldib. From it come various precious stones and diamonds. Then the island Galah from which tin is obtained, and Sarbuzap, Sarira A from which camphot comes, (and other islands from which cloves, sandal-wood, coconuts, ebony, barhank (Kanbar? 001r.), rattans, aloeswood end the like are obtained. ${ }^{\text {( }}$ )

In the middle of the habitable land is another sea called Pontus by the Greeks in the country of the Slavs and Russians. Our people all it the Sea of Trebizond from the Greek port on its shore. Hence a great body of water proceeds which becomes narrower as it approaches Constantinople, and still narrower before it opensinto the Sea of Syria. On the southern shore of the Syrian Sea are the countries of Morocco and Ifriqiyya (Tunisia) as far as Alexandria and Egypt, opposite these are Spain, the Roman Empire, Asia Minor and Antioch, while between them are the cities of Syria and Palestine. This sea constantly flows towards the ocean through a arrow place known as the Passage of Hercules and now better known as the 'zuqaq". The sea contains several rell-known islands such as Cyprus, Samos, Rhodes and 31011y.

Near Tabarisitan there is another sea and the Capital town (bärgäp furdat, port A) of Gurgān on the shore is a oily Abiskun by which name also the sea $1 s$ known. From this point the coast-line follows Tabaristān, Dailam and Shirvan, Derbend of the Khazars, the territory of the Alana, and arrives at the oity of the Khezars where the river Itil (Volga) flows into the sea; thereafter passing the country (diyar, habitations A) of the Ghuzz it reaches Abiskun again. The sea is also known by the name of the adjacent countries, perhap best after the Khazara; our ancestors knew it as the Sea of Gurgan, Ptolemy as the Hyroanian Sea. It is not connected with any other sea.

The habitable land contains numerous lakes, batēih,

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 نهى مستنقتات وبطان


1. Caspian, 2.Turks. 3.China. 4.Java. 5.India. 6.Makran. 7.Persia. 8. Khurasan. 8.Persian Gulf. 10.Oman. 11.Aden. 12. Qulzum. 13.Syria. 14.Iraq. 15.Pontus. 16.Mediterranean. 17.Alexandria. 18. Egypt. 19.Sudan. 20.Ras Berbera. 2l.Mounts.of the Moon. 22.Sofala al-zanj. 23.Mor0000. 24.Zuqäq. 25.Andalusia. 26.Rū. 27.Constantinople. 28. Slavs. 29. Khazars. 30.Baltic and Varangians. 31. Surrounding Oeean. 32.Dibācha Islends. 33. Islands of the Zanj Empire.
and sometimes they are called small seas, puhairat, like those of Apamea, Tiberias and the Dead Seal in Syria, and the sea of Ihwarizm(Aral) and Issiq-kul near Barsukhän. The above figure approximately represents what we have described.
2. Aln khatt al-istiwa, wa ma khawesshu. The eauator nasses from the east into the Cnine se and Indian Ooeans and through several of the Islands there. after heving treversed the boundaries of the

[^54]






Zandian arrives at the deserts of the Sudanese, who are engaged in the slave-trede, and thence passes into the Western ocean. Those who dwell on the equator have their nights and days always of equal length, both north and south poles are equidistant on their horizon, and the parallels of latitude are perpendicular to the horizon, not inclining to either side. The sun crosses the equator twice a year, first when at the first point of Aries, and second when at the first point of Libra, on which occasions it passes to the north and south respectively. The equator is called khat al-istiwa and spectively. The equator 1 s called khat al-istiwá and
khat alai tidal on account of the complete equality of khat alai tidal on account of the complete equality
day and night. As for the opinion expressed by some people that the nature and constitution of the inhabitants is of even temperament, there is evidence to the contrary in the burnt-up condition of the people and their neighbours because they vary much in their complexion and their hair, and are not alike in their physical characteristics, although all of small stature. Who, indeed, could be of equal-tempered constitution in Who, indeed, could be of equal-tempered constitution in a place where the sun cooks the brains of the inhabit-
ants from above, till it moves out of the zenith at those ants from above, till it moves out of the zenith at those
two periods which we ail summer and winter, and brings two periods which we asl summer and winter, and brings about a little coolness and relief.l
213. Kaif intisab al-qēmāt tala wajh al-ard. Anyone who considers the question of the erect posture at one place naturally thinks that his ERECT POSTURE ON posture is parallel to that of everySURPACE OF EARTH one on earth, and that the same is the case with the inge of falling bodies. But whoever reflects on the matter at differont places, and gives some consideration to the subject knows that the erect posture is in a line with the diameter of the globe, the head directed to heaven and the feet to the centre of the earth. (For this reason everyone prays to what is above him.P) But what is upright to him is not upright to others and may be quite inverted. If we consider the situation of the chinese

1 Cf. Wiedemann, Arch. gesch. Nature. u. Tech. V. 56.
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## 213-215

and the Spaniards who live on the two opposite margins of the habitable earth, the one on the east, the other on the west, (and we are watching the phases of an eclipse of the moon with them,P) we find that the soles of their feet are directly opposite each other. If one of those logicians who are accustomed to judge matters high and low by their own standards, not according to their actualities, were to picture to himself the situation with a ball made of wood or other material, Whose centre is outside the centre of the world, and Were to observe the conduct of an ant creeping on the under surface, he would feel faint in contemplating the condition which he calls falling off, but which we regard as leaping or flying.
214. Max Para al-balad. The latitude of any town is Its shortest dist once from the equator in a northerly direction, because all towns are thus direction, because all towns are thus
situated. Corresponding to it there is an situated. Corresponding to it there between the zenith and the equinoctial. The

## LATITUDE

LATITUDE OF TOWN elevation of the north pole is equal in all places to their latitude and therefore this is sometimes used instead of the latitude. The depression of the south pole, although it is also complementary is concealed from us, and we are not cognisant of it.
215. Ma tūl al~balad. Longitude on the other hand $1 s$ the distance from the extremity of the dry land whether calculated on the equinoctial or the equator, or on a parallel circle, because these having comparable parts can be substituted for each other. In consequence of the fact that our astronomers have adopted the customs of the Greeks in this matter, and that the Greeks have selected the western extremity of the land, the longitude of towns is now calculated from that point. But there is some discrepancy as to this extremity for some people take it as the shore of the Western Ocean, while others adopt the Fortunate or

1 Quoted by Wiedemann, Beitrlige, LX p. $57 \mathrm{Bd} .52 / 53$.

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Eternal Isles－six islands situated 200 parasangs off the coast of West Africa．This is an unimportant matter as long as all longitudes are measured from one point， but in those cases，some of which have been measured from the one and some from the other point（or where two longitudes are given in the books for a place with a difference of $10^{\circ}$ 音，people who have not the requisite knowledge and are not＇proficient in this science are unable to distinguish the one from the other．

216．Max alladhi yusammi mäbain al－tūlain．The difference of longitude between two places is arrived by subtracting the smaller from TWO LONGITUDES the difference of time units between
 their meridians，calculated either on the equinoctial or the parallel of either of them or some other parallel．

217．Ma alladhi yurrid min ikhtilär tūlai al－ baladain ida tasani rardahuma．Should the latitude of longitude different，there is
only the difference of time only the difference of time and ill
sunset do not occur at the same time，being earlier in the eastern place proportionally to the difference of longitude；the climate of both Will be alike unless proximity to the sea，or mountains， or sandy desert，or a difference of level occur to account for a difference．

218．Ikhtiläf randal el－baladain fha tasāwI tüiā human．If on the other hand two places agree in

WHEN LONGITUDE SAME AND
LATITUDE DIFFERENT longitude but differ in latitude midday and midnight occur in both simultaneously and all stars which have no declination rise and set each at the same time as does the sun during the equinoxes；when however the

[^55] comédie－ 1901.
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sun or planet leaves the equinootial, if to the south, then the rising is earlier and the setting later in the place of lower latitude, and if to the north, then the reverse is the case. The amount of difference between rising and setting in the two places is different with each parallel of latitude, as are the length of day and night, the ortive amplitude, the meridian altitude, the shadow at noon and the number of stars of perpetual apparition and occultation. The place w th the higher latitude is necessarily colder, unless some of the circumstances enumerated above intervene, as e.g. Gurgen which has a higher latitude than Raj, but has less air, and Ghazi (Ghaznah A) which although on the same parallel as Baghdad is a cool place while the latter is hot.
219. Ikhtil̄̄t al-tūlain wall-rardain. If latitude and longitude are both different, then the natural characteristics of the
BOTH LATITUDS two places are compounded of the AND LONGITUDE DIFFLGRENT'
actors adverted to above. The rise and setting of any star never cc cur at the same time, unless at one of the two points where their horizons are in contact with each other.

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220. Ma sadat al-mashrig. At the equinoxes the sun rises and sets opposite the ends of the equinoctial in e which we drew in the Indian Circle ORTIVE 131, but when it moves to the north, sun AMPLITUDE rise and sunset occur at two points of the horizon north of the equator, the ends of a line parallel thereto. Every day this in ne becomes mare distant from the equator until the sun enters the first point of Cancer, when the points of summer sunrise and sunset are know a as mashria wa maghrib alsalt. The reverse occurs when the sun moves south, and when it reaches the first point of Capricorn, the points of winter sunrise and sunset are called mashrig wa maghrib al-shitā'. The arc between the point of rising of the sun on the horizon and the equator, the ortive amplitude, is called sa'at al-mashrig, and similarly sa'at al-maghrib $1 \frac{1}{s}$ the arc between the point of setting and the equator, the occasive amplitude. In the case of places with latitude the amplitude is greater the higher the latitude. A diagram follows.

Above is the $S$. point, below the $N$. the vertical line joining them is the Meridian, khat al-zawal. The line joining the $F$ and $\mathbb{N}$ points, khat al-ittidal, has, right and left, the equinoctial sunset and sunrise points; the limes parallel to it above and below respectively the winter and summer points. The copyist makes the summer sun rise in the West and set in the E .

E. W. Equinoctial Sunrise and Sunset points

A, B. Summer, C.D. Winter Sunrise and Sunset points
A. E. and C. E. Ortive Amplitude. B. F. and D. F. occasive do.

One folio is absent from this NS containing paragraphs 22I-223: these are supplied from $A O^{1}$ ff 41 and $42^{r}$.

فَطْ






 مآمَا



## IEAGTE $O P$ the equinoctial or on circles parallel

DAY AND NIGET thereto; all having the same pole, the pole of the universe. When the horizon passes through the pole (it is only at the equator that this occurs) it outs these oircles into two halves, that above the horizon being equal to that which is below. It is for this reason that at the equator day and night are equal. As soon as a place is away from the equator the north pole rises from the horizon proportionately to the latitude of the place. When the horizon passes beyond the pole, it is only the equinoctial that is cut into two halves, both of them being great circles; it is on this account that day and night are equal all over the earth when the sun is in the first point of Aries or Libra, because the sun is then revolving in the equinoctiai. But the horizon cuts the other oircles unequally, the result being that larger parts of the northern circles are above the horizon than below, and consequently when the sun is in the northern constellations the day is long and the night short. With regard to the southern circles the parts above the horizon are shorter than those below and consequently the day is short and the aight long. If two circles be taken at equal distance from the equinoctial, the excess of the day or night in the one will be complementary to the deficiency in the other, 1.e. that the aight of the one will be equal to the day of the other.

222. Ma caus al-nahār wa fadihu wa tardilhu. The arc of day is as much of the circle as is above the horizon, and the arc of night as much

ARC OF DAY
ITS EXCESS AND EQUATION as $1 s$ below. The comparison of this arc to a bow is particularly appropriate when a place has latitude. Its length can be expressed in degrees of the parallel of latitude of the place, or in hours, the equinoctial day being $180^{\circ}$ or 12 hours. The difference of the length of days is the excess over or deficiency from this, and the 'tardilu "l-nahar' the equation of the day is the half of the difference.


NS North and South Poles INa Zenith and Nadir ZN Height of Pole DE Semi-diurnal arc of equinoctial EEl
CA Semi-diurnal arc of Northern Parallel AA l FB Semi-diurnal arc of Southern Parallel BB
GG,HF equation of day, the amount to be subtracted and added to make equal to the aquinoisl semi-diurnal arc DC ortive amplitude
223. Ma al-kawākib al-abadiyyah al-zuhūr wailkhara. If an imaginary circle be drawn ron nd the north pole, the circumference of which
STARS OF PERPETUAL APPARITION AND OCCULTATION touches the horizon, then all circles within that do not touch the horizon, and consequently all stars which revolve on these are always visible, ie. are stars of perpetual apparition and neither rise nor set. If they are not visible it is due to the brightness of the daylight, while darkness renders them visible.All the stars of the Great Bear are always visible throughout Transoxiana,e.g. while at Mecca and Aden the three stars of the tail rise and set. Similarly round the south pole there is a circle the nadir of the above, within which are stars of perpetual occultation for the above mentioned places. Canopus may be taken as an example which is never visible in Transoxiana, while for a part of the year it does appear above the horizon in Iraq and some parts of Khuräsän.











## 224-225

224. Hadha'l-tarabbud II 'l-zuhūr wa'l-kharä haqIqI am lahu taghayyur. The distance of each of the ix ied

IS TBTS PERPPMUTTY R EA stars from the pole of the OR SUBJECT TO CHANGE never departed from, because the movement of the fixed stars is with that pole, but their distance from the universal pole is not uniform. So it is possible that a star which has never been one or perpetual apparition or occultation, and has formerly risen and set may move eastwards into one of those two circles touching the horizon and there carry out its circular movements, while one that has been in perpetual apparition or occultation emerges from the circle on the other side, but such changes of position can only take place in immense lapses of time owing to the slowness of the movement of the stars. Indeed they cannot happen to every star, and the rule for that is this:- To decide whether a particular star which is permanently visible or invisible at a locality may sometime rise and set over it, deduct its latitude from $90^{\circ}$ and compare the remainder With the difference be tween the latitude of the place and the obliquity of the ecliptic, if more, then it is possible; if less, the star will never alter its position with regard to that locality.
225. Mä al-irtifär wail-inhytāt wa tamäăhumā. If a great circle be imagined passing through the zenith ALPITUDE AND and the sun or a star or any given DEPRE AN point in the heavens above the horizon, it is perpendicular to the horizon and the altitude of the body is the are of that circle between it and the horizon. That portion of the same circle between the body and the zenith which is one of the poles of the horizon is called the complement of the altitude or zenith distance. If the body is below the horizon the arc between the two is named its depression inhität or inkhifād, and that between the body and the nadir the complement of the depression.
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22B．Ma al－irtifar al－ausat．The mean altitude is the arc of such a dircle between the horizon and the MFAN ALTITUDE equinoctial，and its complement that zenith．

227．Ma al－miqyās wa＇l－z111．A gnomon and its shadow．The style，shakes，may be made of wood or other
$\qquad$ AND SHADOW material sharpened at each end and driven like a peg perpendicularly into the ground．Then the sun is out，the shadow of the style with its divisions is measured to see how they compare．The line joining the point of the style and the point of its shadow is called the diameter（hypothenuse）of the shadow．

228．Aj致＇al－migyEs kan hiya．If the style is divided into twelve equal parts these are named fingers， esābI，if into sixty，divisions，ajză＇， DIVISIONS and if into seven，feet，aqdäm（Some people OF GNOMON use $61 / 2$ for the last）．

229．Anwāral－azlĒl kan hiya．There are two kinds of shadow，the one cist on a horizontal，the other on a vertical surface，when eeg．the gnomon is KINDS OF fixed perpendicularly to a wall．The former SHADOW shadow is oiled mustawl（umbra reata）， while the latter is named muntasib on account of being perpendicular to the ground，and marcus because the point of the shadow is directed to the ground（umbra versa）．
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230. Ma al-samt. The point of intersection of a vertical circle of altitude of the sun or a star with the horizon is called same (azimuthal
AZIMUTHAL point. 1 If the distance of the same from POINF the equinoctial is taken, then the complement of that is the distance from the meridian, (azimuth) and vice versa. If from the centre of the Indian Circle you drava diameter through the middle of the shadow, that end of the diameter which is towards the sun or star is its amt, and the end of the diameter which is towards the point of the shadow is the nadir of the same, and the distance of both is equal, but in different directions, ie. if the shadow points west the amt is east, if east, west, and similarly with regard to north and south.


Eq. Equinoctial. H H ${ }^{l}$. Horizon. E its east point. N. North Pole. $Z$ Zenith. HZH ${ }^{1}$. Meridian. S. a star. DS its declination, $S N$. complement of declination, A its 'semi', Azimuthal point, AE its distance from Equinoctial, AH complement thereof 'azimuth'.
SZ. Zenith distance, AS. altitude.

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231-232
231. Ma dhālika Pi ni af al-nahër. All great circles with pes through the zenith are called
circles of altitude, and the meridian is one of these
distinguished by passing through the zenith and the pole of the universe. When the altitude of the sun is taken in the meridian, it is the highest of all altitudes, and as the shadow corresponds to this, the meridian shadow is the shortest of all shadows of the day. The meridian intercepts the horizon at two points, north and south; these are the meridian sumut, but the distance of any point from these is not taken notice of.
232. Ila kan yanqasimu azlāl nisi al-nahār we irtifar ${ }^{2}$. The extremity of a meridian shadow always points north in those places

DIVISIONS OF
MERIDIAN ALTITUDE AND SHADOW rose latitude is greater than the obliquity of the ecliptic, and the meridian altitude is south, its complement being the distance from the zenith southwards to the sun The meridian altitude of the sun is of three grades, 1 . highest in summer, when the sun arrives at the first point of Cancer - the shadow is then at its shortest, 2. lowest in winter wen the sun reaches capricorn - the shadow then is longest - and 3. both altitude and shadow are intermediate between these two when the sun is at the first points of Aries and Libre; the shadow is then know as the equinoctial shadow, and the altitude $1 s$ equal to the colatitude of the place.

In those places mise latitude is equal to the obliquity of the ecliptic, the conditions are as we have described, except the the altitude at the first point of Cancer, which is equal to $90^{\circ}$, is neither north nor south, and then there is no meridian shadow

In those cases where the latitude is less than the obliquity of the ecliptic the conditions of

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altitude and shadow in winter and spring are of the nature already indicated, but the altitude at the first point of cancer is in the north not in the south, and so when the sun begins to ascend towards the North and also to descend from the North, and wen 1 ts declination is equal to the latitude of the place, it stands overhead and there is no shadow. When its declination increases beyond the latitude of the place, the sun passes from the zenith towards the north, the meridian altitude changes from south to north, and its complement is the distance of the sun from the zenith towards that quarter. At that time the meridian altitude decreases as it increased in the south and becomes less until the first point of Cancer is reached, then it begins to increase. When the altitude becomes north the point of the shadow is directed south. Therefore, those places are designated as 'of two shadows' because the point of the meridian shadow is sometimes directed north and sometimes south.
233. Mā al-1rtif̄̄r wail-zill alladhi la same lihumā. That circle of altitude which passes through the two points of intersection of the PRIME equinoctial with the horizon is known as VERTICAL the circle without same, and also as the circle of the beginning of the sumit (prime vertical). When the sun is in this circle its altitude and shadow are described as without same, because it is then over the equinoctial point and there is consequently no interval between the sam and the equinoctial point until the sun diverges northwards.
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## 234-236

234. Ma zill al-rasr. This in the opinion of the Imams is the length of síadow which determines the time of the end of the early afternoon SHADOW OF THE prayer Ruhr, and the beginning of the FASPR PRAYER late afternoon prayer, tass, and its end. If the length of the meridian shadow is known, called fl'l-zawril, then the shadow is observed until it is twice as long; this is the beginning of the rask according to the Imams of the Hijaz, and is called, ziyadah al-mithl and is marked on the instruments, annal al-rasr.

If the shadow is observed until it is twice as long, this is the time of the rasp according to the Imams of riraq, is called ziyädah al-mithlain, and is marked on the instruments akhir al-rasr.
235. Ma same al-giblah. The point of the horizon corresponding to the qibla is that where the horizon is intersected by the circle passing through the zenith of the locality and that of Mecca. Its distance from the equator or the meridian is the manure
 which it is incumbent on any one at prayer to use in determining the situation of the qibla.

EF. Equinoctial. ZM. Zenith of Lucca. ZT, of a tom SN. Meridian of Tom. P. North Pole. Q. Sam of the Qibla. as. Distance from the meridian of Town.
$2 \pi$. from the equator. 2 ML and P. Latitude and Colatitude of Mecca. ZTP. Colatitude of Town.

1 In a modern Arab daily calendar the times for prayer are marked thus:- egg. March $21 s t, \mathcal{C}^{\prime}$ for raja, dawn 4,19 , for sharüq, sunrise, 6,01, \&' for gharub, sunset, 6,07, $\mathcal{E}$ for rasp, 3,30 and $\mathcal{E}$ for rishá, early night prayer, 7,37.
2 There is a lacuna in this MS. Involving paragraph 236 which is supplied from 44 V and 45 ra A .

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236. Mas al-aqailim. Members of this profession on divide the habitable land into seven long strips from east to west parallel to the equator called
'climates'. The principle of the division is that the middle points of contiguous CLIMATES is that the middle points of contiguous strips differ from each other by half an hour in the ditions is dependent on latitude and is not effected by longitude with only causes differences in the begiming of day and night, a matter which is not obvious without consideration. In the central climate, the fourth, the longest day is fourteen hours and a half in the first thirteen and in the seventh, sixteen. In view of the fact thirteen and in the seventh, sixteen. In view of the fact that the books contain contradictory statements as to of opinion as to the obliquity of the ecliptic, different methods of subdivision determining sines, and the ability of the calculators to distinguish between truth and felsehood, I have mede calculations myself and recorded them in this table with the utmost accuracy.


In the minutes of shadow $P$ 28 was skipped and an aditional 15 introduced lower down. to has moved 2.19 into the equator line, and introduced an additional 4.19 to fill the gap. The first three shadows point south; firm in 40 and AOL for yanab: MS has 8.17 and 49 for 3
Cf. Wiedemann Beitrage, XXVII p. 11. Bar-Hebraeus iefines the length of the day at higher latitudes. Neap, 188.
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237．Mä alladhF yurraఫ fi＇l－aqālİm wa hal bardhā ramarah．Ptolemy considered that the init of the CHARACTERISTICS OF OITMTES Thule（situated in the country o the Slavoniang in the Varangian Sear）Its latitude is nearly the same as the complement of the obliquity of the ecliptic， viz． $66^{\circ}$ ．As for the people who live in the last pert of the seventh climate as far north as the Island of Thule，they are more like savages than human beings and as regards the conditions of existence，are living in the extreme of misery．The further you penetrate to the north the more do the conditions described prevail．The points of the horizon at which the sun rises in summer and winter keep getting further apart until eventually they coincide with their sunset points at that latitude which corresponds with the complement of the obliquity of the ecliptic．Then the parallel of the beginning of cancer is always visible，and the longest day is 24 hours［without might：that of the beginning of capri－ corn is never visible and the longest night is 24 hours without day．There also the pole of the ecliptic passes over the zenith once every day，et winch time the zodiac belt coincides with the horizon，（and nothing is seen of it until the pole passes away from the zenith，$P$ when suddenly six constellations rise altogether．Here also is the beginning of those places where the shadow of a gnomon revolves round it uninterruptedly oren the sun is at the first point of cancer，and the further you penetrate to the north the number of circles in which this condition obtains is increased．）？

238．Famā alladhi yuriad flmä warä hadhā al－maudi： Beyond this point in addition．to the parallel of $0^{\circ}$ Cancer，other parallels be come visible， BEYOND $66^{\circ}$ and，as long as the sun is there，day persists，and the longest day instead of being one of 24 hours，lasts for several days，and increases in length until it becomes a month or months． In the south，the parallels round about $0^{\circ}$ of Capricorn are invisible，and when the sun is there，the longest night in the north becomes first days and then months in length，in proportion as you penetrate further north．

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In such places at certain times the rising of the signs takes place contrary to the order of succession as eng Taurus, Aries, Pisces, Aquarius. And just as at the equator the circles of declination are perpendicular to the horizon (for that reason the orbit here is spoken of as the erect sphere flak mustaqim or kurah muntasibah, [guy raster], so in places possessing latitude these parallels become inclined to the horizon, and the revolution of the heavens is then oblique like a shoulder belt, hamé:il.

The highest latitude is when the pole is overhead, and the equinoctial is on the horizon, the parallels of north declinations are ali visible [and coincide with the muquateras of altitude] ${ }^{\mathrm{P}}$, those of the south are invisible [and coincide with the muqantaras of depression] and the movement of the heavens overhead is like that of a millstone. As soon as the sun moves north from the equinoctial it becomes visible; while when it moves south it disappears. So the period [during which the sun traverses the zodiac and] which we call e year is like a single nychthemeron, day lasting for six months and a night for the remainder of the year.
239. Qubbat al-ard. A central point of longitude between East and West of the habitable world is oalled the cupola of the earth qubbat al-ard.
CUPOLA OF Sometimes it is described as lacking rand, THE EARTH latitude, because it is on the equator. We do not know whether this is an
expression of opinion of the Persians, or others, at least the Greek books do not mention it. The Hindus however say that it is a high place named Lanka, the home of (devils (shayatin) and peris)?, and that under the North Pole there is a mountain called MIX, the abode of angels. On the line joining Lanka and Miru is the city AuzIn (Ujjain) in the MĒ工配 Kingdom, the fortress RühItak (Rohtak), the plain of Tenishar (Thaneshwar) and (the district of the Jaman (Jumna) where are $\rangle^{P}$ the snow-clad mountains which separate India from Turkestan. 3

[^58]3 v. Sedillot, Materiaux II. 651 seq.

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240. Pahal qismat al-ard bishayr al-aqēIIm. Other methods of subdividing the land exist besides that of the seven climates. A tale is told of Afridun, one of the kings jababirah of the Persians, that he OTHER DIVISIONS into three portions between his divided the world into three portions between his
three sons. The Eastern pert including Turkestan and China he gave at his death to Tūr, 1 the Western contanning Rum to Sam, and the Central part embracing the Iranian countries (Iranshahr) to Iras. This is a division by longitude.

Then there is that of the Prophet Noah (on whom be peace) which is by latitude, but also into three parts. At his death he gave the South where the Blake ere to Hamm, and the North where the Whites live to Yäfeth, and the central part the abode of the Browns to Sam.

The Greeks also, have a threefold division, differant from the foregoing. In the first place they divide the world into two through Egypt, the Eastern part being spoken of in a general way as Asia, 2 while that towards the Fest and the Mediterranean is divided into two, Libya to the South including the black and brown two, Libya to the South including the black and brown inhabitants and Europe to the North with white and
inhabitants. In view of the fact that Asia is many times larger than the two Western divisions, they separated Iraq, Färs and Khurasan from it under the name of Asia Minor, the rest being Asia Major. These methods of division are represented below.


Division of Faridūn Division of Noah

| ASIA | Libya |  |  |
| :---: | :---: | :---: | :---: |
| Division of <br> the Greeks. | Major | Minor | Europe |

1 APL Tum. PP TUsh.
2 Aisiyya AO. Ansiȳ̄̄ MS. Absiyā PP.
3 Auraqi.
 الـُرْ










The Persians divided the world by the kingdoms into seven regions (kishwarat) end attributed this division to Hermes..It is represented in the following figure.


The Hindus divide the world into nine portions called nükand (navakhanda) to eight of which they give names in their own language corresponding to the points of the compass, while the ninth is the central part as represented in the figure. 1


I India I 290. These names really mean North South \&cc.; the Khanda are represented in India $I, 296$.
241. ME fill-againm min al-bilad. Since the latinudes of the beginning and end of each climate are given in the table in $236,1 t$ is easy to know in CITIES IN which climate a city is situated if its THE CIIMATES latitude is known. But the latitudes of such cities as are recorded in books are very inaccurate. We have hitherto not had the opportunity of getting accurate results, except to a certain extent, accordingly the following list of the cities situated in the various climates is only approximate, but certainly nearer to the truth than has hither to been published.

We have stated that, following the equator from the east where it begins in the sea to the south of china, it passes through the Zanjl Islands (Zāah)P known as the land of gold, then moves between the two islands Galah ${ }^{2}$ and Sarira (Sarbazah)P3 to the south of the Island of Sarandib (Ceylon), and through the DIbejat Islands (DIva)P4 to the north of the Zany people, 5 their islands, ${ }^{6}$ coasts and low-lying grounds, 7 passing thence north of the Mountains of the Moon to end in the Western ocean.

The first climate begins with the east of the Chinese Empire, traverses the Chinese Sea, and contains those cities which are 1 ts ports, and where are the rivers on which the merchants' boats ascend into the interior like Khänjū and Knunqu. The Island of Sarandib belongs here, and of the Yemen country everything that is south of San ra, like Dhofar, Hadramaut and raden; then in africa it includes Dongola, a city of the Nubians, and Ghana of the Western Sudanese, after which the Western ocean 1 a reached.

The second climate begins with some of the cities of China, traverses Hindustan north of the Qumrūn Mountains and contains Kanauj, Baranasi, and Ujjain, and several of those cities which are on the seacoast like Thana, Jimur and Sindan (Saindān), also cities of F But in other WSS Rabid. P has quite clearly Zavah (Java group): 2 Malay Peninsula. 3 Sumatra. 4 Maldive Isl. 5 Zanū. P. Zangiyan. 6 like zanzibar. 7 P has here Sofala al-Zanj which is fer south of the Equator. 8 Or White Mountains, qum, instead of qamar, referring to the snow-capped Ruwenzori, Kenya and Kilimanjaro. See Storbeok,1.0. p. 19 and sedillot, Mem. II. 752.
9 These names suggest Rang-ohow and Hang-kow; the latter might be Khanfu the port of Eang-ohow. Devio, Livre desc Mervellles de l'Inde, 1883, p. 215 - Nallino, however, thinks both refer to canton (Khwang-chowfu,) and HongKong, Att Linoel 1894 II. 43.


Sind like Mansarah and Daibal; thereafter Oman and the Arab districts of Hajar, Nejrān, Yemâma, Mahra, Saba
Tabālah, AlTair, Judah, Mecca and Madinah Yethrib.
Then the Abyssinian Kingdom and the country of the Bejah, the cities of Aswān and Ques, AI-Sa'fa al- $\bar{a}$ rif, and south of the cities of Ifriqiyya (Tunisia) and Morocco before arriving at the Western Ocean.

The third climate begins in the east of China and includes the Capital of the Empire: then comes the centre of the Indian Empire with Tanishar and Qandahär and the cities of Sind, Mūltān, Tahama, 1 and Karari then the mountains of the Afghans, on to Zăbulistān, ZWalistan Sifistān, Kirman, Fārs, Isfahan, Al-Ahwaz, Al-Baṣra, Al-Kūfa, and 'Iraq and the cities of Mesopotamia, Syria ${ }^{3}$ and Palestine, Bait al-maqdis, ${ }^{4}$ and Qulzum, ${ }^{5}$ Al-Tih and Egypt, Alexandria, and the cities of Barqa and N. Africa the tribes of the Berbers and so by Tāhart and suss to Tangier and the Western Ocean.

The fourth climate begins with China and Tibet, Qital and Khotan, and the cities within these, continles across the mountains of Kashmir, Balūr (Boor) Waken, and Bädakhshē̆n towards Kabul and Ghär, Herat, Balkh,
FokhEristan, ${ }^{7}$ Mev, qühistān, ${ }^{\circ}$ Nishābūr, Qümis, Jurjun (Gurgan)P Tabaristān, Raj, Qum, Hamadān, Mausul, Adarbai jan, (Adharbädgan) ${ }^{P}$ Manbij, Tarsus, Harrar, the Passes (of the Christians) ${ }^{P}$ and Antioch, the Islands of Cyprus, Rhodes and Sicily, ending at the straits separating Andalucia from Morocco called zuqāq.

The fifth climate begins with the country of the Eastern Turks, and the territories of Gog and Magog, Yājū ${ }_{j}$ s nd $\frac{M a}{a} \bar{u}_{j} j$; ${ }^{\text {ri }}$ th the surrounding wall, ${ }^{\circ}$ passes the mountains of the Turks with their well-known tribes,
1 Several MSS have nihayat.
2 P. MSS have Zamulistan faccording to Fullers a colloquial form). Walistan or Welishtan absent in PL but Fāltisēn in PP, perhaps a fragment of the coll. form. 3 MS has shāpür for Al-Sha?
4 Jerusalem, MS has muqadiis.
5 Near Suez.
6 Misspent in MS. Khitāp, Northern China, from the khitān nation wish ruled over it in the lath and Il th centurlies, the Cathay of mediaeval Europe, still used in Russian and Turki for China.
7 South of the middle Oxus, v.Marquert, Eran-Shahr.
8 KUhistan P.
9 The great wall of Chine was attributed to Alexander, Fa sadd-1 S1kandar enjẵat PL'.



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241-242
and arrives at Kashghar, Balāsāghūn, ${ }^{1}$ Thāsht, ${ }^{2}$ Ferghana. Isbīj̄̄̄b, ${ }^{3}$ Al-Shāsh, ${ }^{4}$ Ushrūshna, Samarqand, Bukhara, Khwarizm, and the Sea of the Khazers (known also as Abiskun) P [the Caspian] and passes Ba b al abw of the Ghazars)P, Barda'a, Maiyafarqin, 5 Armenia, the Passes into Asia Minor, the cities there, then crosses over Rumiya the Great, the country of the Galicians ${ }^{6}$ and the cities of Andalus to end in the encircling ocean.

The sixth climate begins among the dwelling places of the Eastern Turks with the QTy and qua, the KhirkhIz and Kamāk and Taghazghaz ${ }^{8}$ towards the Turcoman country and Farad, the city of the Khazars (Itil) 9 to the north of their Sea and the Alana 10 [and As] $P$ who occupy the country between that sea and the Sea of Trebizond which leads to Constantinople, Burjän, II France and Northern Spain where it ends in the Western Ocean.

The seventh climate contains little habitable land; however in the east there are forests and mountains which shelter groups of Turks in a miserable condition, then the Beshkhirt mountains are reached and the boundaries of the chuzz and Pechenegs, the two cities of Suwarid and Bulgar, Russia, Slavonia, Bulghariya and Majrar, 13 and finally the Western ocean. Beyond this climate there are few people living, except groups like the Ansu, the Varangians, 14 the Bardah and the like.
242. Ma matāl1ral-burū. wa daraj al-suwā. The daraj al-suwa are the equal degrees into which the ecliptic is divided, each sign having CO-ASCENSIONS thirty degrees. Since the ecliptic is related to a pole different from that of the first movement, the degrees of the signs as they ascend do not correspond to the divisions of the equinoctial, and so in the case of each sign the arc of the
1 See the long and interesting note, Tarikh-i Reshraip.361. 2 There is a Ghazi on the frontier of Ferghana, Lands East. Caliphate p. 485.
3 Sipjäb or SipIjab p Sipenjäb in Shahngmah. Modern Sairam near Chimchend.
4 Chinch P. Old Tashkent.
5 Now Parkin near Diyarbekr, Martyropolis.
6 . Lopes, Trois fits de phonetique historique ArabHispanique; Internat. Orien. Congr. 1905 p. 245. PP has Jaliqiyah for Galicia, as in Idrisi, Rome 1592, Sheet 32

equinoctial which rises with it is different from that which rises with another sign. [Similarly the degrees of the signs as they set do not correspond with the divisions of the equinoctial.] At the equator the ascensions being vertical are said to occur in the erect sphere, and there the ascensions of sets of four signs are equal if the signs are equidistant north or south of the equinoctial points. Thus Aries and Pisces which are at the same distance from the vernal equinox as Libra and Virgo from the autumnal, have all equal ascensions. The same is true of Taurus and Aquarius and Leo and scorpius, as well as of the four other signs. Again the descensions of these signs are equal to their ascensions. But these facts are only true at the equator; as soon as a place has latitude the signs equipdistant from the equinoxes have still equal ascensions, this is true of Aries and Pisces, and of Libra and Virgo, but these groups are no longer equal to each other. If however the ascension of a sign be added to that of its nadir, the result is equal to the sum of their ascensions at the equator. Moreover the descension of any sign is equal to the ascension of its nadir. The table shows the ascensions of the signs at the equator and in the middle of each of the seven climates.

7 Quay occurs in a list of Turkish tribes, Browne Vol. Orient. Stud. p. 407. Kien-Kun? Gzaplicka, Turks of Central Asia. p. 66.
8 Kirghiz, Kimak and Tughuzghuz (Toqquz-Oghuz) (MS has initial $B$ for T) PP has KImak, all three neighbours. 9 Near Astrakhan
10 P Al an, MS Allan both without rain. MS has al-sarir? between the Caspian and Black Seas. The Alan and is are represented by the 0ssetes.
11 The Bulghars on the Danube were also ogled Burjān, Encyal. Islam I 806.
12 Sumer and Bulghur were two large cities of the Bulghars on the Volga south of Kazan.
13 A has Bulghariya alone, PL Majrar alone PP both Bulghariya and Majrar. Bulgaria lies south of the 44 th parallel and is therefore largely in the 6 th climate, while a large part of Hungary is in the Fth. Hungary is generally spelt Majär without rain.
14 The spelling of these names is so varied that it is impossible to identify them except the Varangians.


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243. Më darajah al-kawkab wa darajah mamarrhu wa tulūrhu wa ghurabhu: If a star has no latitude, the
'DEGREE OF
A STAR gre of the eoliptic on which it is situated rises, sets and passes the meridian with it. put if it has latitude, its degree is that point of the ecliptic which is intersected

[^59] but not Ptolemy 's ? $\pi 0 \times 1$.


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为 هوby its circle of latitude, i.e. the great circle passing through the star and the poles of the ecliptic. If the latitude is north, the star rises before its degree, and sets later, while if south, it rises later and sets earlier. So $1 t$ is plain that the degree which rises with a star is different from its 'epoch', and must be distinguished as the degrees of its rising, and similarly, that which sets with it as the degree of its setting. If the degree of the star with latitude should be on a solstice, the arrival of the star at the meridian will coincide with that of its degree, Whether its latitude be north or south. If the degree of a star, not on a solstice, is on the ascending half of the ecliptic, 377, from the beginning of Capricorn to the end of Gemini, and its latitude is north, the star arrives at the meridian before ${ }^{1}$ its degree, if its latitude is south, after its degree. On the other hand if its degree is in the descending half from the beginning of cancer to the end of Sagittarius, adits latitude is north, it arrives at the meridian after its degree, if south before. So it is plain that the arrival of a star at the meridian according to the above-mentioned conditions takes place with a degree other than its own, and that is known as the degree of passage, mamarr. The condition at the meridian under the earth is the same as that above it, the degree of passage being the same in each case.

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244. M $\vec{a}$ al-dāir min al-falak. When you know how many hours of the day have passed, then if they are equal hours 135 multiply by fifteen, and if Hindu gharis 137 by six, and if ARC OF REVOLUTION if Hindu gharis la by six, and i
crooked (unequal) hours by the
of degrees of the equinoctial contained in onetwelfth of the arc of day, the result is called the dais or arc of revolution of the orbit, or the number of degrees (amen) of the equinoctial which have risen from sunrise till that time. The same procedure must be followed with the number of night hours elapsed, only if these are crooked hours they must be multiplied by the number of degrees in $1 / 2$ of the arc of night, or which is the same thing, by those of the nadir of the day.l
245. ME al-tElir. That portion of the zodiac which arises on the eastern horizon at any particular time is called the sign of the ascendant or
called the sign of the ascendant or thereof, the degree of the ascendant.
246. Ma al-buyut. If starting from the degree of the ascendant the zodiac belt be divided into twelve unequal parts, 3 the first of these THE TWELVE 'HOUSES' is known as the first 'house' the second in the order of succession of the signs as the second, and so on to the twelfth which comes back to the ascendant. The degrees of any house are identical with those of the seventh from it. This process is called the equalization or adjustment of the houses.
247. MĒ al-autād wa mēiliIhä walł-zawáil. Those houses which are situated on the east and west horizons ANGLES SUCCBDENT and on the meridian above and below AIN CADENT the earth, are called the four angles or cardines or pivots (autga): the first of these is the ascendant, the second, the fourth house, also called the earth-pivot I See fig. after 390 .
2 cpa, the degree ascending - Garnett Class. Rev. 1899 Horoscope later used for a figure of the heavens at a nativity. Figs. on pp. Lou, 190, 191.
3 The houses are twelve equal parts of the visible heaven divided by great circles passing through twelve equal divisions of the prime vertical, 2 os: as the ecliptic is not in the same plane they are unequal divisions of it.
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(Imam medium coelum) I.c., the third the seventh or occident angle and the fourth the tenth house or 'medium caelum M.C. Those houses which follow the angles in the order of succession of the

A. the Ascendant is at the 1 st degree, cusp, of the first house.
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'mutlaq. and is known as a lesser conjunction. If this be studied in relation to the mean rate of progress of the planets, 2 it will be found that the next conjunction Will take place in the 9 th sign irom that in wioh it last ocourred, and thus the situations of conseoutive conjunctions proceed in the same triplicity for 12 times, after which conjunotion occurs in another triplioity. For example,if the first conjunction takes place in Aries, the second will be in Sagittarius, the third in Leo and the fourth in Aries. After the twelfth conjunction bes taken place which oocurs in Leo, the next meeting ocours in the triplicity of Taurus, the first in Taurus, the second in Capricom, the third in Virgo, and so on for 12 times. The change from triplicity to triplicity takes pleoe in 240 years end is known as the middle conjunction or transfer of the passage to the new group of signs (intiqai al-mamarr), while the tahwil (249) of the year in wich it takes place is called the tabwil of the transfer. As there are four triplicities, viz. those of Aries, Teurus, Gemini and Cancer, it takes 960 years for saturm and Jupiter to get back to conjunotion in Aries, and this is called the great conjunction. Astrologers also make use of the conjunction $\mathrm{m}_{\mathrm{h}} \mathrm{ch}$ occurs between Saturn and Mars, but only in one sign viz. Cancer; this takes place every 30 years
251. Mā al-mamarr alladhi yustu'mil fịI-qirānāt. The expression transit (mamarr) in relation to conjunot fons is not used unconditionally with
TRANSIT IN regard to the superior and inferior
CONJUNCIONS planets, because if it were so, no CONJUNCTIONS planets, because if it were so, no superior one, since 1 ts orbit is inferior, as e.g. the passage of the moon over Mercury or Saturn is absurd and impossible. However as it is constently said that the moon passes over Mercury or the Sun over Saturn, the meaning is that regard must be had separately to their positions in relation to the mid-distance on the
ICf. Chron. p. 91 on the connection between length of 11 fe and these conjunctions.
2 Jupiter moves $30^{\circ}$ in a year, Saturn $12^{\circ}$.therefore when Saturn has travorsed 8 signs from a starting point Jupiter has made a complete circuit +8 signs. See 190. 3 The explanation $1 s$ that in 20 years Saturn traverses $2 \frac{1}{2} 0$ more than 8 signs of the zodiac, which in 240 years amounts to a complete sign. Cf. f1g. 373 .
deferent and on the epicycle. If both planets were at their mid-distance on the deferent, or on the same path on the epicycle, the one would not pass the other but if one were in the first or fourth quadrant (nite) of its orbit, it would pass over that which was in the and or $3 r d$ quadrant, although the orbit of the latter were above that of the former. If both were in the same quadrant, e.g. the first, that winch is furthest from the mid-distance, would pass over the other which is nearest to the mid-distence And if both were in the 3rd quadrant the one nearest to the mid-distance would pass over the other which was furthest from. it. You have to imagine that both are in the one orbit, and then judge by the distance from the earth. But the knowledge of all this is a separate solence.
 of the sun and the moon takes place at the end of the month; it is called in the
CONJUNCTION AND Almagest ittigel, the degree and
OPPOSITION OF MOON minute of the sign in which it
occurs being called the jus' aljtimār, and the ascendant of that time the tãlirallatimer This conjunction takes place when the moon is under the rays of the sun and is therefore invisible; it is on this account called in arabic sirdar and muhäg. Opposition, istiqbal, occurs when the moon is in the seventh sign from the sun, and the degrees and minutes of both are equal. This is the time of full moon, imtila, and, badr called so on account of its haste to rise at sunset, and the ascendant of this time is tali al-istiqbāl. The jus' al-istiqbal is generally understood to be the exact degree in which the moon is, but astrologers are in the habit of taking it from moon or sun, whichever is above ground.

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253. Ma al-nimburin. When the moon is in the fourth sign from the sun, and their degrees are the same, this is the first quarter, and takes HAIT-MOON place approximately on the fth night of the month; when in the luth sign, about the 22nd alight, this is the second quarter. These are called by the Persians "nim purim', half-full, because the moon appears to be out in two. The degrees of the ascendents at these quarters are noted just as they are at conjunction and opposition.
254. Max al-fōgisāt. ${ }^{1}$ The phases of the moon are due to its various distances from the sun. As these effect changes in the atmosphere and also MOON'S crises of diseases, astrologers study them PRASES from the angles of an octagon from the position of the moon at the beginning of the disease by intervals of a sign and a half, viz. at $45^{\circ}$ $90^{\circ}, 135^{\circ}, 180^{\circ}, 225^{\circ}, 270^{\circ}, 315^{\circ}$ and $360^{\circ}$. The phases of the moon are as follows:- conjunction and opposition, 12 degrees each side thereof, every 45 degrees and both. quarters, so that the result is, taken in the order of succession of the signs, $0,12^{\circ}, 45^{\circ}, 90^{\circ}, 135^{\circ}, 168^{\circ}$, $180^{\circ}, 1920^{\circ}, 225^{\circ}, 270^{\circ}, 315^{\circ}$, and $348^{\circ}$.

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255-257.
255. Kubūf al-qamar ma huwa. As the earth is a
solid opaque body which vision cannot penetrate, the

ECLIPSE of it and the other is in shadow, just like OF MOON a solid body between a lamp and the wall on is round its shadow is also round, and falls on the
zodiac belt opposite the sun. Now when the moon at the time of opposition has no latitude either to north or
south its face is necessarily within the circle of the earth's shadow, the earth intervening between it and sun is therefore cut off from it, its luminosity the time of opposition the moon diverges from the ealiptic if only to a small extent the eclipse is pro-
portionally partial, and if to a large extent does The latitude of the moon is dependent on its al-athar. $\begin{array}{ll}\text { EFFECT } & \text { from its ascending and descending nodes; } \\ \text { should it be at one of these when in } \\ \text { OF NODES } \\ \text { opposition or be as near it ss less then }\end{array}$ little divergence from the ecliptic. Its nearness therefore thereto at the time of opposition brings all not eclipsed unless the nodes are near the sun. 257. Mam answer kusū al-gamar. A lunar eclipse $\begin{array}{ll}\text { KINDS of } & \text { continue for some time (delayed captivity, } \\ \text { math) or as soon as it has become } \\ \text { ECLIPSE } & \text { entirely dark, it may again begin to appear }\end{array}$
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## 258-259

258. Kin ayyati jihat yabdū al-kusüf. The movement of the earth's shadow on the ecliptic is the same as the movement of the sun, but that of the

## BEGINNING

 OF ECLIPSE moon is quicker. The moon therefore at the full continues to move through that shadow, first coming in contact with it by its eastern margin. The beginning of an eclipse is therefore from the east, either absolutely or with slight declination to north or south. Anyone who remembers this will know that the end of the eclipse will be on the western margin, the beginning of the luminosity again on the eastern, and the completion thereof uncovering, injila, on the western margin.259. Sam auger kusuf al-gamar. If the eclipse is partial, three periods may be distinguished, the beginning, when a notch appears on the RERIODS OF margin of the moon, the middle, when ECLIPSE the darkness has reached its maximum the darkness has reached its maximum the end, when the moon has become entirely full again. If it is a total eclipse five stages may be noted, the beginning, the complete obliteration of its light, the middle of the delay, the end thereof, with the beginning of the illumination, and finally the escape from the shadow. The accompanying figure will help to make the matter intelligible.
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258-259



260. Hal yakhtalif kusüf al-gamar fi:l-bilād. The events of an eclipse have nothing to do with the body

APPEARANCE AT DIFFERENT PLACES of the moon, consequently to all observers its condition is in the same state at the same time. However, since the hours of the night wish have elapsed till the eclipse occurs in different regions on count of the different time of the moon's rising in these, the hours during which it is eclipsed are less in one region and more in another, and the eclipse is visible in one place and not in another because the beginning of the night in different places is not the same except accidentally.
261. Kusūf al-shams mä huwa. The moon at the end of the (Arabio)P month appears in the morning as a slender crescent to the west of the sun and ECLIPSS then exhibits the same form in the evening OF SUN at the beginning of the next month E. of the sun. When however the new moon appears to the east of the sun it is obvious that it has passed by the sun. Should this passage have taken place in a position between the sun and our Vision, the sun would be partly or entirely concealed from us. Consequently that blackness which we observe in an eclipse of the sun is due to the body of the moon which conceals the sun from us.



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262. Fahal takhtalif dhäika fīl-biläd. Eclipses of the sun also offer different aspects at different localities, firstly, due to the APPEARANCE AT same reasons as have already DIFFERENT PIACES been referred to in the case of the moon, (time of sunrise) and
secondly, due to the point of view of the observer, (parallax) for the moon which conceals is near to us than the sun which is concealed distant. The phenomenon of the eclipse has nothing to do with the nature of the sun, but is solely due to our vision of it. Moreover the passage occurs everywhere at the same time, but is observed at different localities at different times, and the amount of the eclipse observed at one locality is different from that at other localities, in one case the eclipsed area is two thirds, in another $a$ half, in a third complete, and in a fourth there is no eclipse at all.
263. Ma ikhtilā al-manzar. This is the observation of an object at the same time from different places involving different points of view. involving different points of View.
Calculations as to eclipses of the sun
PARALLAXIS Calculations as to eclipses of the sun
are made from the centre of the earth. There is therefore only one point unction will be identical earth where the calculated conjunction with the observed conjunction. At ans Will be a difference of time, the observation being either before or behind the calculated period. Similarly it depends on the place of observation whether the eclipse will be total or partial or not visible. The accompanying illustration will make this easy to understand.

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A centre of earth. B its surface.
M Moon on its orbit.
$S$ orbit or sun.
P Position of moon from both centre and surface of earth. P' Position from centre.
p" Position from surface.
264. Kan aught kusūf al-shams. Eclipses of the sun exhibit three periods, for as there is no delay, only the beginning, middle and end are PERIODS OF distinguished. ECLIPSE
265. Famin ayyati jihat yakün badūhu. Owing to the moon's being cause of the eclipse and to its more rapid BEGINNING OF ECLIPSE mOvement it overtakes rap Fest so the eclipse always begins with the contact of the moon from this quarter, contrary to what was said of eclipses of the moon, and ends by the complete clearance on the east, but there is always a slight declination from these two points of the compass.






266. Lima la yankasif al-shams fin kulli 1jtimā-wa'l-gamar yumarr tahtha. That there should be an
CONDITIONS eclipse of the sun it is necessary that

$$
\begin{aligned}
& \text { eclipse of the sun it is necessary } t \\
& \text { CONDITIONS the moon should have no latitude at }
\end{aligned}
$$

OF ECLIPSE conjunction, or so little that it comes between the sun and our vision. It is consequently restricted to the times when one of the two nodes is near, because when distant the moon cannot conceal the sun being either further north or south. The condition is the same at opposition in the case of eclipses of the moon.
267. Hal yarrid lighair al-naiyirain kusūp. occultation of the planets and of a number of the ECLIPSES OUTSIDE fixed stars are occasioned by

SUN AND MOON? phenomena beginning on the east side and ending on the west.
[You have to consider that these originate with the moon, that they occur frequently and are generally unnoticed.]P Further, planets occultate each other or a fixed star, or two planets and a fixed star may all appear as one to the observer. Of course the sun conceals these by its brilliance whether it covers them or no, but it is not affected by them in such a way that any portion of it is concealed.
268. Max al-ayyem al-wnatā al-mu'addaleh. If the sun had no eastward movement and simply continled revolving in virtue of the first MEAN DAY movement.

it would regain any great circle from which it set out, after having passed the $360^{\circ}$ (units of time) of the equinootial. The sun however during that period moves east at its own rate of progress and only regains the circle from which it set out, whether horizon or meridian, after having traversed the $360^{\circ}$ of the equinootial plus the amount of its movement in the contrary direotion. 175. The rate of this is not uniform, being sometimes quick and sometimes slow, and in consequence of its varied character the sun does not pass all circles at uniform times. But it passes the east horizon in accordance with the ascension of the locality, the western in accordance with the descension of the looseits and the meridian in accordance with the ascension In the erect sphere, for this oirole everywhere on account of 1 ts passing through the poles of the universe has the equator as its horizon. So it is obvious that the true solar day is that time during which $360^{\circ}$ have been passed according to the Sun's observed rate of progress, and that mean day is that time during which $360^{8}$ have been passed by the daily mean movement or the sun.

## CHRONOLOGY ${ }^{2}$

269. Ma al-shahr. The month is of two kinds, natural and conventional, the latter as agreed on between people. The natural month is that MONTH period of time required by the moon, situated at a particular distance from the sun east or west, to travel until it reaches the same distance. As the shape of the illuminated part of the moon corresponds to its distance from the sun, the month is that period during whit oh the moon gains the same shape, and the same side of the sun, and has not a third time shown the same outline. People customarily speak of one of these phases as the new moon, because it is the beginning of that series of figures, and there is no other similar to it in shape and position. The period is $281 / 2$ days and a small fraction; as it is impossible to deal with a month containing half a
$159^{\prime \prime}$. According to Jagmini the amount of time
necessary to traverse 1 ts own diameter. Ref. p. 148. 2 Paragraphs 269-323 may be regarded as an abstract of pp. 199-334 Chron.
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day the sum of two days, 59 days, is divided into periods of 30 and 29 days. This determination is based on the mean progress of the sun and moon or by their corrected rates of movement, for $1 t$ agrees with the determination of the months by the visibility of the new moon, whether there be a succession of two or three months greater or less succession of two or three months greater or
than the average or no. The conventional or than the average or no. The conventional or natural year as near as possible.
270. Famā al-sanah al-tabI riyyah wa ghayrhä. The natural year is defined as that period or time NATURAL AND and cold seasons, harvest and seedOTHER YEARS time) are completed once. It is measured by the return of the sun to a particular point of the ecliptic from which it set out: it is therefore called a solar year. Its extent is 365 days and a fraction of less than a quarter of a day as we have found, but more than a quarter according to our predecessors. The natural year being as described, its months, the twelve equal parts into which it is divided, are the solar or conventional months not the natural ones. On the other hand the conventional year is composed of twelve natural months, its length being 354 days and 11/30ths of a day; such a year is styled lunar.
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271. Fa kaif tustu fill hadha al-kusur fill Pl-sinin. In the case of the solar year the fraction of a day LAAP-YEAR years until a complete day results, which is then incorporated into a year of 366 days. This is the custom of the Greeks, Romans, Syrians and Copts of Egypt since the time of Augustus Caesar, 1 King of Rum, and this leap-year is styled in Greek (the royal year) ${ }^{2}$ and the regulator (al-miqyäs) ${ }^{3}$ and in Syriac kabishnä, which when turned into Arabic becomes kabisah, i.e. filled in. The persians influenced by the Magian religion, which forbids the intercalation of a day in the year, abandon the quarter days until a whole month is arrived at in 120 years. This is then incorporated as a thirteenth month in the year, the name of one month being used twice. This year is called "bihtarak', ' but after the destruction of their dominion and religion this bihtarak has not been used. Before the time of Augustus the Egyptians allowed these quarter days to accumulate until they made a whole year in 1460 years and then deducted a year from the date, because it comes to the same thing if you deduct one year or if you add one and then reckon two years as one.

As regards the lunar year, out of the fractions of $11 / 30$ the of a day, a complete day is arrived at in the third year, which has then 355 days, similarly in the sixth and so on, till after 30 years, and the intercalation of 11 days, the fraction has disappeared. These years of 355 days are called Arabic kabisah years, not because they are in general use in arabia, but because the authors of astronomical tables, in which they are necessary, calculate by them.

I Chron: $33 / 2 \theta$ refers to the fact that the Julian Intercalation was not regularly introduced till the 6 th year of the reign of Augustus.
2 malik al-sanah for Sanah al-malik? Not in $P$.
3 au 11 qiyas $P$. Not in chron. I have not found any other expression in Greek for leap -year except Bióntor eros.
4 bhIrk P. and $40^{1}$, of. Chron. p. 54. bhrzk $40 \mathrm{ct}$. 274 for their method of disposing of the 5 days in excess of their 12 months of 30 days each.


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272. Fame al-nasi: The word nasik' means interoaleating or postponing, and is used in connection with the fact that the lunar year finishes about INTERCALATION 11 days before the solar, and consequently the arabia months change through all the seasons in about 33 years, any month you name occurring in any season or part of a season. The Jews are commanded by the torah (the Mosaic law) to keep both sun and moon natural; this they did by arrangeing a leap-year containing an additional month made up by accumulating (for 3 or 2 years) the difference between lunar and solar years, so that the year returned to its proper position after having been too far in advance; their leap-year is called in Hebrew ribbūr i.e. pregnant, because they compare that 13 th month which is added to the year to the fruit which a pregnant woman bears in her womb.

The Jews were neighbours of the Arabs in Yathrib the city of the Prophet. Now the Arabs not only wanted their pilgrimage to occur in the proper month (dhu'lhijjat) but also that it should be fixed at the pleasant est time of the year, so that they might set out and find travelling and commerce easy. They acquired the Jewish method of intercalation not in any learned way, but in one suited to the people generally. It was communlcated to the public by the voice of the qalammas or interoalator, a hereditary office before the new moon, and, the calculation of the period when it was desireable to intercalate the kabisah having been carefully attended to, announcement would be made from the pulpit that such and such a month would be postponed. P) Supposing that were a sacred month, e.g. Muharram, the Interaalator would say "I postpone Muharram and make this month free from obligations" so there would be two Muharrams in the year, the first free from restrictions and from war, while the second (in reality Safar) would be observed as the real Muharram. This practice vas adhered to till Islam put an end to it in the goth year of the Hijra, known as the year of the Farewell Pilgrimage, when the Prophet (on whom be peace) bade farewell to the world and to his om people.l

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Whoever desires to associate lunar months with solar years cannot dispense with the kabIsah; the Harranians of Harran and of Baghdad, known as Sabins, l who are a remnant of the Greek pagans, also employ it, although we are insufficiently acquainted with their methods and opinions.

The Hindus also duplicate any month when necessary to complete the reckoning, calling the year in question ram malmāsa, ${ }^{4}$ which means a year with a month to be discarded. This word is, however, replaced in the literary language by adhimgsa, 5

272a. Ismá al-hind lilayy品 al-sabrah. This paragraph, present in the Arabic versions and in PL', is absent in PL and PP. These Hindu names HINDU NANES for the days of the week are names of DAYS OF NEEK planets followed by war or bra (day in composition). See India, I, 213.

| $\bar{A} d i t$ <br> war | Som <br> war | Mangal <br> war | Budh <br> war | Brihaspat <br> war | Shukr <br> war | SanIchar <br> w Er |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Sun | Moon | Mars | Mercury | Jupiter | Venus | Saturn |
| I | II | III | IV | $\nabla$ | al-jum'ah | al-sabt |

273. Fa kaif agma' shuhur al-umam. To explain in detail the various characteristics of the months among the different nations would take too long; NAMES OF I have accordingly constructed the THE MONTHS following tables which will make their names clear and easily comparable.

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2nd column:- Chron. p. 7l-2 has suwan for wansan, zabbe, radil, Nafiq or Natil, Huwar and Rannah for Warannah.
3rd column:- India I. 217 has older forms.



Znd column:- F . Ch. p. 59. In nos. $2,9,10,11$ the I represents p. Both AO and AOI have the modernized names interpolated:-Tath (Ighmana), Babah, Hatar, KIyak, Tuba, AmshIr, Barmahat, Barmudha, Bashans, Ballnah, AbIb , M1sra. See Lane, Manners \& Custons Mod. Heypt 4th column: - Follows Persian Custom, the beginning of the year is the 6th of Farwardin viz. Khurdedh. v. Chron. p. 56.
$A O^{1}$ has also p. 65 a marginal note on the Armenian months. These are solar and the year has 365 1/4 days. Each month has 30 days except the last which has 35, and in a special year 36 .

Zakhent;10.MarIdI;ll.MarkEs;12.Harar. of. Encyol. Brit. VI. 316 and Sohram, Chron. Tafeln; Leipz, 1808 p. 175.

274. Ay hadhihi al-shuhür tattailg aw $\vec{a}$ :11hā. The Jewish and Arabian months are equal, and there is no
arference be tween them ex cept for one day AS TO BEGINNINGS on account of religious con siderations among the Jews. But the same name would not be applicable to these months, becouse the Jews interoalate and the Moslems do not. Similarly the Hindu months are of the same nature as those of the Moslems and Jews and their beginnings nearer to the latter as they reokon from the time of conjunction of the moon. The Hindu and Jewish months also correspond for two or three years until ad,himssa is made, when they become different, after whioh they again correspond for two or three years until the next ad, himasa. So the months of the Hindus do not coincide with those of the Arabs, fille they do from time to time With those of the Jews, but not invariably on account of the intercalation being carried out in different years.
on the other hand the Syrian and Greak months do correspond both as to number of days and name for name, only the beginning of the year is different, the Greeks taking from Kinaln II

The beginning of the Egyptian year coincides with the Persian month Dai,and from this point the months correspond till the end of Ibent whon a differenoe comes in due to the fact that the Persians then make their intercalation of five days (not as belonging to that month as some people think) and the Egyptians at the end of the year. The last Persian Kabisah, bintarak, ${ }^{\text {o }}$ ocurred in the month IbEn, gnd the five supplementary days = called andargāhan - lawāhq A are inserted after Abān, as an indication of the month which was last duplicated as bihtarak. 2

The beginning of the year and the first month of the Soghdians (who are Magians of Transoxania ${ }^{\text {P }}$ ) is on the sixth of the Persian Parwardin, from whioh point onwerd the two calendars progress regularly to the end of the year.

[^63]LENGTH OF and each of these has again three varieties； $1 /$ hasexin（baserah）or deficient， 353 days，in which
Marpeswan and Kisliw have only 29 days， $2 /$ shall amin， （Shelemah）complete or rather redundant 355 days in which both months have 30 days，and 3 ／kasdaran （Kesidrah）or intermediate， 354 days，where they are as in the table，Marheswan being deficient and Kisliw complete．The variation of these two months is necessitated by the fact that the first day of the year must not be on a Sunday，Wednesday or Friday． No other month departs from the number set down．

276．Fakaif 耳uwafiq shuhūr al－hind shuhür al－ gamer．The $\frac{\text { Hindus have days of different lengths i／}}{\text { II }}$ suryamana or the solar day，ice．

## CORRESPONDENCE OF HINDU AND

 LUNAR MONTHS 1／abli part of a solar year 2／chandramana，or the lunar day（lith）1．e．the $1 / 360$ th part of a lunar year，3／nakshatramana，measured by the mansions of the moon， 1．e．the time spent in each of the 27 mansions，and． 4／sabamana（savanamana）the time between two sun－ rises．This is the generally recognized day，the people＇s day．To any one who knows about solar and lunar years it will be obvious that the solar day ia longer than that between two sunrises and the lunar shorter．

What has been said above with regard to the length of a lunar month means $29 \frac{1}{2}$ days as determined by sun－ rises，but with regard to Hindu months of 30 days，as In the table each of these．is the 30th part of the interval between two mean conjunctions．




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277. Hal li ayyäm al-shuhūr asāmi. The Hindus have names for each day,and the guardians of these are the NAMBS OF Celestial beings, daiva, who are their DAYS OF MONTH Khwarizmians and the like have names for each day of the month but these are not very well known, and become rapidly altered by frequent copying. Philologists have suoceeded in traoing an Arabio name for each of the thirty days of the arabio month, but these are not known to the desert Arabs, they are not ourrent, it is an effort to remember them and in difference with regard to them is obvious, Among the peoples of the earth the use of names for the days of the weok is general, and differences tend to disappear, but the Persians do notl use this method; they have a separate name for each day, and they regard these names as those of God and the angels. They are set down in the acoompanying table.

Names of the days of the Persian months.

| 1. Hurmuz | 11. | Khūr. | 21 | Râm |  | Abunavedh) ${ }^{\text {a }}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2. Fahman | 12. | Mäh | 22. | Bädh |  | U shtavadh) |
| 3. Ardibahisht | 13. | TIr | 23. | De1-ba- | 3. | Asbandmadh) |
| 4. Shahriwar | 14. | Jush |  | dIn | 4. | Vahisht) |
| 5. Isfandarmadh | 15. | Dai-ba- | 24. | Din |  | ashatra) |
| 6. Khurdadh |  | mihr | 25. | Ard | 5. | Vahisht) |
| 7. Murdādh | 16. | Minr | 26. | Ashtādh |  |  |
| 8. Da1-ba- | 17. | Srüsh | 27. | Asman |  |  |
| adhar | 18. | Rashn | 28. | Zamyādh |  |  |
| 9. Ėdhar | 19. | Parwardin | 29. | Maraspand |  |  |
| 10. AbEn | 20. | Bahrām | 30. | anirañ. |  |  |

T Read lam for thumma.
2 The firat seven are devंoted to Ahuramazda and the $31 x$ Archangels, Ameshaspentas, and the remaining 23 to Angels, among which the names of the Sun, Moon, Meroury (11,12,13) and Mithra (16) may be recognized.-These are worshipped in the Yashts which correspond to the names of the days - (Haug. p. 194 seq.) The names of the five supplementary days given above may be traced in the five Gäthas (1.c. 142 seq.)

1. Ahungvaiti
2. Ushtavaiti
3. Spentimainyu
4. Vohukhshatire
5. Vahistoisti

Nos. 4 and 5 transposed in the Tafhim.


278．Kaif suniy hā＇ulā＇1 al－umam．From whet has been said above in regard to months，intercalation and leap year it is clear that there are FEARS OF two kinds of year，solar and lunar，and THE NATIONS that of the latter there are two varieties，the first，simple，formed of 12 months such as the Moslems and Turks and orientals use，each having as a mean 354 days，but occasionally 353 and 355 ，this excess and deficiency being outside the control of man．The second，that where interoalat－ ion 18 practised，and 13 months result as is the case with the Hindus and the Jews as well as the Greeks in ancient times and the pre－Islamic arabs（and Kafirs）${ }^{P}$ ．On the other hand the solar year has 365 days and a fraction which is nearly a quarter；it is employed by the Greeks，Syrians，Egyptians，Persians and Soghdians，but these differ as to their method of dealing with the fraction．

279．Ma al－tawarikh．A＇date＇is a point of time well－established at which something has taken place， knowledge of which has reached and been
DATES diffused among the people，such as the formation of a new religion or sect，or some occurrence in a state which，like a great battle or a devastating hurricane，has arrested attention to such an extent that it is taken as an artificial point of departure from which to reckon years，months or days，so that whenever it is desired，the amount of time which has since elapsed can be know，or the relative dates of events fixed whether before or after．

280．Mä al－adwar．Cycles are periods of years which separate recurrent events，like the 33 years required by any lunar month，a Muharram in CYCLES the beginning of spring，for instance， to regain its former position in the





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seasons of the year，or the 30 lunar years required by Saturn to make a complete tour of the ecliptic，or the time required for disposing of the fractions of a day which occur in every year．

Again when the number of years in an era becomes high，oyoles are usedplike knots in a rosary（such as decades and centuries ${ }^{P}$ ）together with the remaining units．

280a．Ma tawarikh al－umam．The Mussulman era［Al－ Hijra］dates from the year［16 July 622 A．D．］when the Prophet（God be gracious to him and give
ERAS OF him peace）removed，hajara，from Mecca
THE NATIONS to Medina：its years are all lunar．That one known as the the people or the the beginning of the year when Seleucus was appointed King of Antioch［l Sept． 311 B．C．］．Christians employ in it Syrian or Greek years，while the Jews use their own lunar years with the necessary intercalations，and the Harranians，who call themselves Şāblansl have ouse－ toms＇similar to the Jews．Other eras are known to the people of the Book such as the oreation of adam（on whom be peace），and the deluge of Noah（on whom be peace），the drowning of Pharaoh（may the course of cod be upon him－1P the erection by solomon lon whom be peace）of the temple in Jerusalem，and the destruction of that temple by Nebuchadrezzar（Bukhtinaş̧ar），but there are controversies about these，consequently it has been agreed that the era of Alexander is most satisfactory by reason of the fewer difficulties at－ tending it，and the smaller number of years involved．

During the ignorance the arabs reckoned from celt－ brated battles among themselves，and before the Hijra， the year of the Elephant when the Abyssinians coming from Yamen to destroy the Karma were routed and in which the Prophet（the blessing of God be upon him）was born．

The persians have been accustomed to date from the beginning of the reign of their reigning king，and on his death to use that of his successor．At the time their empire was destroyed they were dating from Yazdigird bn Shahryar，ion Khusra Parviz the last of the Khusraws，the years being without intercalation［and bihtarak？］The majority of the Magians date from his murder 20 years after his accession．${ }^{2}$
1 The Harranians were entitled as Gnostics to call them－ selves＂Sabins，Podersen，Browne，Vol．Orient．Stud．p． 381. 2 Murdered at Mirv．A．D． 651 ．Era of the Zoroastrians；cf． Chron p．138．The Parsees date from his accession 16 th rune 632
\％捲 Hex البوْابْفْنْ年．
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The Egyptians on the other hand date from Bukhtinassur the first (Nabonaspar), a practice which Ptolemy followed in the Almagest in determining the mean motions of the planets, while in regard to the fixed stars he dated from Antoninus the then King of Greece. At the present time, however, the modern Egyptians who intervalate along with Rome date from Augustus the first of the Emperors. In astronomical books the era of Diocletian 18 always found. He was the last of the pagan Emperors of Rome; after him they became Christians.

Among the Hindus many eras are in use, some old, some new. The best known and most current of them is shakakad which means the era of Shaka, that man who became viatorious and all-powerful at that time, and tyrannized over the people; when they killed him they made this era from the year of their delivery from him.

Necessarily every nation has one or more eras; they are only of two kinds, either knowledge of them has reached us or not. However this is a long story, and has been dealt with more conveniently in another place.
281. Pahal yurlam mäbain hadhihi al-tawārikh. In comparing two eras, il the words year and month are used, it is necessary to remember that these HOW TO COMPARE terms do not necessarily mean the same IHESE RRAS period; there is however no ambiguity table in 'mimbar' form the number of the accompanying till the succeeding one is set down, and these numbers are added together so as to show the entire number of days in any ere till the beginning of any other down to the Persian era. This table is extremely accurate and very useful to any one who wishes to translate from one era to another, if he associates the data with years and months in the manner which is necessary.

The Sra of Diocletian beginning 29 Aug. 284 A.D.] was adopted by the Copts as the Era of the Martyrs shuhedäl - although his edict of persecution was not issued till 303 A.D. of. Chains, Chronologic p. 14. 2 The time (Kail) of the Shakes (Soythians) who acoompanied the Parthian invader, Nahapane, who reigned from 78 to 125 A.D. The Bra much used by Astronomers, begins in 78 ADD.

282. Ma dryad al-umam wa ayyamhum. As the years and months of the various peoples are different, so the special days which FBASTS AND Pasts they observe as feasts or fasts are also OF THE NA PASTS different. In the former they make merry, OF THE NATIONS dress gaily and practise various customs to their religion or sect. In the latter they are looking forward to future rewards in accordance with the commands of the holy law which explains the virtues of such days, or else, on account of events evoking anguish and grief which by common consent are held to have occurred on these dates, keep strict fast therein.
of such special days another kind is characteristic of Christians who on these pray in the churches to their saints and martyrs, and desire to approach them for intercession. the festivals fall the year, but if it begins

## Nabcnassar

 This is the lower half of the table in chron. $p$. I33, with the The union of the Era Diluvil, Era Philippi and the Era Mretadid until pormost figures indicate the number of days in each era thereto of the length e of subsequent Bras, while the lowest row shows the number of days from the beginning of each sra until that of Yazdigird:
The accepted dates for the beginnings of the Eras in this table are:-

1. Nabonaggar $26 \mathrm{Feb} .747 \mathrm{~B} . \mathrm{C}, 1448273 \mathrm{p} .18$ Number of days ale


 6. Hijra 16 Jul. $62 Z^{2}$ A. D. $19484400^{\prime \prime} 16$ the Julian 7. Yazdigird 18 Jun. $632 \mathrm{~A} . \mathrm{D} .1952063 \mathrm{M} 11$ reckoning. Deducting the first day of each Era from that of the succeeding one we have the lengths of the Eras in days.

2. Diocletian
3. Hijra



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sometimes later and sometimes earlier with regard to the seasons as is the case with the Jewish and Hindu years， then the feasts change also．

Those people who have a stable year have also festivities of another kind，namely those in connection with agriculture，viticulture，planting and sowing， harvest and breeding，also with the atmospheric signs such as heat，cold，winds so which form a normal series in such year．Those communities have similar festivals whose year is movable，for an earlier or later beginning $1 s$ not such as to make an appreciable difference．

283．Ma al－fish fir arad al－yahud．of the Jewish festival si Passover，fIsh（Tor pesach），is the lith day of Nisan，and is that day on which the
JENISH Children of Israel fled out of Egypt，were
PaSSOVER delivered from bondage，and made saorifioe as they were commanded．It is the first of
the seven days of unleavened bread during which it is not permitted to the Jews to eat or to keep in the house leavened bread．On the last of the seven days Pharaoh was drowned in Bahr sur ${ }^{3}$ the sea of Qulzum，and the day is known as al－kass． 4

284．Ma al－tansarah．The sixth day of the month of Sivan is called fishratinom their assembling together， rassärd，rassereth，and is one of the Jewish pilgrimages：it coincides with the ripening of the orops．

285．ME al－kibbūr．Kippur is the tenth day of Tishrin，itisgometimes on this account called「気shurā（＂lEssors）．The word nippur in
 ment；fasting is obligatory on this day and non－compliance is punishable by death．The fast lasts for 25 hours beginning（half an hour）P before sunset on the $9 t h$ and ending half an hour after sunset on the roth when fast is broken．Klppur mist not fall on Sunday，Tuesday or Friday．

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286. Mā al-mazallah. The Hebrew word mesullā means a shady place: this, the feast of the Tabernacles (Sukkoth), lasts for seven days begin-
FFAST OF ing on the 15 th of Tishri, during which TABERNACLSS the Jews are commanded to live under the shadow of booths constructed of reeds, willow and olive branches, and are forbidden to live under a roof, in order to commemorate the cloud which the Lord commanded to shade them in the desert of Al-Tin.
287. Max rarabē. The last dey of the foregoing feast is called (in Hebrew) rārabl which means a willow (A. khilàf, P. bIa); it is the 21 st day of WILLOW Tishri and is also a day of pilgrimage.
288. Ma al-tabarrik. Tabarrik, the feast of BENEDICTION Benediction, occurs two days after 2B9. Max al-hanukkah. The feast of Hanukkah or Dediaction ${ }^{3}$ lasts for eight days beginning from the 25 th of Kislev. On the first night they light one
DEDICATION lamp at the door of the house, on the second two, and so on, till the eighth when they light eight lamps. This is to commemorate the fact that a certain king oppressed them, and deprived brides of their virginity before they went in to their husbands. Then there were eight brothers who had a sister who was asked in marriage, the youngest brother from a sense of honour dressed himself as a woman, went in to the king, killed him and by his action purified Jerusalem.

4 290. Ma al-bari. Purim which occurs on the fourteenth Adhar and is also called the feast of Megille, 5 derives its name from the casting of lots. Its
PURIM origin is as follows: Haimūn wazir of Ahashwirus or Kisrā was badly disposed to the Jews then captive in Babylon, and plotted to extirpate them. The order however recoiled upon himself, he was killed on this day and crucified. The Jews therefore on this day tratmun sur (feast) ${ }^{\text {P }}$ ) hang and bum him in effigy, expressing their joy. $\frac{1}{2}$ arabia means a desert plain, and is transla ted bald in PP. ${ }_{3}$ chron. the day after.
3 The root means dedication, not purification (tanzif) Really to commemorate the rededication of the Temple by Judas Maccabaeus after its pollution by Antiochus Epithanes who had set up a pagan altar there. Also Festival of Lights. 4 And fifteenth and the Fast of Esther on the 13 th.
5 The Megillah or 'roll' of Esther which is read at this time.


In the other months there are supererogatory fasts, occasioned by new grievous trials, on which mourning and abstention from food are incumbent on them.
291. Min aryed al-nasari me al-milad. Of the Christ ian festivals Mind is the night of the birth of risk bin Maryam (on Him be blessings and peace), $A O$ which occurred on the 25 th of Eanun I at a CHRISTMAS which occurred on the 25 th of Kanun I at a salem which is Bait al-maqdis. people were in the habit of calling him Ishtar al-naşri, ${ }^{2}$ whence the Christians are called nasará.
292. Max al-dinh. Dinh is the fth day of Kānūn II on which day Yahydo bin Zakariya baptized Jesus the son of Mary 1.e. immersed him in the river Jordan. John was accustomed to baptize people to unburden them of their sins, and was therefore
EPIPHANY know as Yuhana marmadan, John the Baptist. The baptism
water maya al-marmudiyyah is that with which Christians water ma ale ar children and converts from other religions When Jesus issued from the Jordan the Holy Spirit descended upon Him in the form of a dove.
293. ME Sum ninuwi. The fast of Nineveh is called from the Syrian town of that name, whit on is also the town of the prophet Jonah (May God bless him). The
FAST OF name Jonah is a Greek one;* cording to the NINEVEH Christians he spent three days and three nights in a fish'g' belly, and this is regarded as a sign that Jesus would remain three days and three nights under the earth. This fast lasts for three days and precedes the greet fast by three weeks beginning on a Monday.
294. Mā al-saum al-kabir. The great fast of the Christians lasts for seven weeks; it always begins on a Monday and ends on a Saturday, but Saturdays and IENT Sundays are excluded from the fast with the exception of the last saturday. In this fast no meat or other animal product is eaten. The following are the conditions determining the time of Lent. It must not begin before the and of shubat, nor later than the 8 th of 1 Chron. p. $28 \&$ seq.
Ashur is an Aramaic form of riga.
3 Yahya and Yubana are Arabic and \$yriac forms for John 4 An etymology suggested by the resemblance of Fanah to yunnan 5 MS has rimini ! for put.

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Adar, and the generally accepted way of calculating it is that it begins on the Monday nearest to the conjunction of the moon in Shubat as long as that ia not before the and. If it is, that injunction loses its validity, the next conjunction after is adopted, and whichever Monday is nearest to it is the first day of the fast.
295. Ma al-sha'anIn wa ma yatlühu. The last Sunday of the great fast is called shaidnin, meaning praise; on that day Jesus for fin be PAM-SUNDAY ass ran after $1 t$, and the people kept shouting Hosanna He entered the temple] ordered the performance of the lawful rites, forbid repronensibie practices ${ }^{2}$ and rebuked the priests and soribes, (Who assailed Him so the) He concealed Himself. On the Wednesday He washed the feet or His apostles, who were His friends and disciples as a sign of humility, and on Thursday celebrated passover W1 th (Bis sacrament or) bread and Wine, and announced to them His approaching death. Then on the eve or Friday (Thursday night) He ascend d and tortured Him all night. In accordance 1 th their representations, He was crucified at midday on Friday. This Friday is called the Friday of the crucifixion. He mas then buried and remained in the tomb during Saturday (which is called the Glad Tidings of the Dead from the Messiah) and rose on Sunday at dam. This Sunday 18 the end of the Christian fest.0
296. Max al-āpad al-hadrth. New Sunday is the first Sunday after the fast; on the previous Sundays during the fast, people were coupled DOMINICA IN ALBIS therewith, but on this Sunday utensils, household uralture and clothes are renewed and dads and contracts are dated therefrom
297. M al al -sulläg. Ascension day is Thursday the 42nd day (4 0th Chron. 4istP) from the breaking of the fast. On this day the Messiah ASCENSION DAY ascended into heaven from among His disciples, (faraqlit); this is the Holy Spirit.
From a marginal note in PL. "Another way of oaloulating it is frow Epiphany, the sixth day or Kanun II; on whichever dey ba chandüm ruiz bon ordinal um added to chand, as to digar in 517) or the arabic from the beginning beginning of the fast if not then it is the Monday next therester. If the latter should if not, the day arrived at will be the first day of the fast." The day or the Arabic month gives the phase of the moon from which the ocnjunction of Shubat (February) is calculated. The method can be used to determine Easter; egg. Jan. 6,1933 = Ramadan 9,1351 . $32-9$ = Forby 23 a Thursine the following Monday, 27 th is the beginning of the Eastern fast, March 1 (Ash Wednesday) of the Western Church. Counting on 46 days we have in March, 30, in April, 16 days making Easter 1933 April 16th.
The phrase is a Qur'anic one, III, 109.
Lacuna in chron. p. 304. A marginal note of the Copyist of al (a copt) reads, The washing or the feet took place in the afternoon of Thursday; He then oslebrated the Passover, but was seized on the nigh or Friday (Thursday night) in a garden near Jerusalem and was not tortured then but was scourged and crucified on Friday.

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298. Me al-banticoosti. Pentecost is Sunday the fiftieth day from the breaking of the Fast; the word is derived from the Greek WHITSUNDAY for fifty. On this day the Holy spirit descended an acquired s Irū giriftand"') and conferred upon them the gift of tangos, after Which each set out to that country where his lanause was used. so as to summon the people to the messiah.
299. Ma sam al-salihin. The Fast of the Apostles also lasts for seven weds. The aallyna are prophets anbiyt', and the faith

JAST OF THK is APOSTLES
300. ME al-mashush. This is one of the impudent statements made by people ignorant about the Christians to the effect that
ustosn hashish as night when men and women meet together
MESHOSH to seek Jesus, when promiscuous intercourse takes place as chance determines in the dark. 3 Fe take refuge in God from offending anyone whether friend or foe, and espeoisily the sect of the Christians, who ae disposition, in spite of sifinat), uprightness and kindness to all.

They have many other separate fasts and commemorations of their saints, devotees and martyrs, which are distinguished by their names.
301. Yams lilmuslimin fI shuhorhum. As regards special days in the Musilm months, the tenth of Muharram is called Kanara; 4 MUSLIM FHSTS the Hijra but was afterwards abrogated by the AND FGASTS setting apart of the month of Ramadan. It remains, however, a very advantageous day for voluntary religious acts, and then it coincides with the date of the murder of qussyn bin rall, so that the Shirites of baghdad mourn for him on that day.

The fifteenth night of sharban is much esteemedit is known as the night of exemption, barit, and I think that beret in this sse means delivery from the fire. durian [the majesty of which is apparent from mentioned in the l-3). It is said that it must be sought among the last ten days, and indeed among the odd days of these ten; the opinion of the majority is in favour of the 27th. $1 \pm$ is celebrated in Egypt on Fth \#bIb, July 11, June 290.9. 2 anbiye dropped.
3 ya taharajuna. Lane $p$ 2880. Bar Hebraeus quotes from another not speosPied work of Ai-Biruni a similar story of promiscuous intercourse assoccase of the a religious rite (which the Persians oil Mashush) in the 219 ;Hoffman, Abhand. flu die Mande a. Morgenlandes, VII 125 seq. and see Enoyol. Islam under Shaban and Sarlya). Lala al-mashush is translated "the night of the spy" in Chron, p. 310, but the word according to Juynboll, Marāsid al-1ttilE. V,544 is probably from ashsh, license wa'shüsh. The date of the feast $1 s$ uncertain, Chron. prefers autumn, but that of the Crucifixion is also mentioned, possibly the feast is 4 vestige of a pagan Syrian festival of death and resurrection. cr. Jewish fast 285 .

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301-302
The first of Shawwal is the feast of fast-breaking on whin day it is forbidden to fast; but there is a reward for anyway was. The first ten days of Dna al-plijjah are the days of the bare, the sacred territory of seopa; the eighth is oiled tarwiyth ${ }^{2}$ be cause on that day the pilgrims have their thirst quenched; the mints, rarafah, as the pilgrims are then "standing" on Nt. "Araflit during the Great Pilgrimage, while the tenth is the feast of the killing of the sheep which the pilgrims sacrifice, rid al-adhs. S on this day and three days thereafter fasting is forbidden and donned to oelebrata the close of the ceremites id in al-salat. (Three days after the sacrifice of the sheen are called the days of flesh-drying, tashria, 5 and these are count days on who h, with sighs, the tax $\overline{01 F}$ is said after every prayer. jp There are controversies as to this among the authorities, to describe the nature of which is difficult and here out of place. There ere 2180 in the Arabic months certain days agreed on to oomemorate the br th, death or murder or great people. These are somites neglected, or observed with zeal among members of particular seats 502. Yam ia al-Nawriz min Fusum al-furn Among the customs of the Persians is the observance of Nawrifio it is the first day

PIRSIAN first day of the New Year. For five days thereafter
NSW YRAR there is feasting and the sixth is called Great Nama, tome to deliver judgments on the requirements of their ace tinstome to deliver judgments on the requirements of their retinue and the people generally, while on the sixth they received the i cola the persians nobility.
day of all time, and assert that the apes
303. Mal-tirjea. TArget is the 13 th day of the month Mir, 8 and derives its name from it, as is the ouse with other days those TIRGT are. This is same as those of the months in which they arsis between Mindohths and ifrisish to the effect that the former dominion should extend as far as the shot. It is said the the arrow went from the mountains of Tabaristan to the highland of Tokharistan.

1 Id al-saghIr or Ramaditin Bal ram.
2 A recent pilgrim thought it wa yam al-tarmin (repose). HajJ Khan with the Pilgrims to Mecca 1905 p. 175 . Cf. Burton Pilgrimage, II, 289, and Snook Hurgronje, Hot Mokkanisohe Pest, D. 84
${ }_{3}$ Id d al. kabir or urban Bairān,
4 The first of these is called gam al-qary, day of repose, Hurgronje, 1.0.p.114. Ms is defective here.
5 Burton II, 219 and 291 . Hurgronje p. 113.
6 Newyear's day was the time of the vemal equinox, the sixth being then the time or the entry of the sun into fries: the astronomical New Year. There are various a counts of the observances of Nawruz, Richardson, Dissertation, p. 156 ; also Al-Kisrawi, trans. Nariman, Armaghan Nawrūz.
8 Coincided with the sumer solstice: also known as abrizgan.





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304. Ma al-mihrian. Mihrajan is the 16 th day of the month inf: on this day Afridun obtained victory over BIvarasp the XIHRGAN HMAN ed him in Mt. Damavand. The following days are also feast days as was the case with Nawraz, the sixth

305. NE al-farwardajEn. The last five days of the month Aba are called Parvardagan (nourishing) because the Magians on PARVARDAGAN of the dead, 3 out food and dining for the spirits pankanain consumed. Since five days are intercalated after Eban, called andargen, some people thought that these are the five parvardagan, and controversy arose about it, a momentous affair in their sect, so to make sure both sets of five days are celebrated, the first being the 26 th of ban man, and tide last, the last of the 'stolen' days, and thus the whole of the parvardagān lasts for ten days.
306. Ma rukūb al-kūas j. The month of Xahar at the time of the Khuspañ was the beginning of spring. On the first day of MOUNTING THE [P. month, as a kind of comedy (read nagual) BEARDLESS MAN seated on an ass, cross man used to arrive and a fan in the other, with which he keeps fanning himself, thus bidding good-bye to the winter, while he asks for contributions from the people. In our day they have asks for contributions from the people. In our day they ha levied whatever has been oolleoted rom morning till midday is banded over to the governor, while that from midas till afternoon prayers ia retained by himself. If thereafter he is found, he 19 beaten by the people and 111-treated.
307. Max bahmanjah. Bahmanjana is the Bahaman (and) day of the month Barman. On this day they eat white radishes with

RAPMANJANA pure milk, on account of the fact that it
bafManjana strengthens the memory. In Krurasan they make a feast by putting all kinds of edible grains in a pot with the flesh of all permitted animals, and indeed everything available at that season and in that the way of [animals], $P$ vegetables and garden herbs.

1 DIbEwand Dict, Geog. Perse. 224.
3 The Autumnal equinox REm, 21st v. 277.
4 Par-nishestan rose n pr
P. Bar-nishastan Kasai or Kusak nishin. Lacuna in Chron. p. are Richardson's Dictionary under mash for a more detailed 5 account or his Dissertation p. 158
been difficult to scourge and a paint-pot the crow must have reminiscent of Kulegh ba castes Kulagh badast girifta perhaps into his hand', meaning he has cot pan. 'The 'bird' has flown 6 batman al-abyed. Centaurea sp. sipand, harmala "rue for remembrance".














## 308－310

308．Ma al－sadag．Sadat（the persian form）is the Ibsen dey of the month of Barman， 1. e，the tenth and on the night SADAH walnuts and almonds，jI drink，（play and enjoy Sadi walnuts and almonds，jour them，and some drive in animals to be burnt． 2 The name is derived from sad，a hundred seeing that it is fifty days and fifty nights to Nawraz：they also say that on this day the first father completed his tale of a hundred children．But the origin of lighting and keeping up the fires is that Bivarasp conscripted two men every day from his dominions in order that their brains should be placed on the two wounds on his shoulders．He had a vazis oiled Amon（sane alive in Demavend．When Afridun seized in and reproached him umisirl said＂the extant of my power was，that eplways save，one from being killed and all of them are behind the mountain．＂So a faithful follower was sent to examine this claim，and $A$ mill sent ahead an order to each person to light a fire on his root，because it was night and he wished that the large number of them should be evident． This was therefore reported to Arridun who set the prisoner free，plagal him on a golden throne，and gave hin the name of sagrughin（1．8，MaghmughinP Chief of the Magians）．Five day before Sadah a day is oalled Bar－Sadah

309．的 kitbat rugar al－ragario．On the isth day of Isfandurnach，the writing or papers to ward off the sting g of SCORPION the doors of housel in the evening．This is not an CHarts original persian oust tom but has been introduced raging 6 anew by the common people．It is also a day， mardgiran，${ }^{6}$ on which wives Have authority over their husband nd claim the satisfaction of their wishes and extravagant demands（1qtiribet．

310．俯 al－wihanbārt．There are various divisions of the days of the year at the bogiming of each of which five days SRISONS OF CREATION these zaradubht conceived that cod Almighty created one species，ouch a the heavens，water，land，animals，plants and man，so that the creation of the world was completed in six days．

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311. Fam $\stackrel{\rightharpoonup}{a}$ al-jamrāt Pi shuhūr al-rūm. With regard to special days in the Greek months, the name Jamrabi is given to certain days at the end of winter when spring JAMRAHS approaches; they say that in these days the interior of the earth becomes warm and vapours issue from it. These jamrahs are on the 7 th, 14 th and 2lst of Shubat, and the Arabs say that on these days meteors fall from the stars of the mansions of the moon.
312. Ayy bm al-rajuz me hiya. The days of the old woman (rajuz) are seven days beginning on the 26 th Shubat. They are not free from ice, cold and winds DAYS OF THS nor of extreme changes in the weather, and OLD HOMAN are consequently called the cold days of the old woman. these are the unlucky days in which the people of rad perished in a storm, only one old woman surviving and continually mourning for them. Arabs however say that the word is not rajuz but rajuz, as it were the hinder part of the winter.
313. Fame rajuz galam. These days are also known as the rajuz-i qalam. Ya'qub al-Kindi has written a book on these days and says that the reason of the change in the atmosphere is the arrival of the sun at $90^{\circ}$ from 1 ts ADJUSTED DATE
where the equation changes from plus to apogee, the place where the equation ganges from plus to minus. Since the apogee ara, abdulah qualm, made these days to accord With the position of the apogee in our time, not in Polemy*s. Therefore the days became known as rajuz-i qalam. ${ }^{2}$
314. Fame ayyām al-bāhūr. Berar begins on the 19th of Tammuz and lasts Hor seven days. The Greeks say that Orion's dog, the Southern Dog-star, is due to DOG-DAYS rise at this time; the heat becomes I The Coal days. Chron. p. 243. The First jamrah falls into the air, the second into water, the third on the earth. These jamrahs and the succeeding cold spell are recorded on the same days in a Persian Calendar for 609 (Jelal.) 1099 A. H. , 1687-8 A.D. reproduced and translated by M. F. Beck 1695. Jamrah he. translates "Solennitas" as if it referred to the $s$ tone-throwing at Mana (Snouck-Hurgronye 1.0. 105-6. Burton II. 203. Lane 453), and the cold spell "dies (vetulae) frigoris adultae hyemis". In an Arabic Calendar for $1349 / 1931$ the Jamrahs are postponed to Feb. 20,27 and March 6 , and the cold and stormy spell (al-hūsum v. Dozy) lasts from March lo-17. 2 Chron. p. 245.

excessive, and the name is said to be derived from buhran a crisis or a decision made, because the authorities try to gain information as to the state of the weather in the winter months from that on these decisive days. The first day of bahur is an indication of what Tishrin I will be like, the second, of Tishrin II and so on, so that if there is fog or rain or wind on any of these days, the corresponding months will have the same. Especially in Egypt do they accept prognostics from these days as to whether crops will thrive or not. 1
315. Papal lighayr ha'ulà' shai'min dhalika. All nations and settled communities celebrate other days by holding feasts and fairs at well-known OTHER SIMILAR points, but it is difficult to know about DATES them all individually; those we do know about we have dealt with in a more
suitable place.
316. Fahal limajüz al-sughd ayyām kadhalika. The Magians of Soghdia also have their feasts and Festivals of a religious nature called aghāms, SOGHDIAN FEASTS but the necessary knowledge wi th regard to them has not reached us.
The people of Bukhara call the first and second Soghdian months by corresponding names. In these they hold bazars, among which are the first and second makhizaj, ${ }^{2}$ at which we are told stolen articles are sold, great confusion prevails and no returns are made. The first of these is the 13 th day of the third month Nisan, and the seognd the 13 th of the fourth month Basāk. 3 The fair of Tawawis, a large and populous tom, lasts for seven days from the 15 th of Mazhikhanda the sixth month, while that of Share ${ }^{r}, 4$ also the name of a town, lasts for ten days from the $15 t h$ of Masafugh 5 the tenth month.

1 Chron. p. 260. Ns has zarf for zoril.
${ }_{3}$ Mäkhiraj Chron. MEkhIrah P.
3 12th Nīsanaj. lith Basākanaj Chron. 221, text 234.
4 P. Char ${ }^{r}$, Chron. p. 425.
5 Chron. text p. 235, 7, has Masafugh in it there is a feast from the 5 th to the 10 th and then the Muslims have a fair at Shargh for 7 days. Trans. has Marsāugh.

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317. Famā Khazān. It is said that Khazānl is not a Soghdian expressign,aithough the soghdians use it, but a Tokhara ${ }^{2}$ one, and the Tokharians regard it as AUTUN $\dot{\dot{a}} \mathrm{sign}$ of change of the weather towards cold.

There is a special autumn feast for the upper classes which is on the l8th of Shahriwar, and one for the common people on the 2nd of Mihr. Both of them celebrate the beginning of the use of the wine-press (and the treading of the grapes?). 3
318. Mä ayyăm majūs Khwarizm. The Magians of Khwarizm agree of th those of Soghdia as to the traditions of their months, and the names of DAYS OF MAGIANS these are not different exoept to a OF KHMARIZM. dialeotal extent. Some of the days of the Khwarizmian months are wellknown; their New Year is called NāūsārjI; ${ }^{4}$ arghā-sūãn ${ }^{5}$ is the first of their third month and the sixth of Khurdād. In our time this arghā-sañ is regarded by them as indicating the time for sowing sesame, and the subsequent operations. Ajghar, which means fire-lighting, is the 16 th of the fourth month on which day they kindle a big fire at night after the fashion of the sadah, and drink (rine sikiP) round about it. From this day they calculate the proper times for cultivation, gathering in and pressing the grapes and the like. Faghburiyah ${ }^{6}$ is and pressing the grapes and the like. Fagnburiyan is expedition of the Shah to the frontiers. There are also Chir-ruz which is the Persian Ram-raz and NImkhab the 16 th 7 of the tenth month, which in our times is in the middle of winter.
319. Famē al-ayyām wa'l-shuhūr al-Murtadidiyyah. When the persians neglected intercalation thélr months aame on earlier; Naurūz arrived beMUTADID'S DAYS fore the ripening of the corn, and
the payment of the taxes berore the
arketing of the corn. The agriculturists of the rural MUTADID'S DAYS fore the ripening of the corn, and
the payment of the taxes berore the
arketing of the corn. The agriculturists of the rural marketing of the corn. The agriculturists of the rural

## TKhizan AO.

$\frac{1}{2}$ Name by which TokhEristan in the upper basin of the Oxus was known tó Hsuen Tsang. Tokhäriyya A correoted in margin of to to Bukhtriyya.
3 Cf . Chron. trans. 207, text 222.
${ }_{5}^{4}$ Misspelt. Chron. p. 22́3, text 235 NāūsārchI. foff.
${ }_{6}^{5}$ arija-sūān Chron. Text 236. arj jahās chüzān dress will be put 6 Faghrubah Chron, trans. p. 224. Faghiriyyah A.
Chron. text p. 236. Faghburnah $P$
Chron. text
7 2lst
chron.
districts became much distressed, and the authorities were in difficulty. So Mutawakkil resolved to postpone Naurūz to a later date, so that it might be easier for the peasantry: but his purpose was not fulfilled for he was assasinated ( $247 \mathrm{~A} . \mathrm{H}_{\mathrm{I}}$ ) before it was carried out, land it was reserved for Murtadid to do so, who was determined to effect it. Nauru was transferred to the lith Haziran, and the various Persian months with their contained festivals which follow Nauru were also transferred; they intercalated five supplementary days in the same way as the Syrians, and Murtadid added a sixth day in that year. ${ }^{2}$
320. Fam ̄ ayyām al-Khwārizmshāhiyyah. Similar changes were effected in Khwarizm (in 348 A.H. 959 A.D.) by Ahmad bin Muhammad bin iraq bin KHWARIZMSHÄH'S Mansúr Khwarizmshān ${ }^{3}$ who was desirous CALENDAR that the number of days which it was usual to count in relation to agraculture and the vintage should start from a fixed point, so that differences as to seed-time which occurred among the peasantry should not arise. So be altered the Khwarizmian months so as to agree with the Syrian ones and made Nausarji (their Nauruz) the and of Nisan. (3rd, Chron.)
321. Ma al-madmūn dafter al-sanah. Calendars are always based on the persian months on account of the CALENDARS opposite each day may be depended on for accuracy.

Similar calendars, constructed in Kashmir for the Hindu year, are used throughout the districts of Hindustan; they are written on rolls of the thin bark of tux and are called 'tithi-pattri' or books of lunar days, but they were not durable and the calculations were approximate not accurate.

With regard to the calendars in use in our country you must know that the first column to the right of the table contains the days of the weak in abjad letters, so that A means Sunday, B Monday, $Z$ Saturday and then the 1 Chron. p. 37/32.
2 chron. p. 36.
3 Abu-Sarid Ahmad. Chron. p. 229. He was the father of the last prince of this dynasty, Abut rabdallăh bin Muhammad, whom Ma'mūn attacked and made prisoner in 385/ 985, annexing then Khwärizm.
4 Chron. $p$. 229/241 Nausērif $P$.

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week having been concluded back to A again. The second column contains the days of the Arabic months from the list to the $29 t h$, if the month $1 s$ short, and to the Both if complete; this is followed by the last of the next month. In the third column are the days of the Greek months from 1-30 or 31, and in the case of Shubat 28 or 29. The fourth column has the numbers of the days of the Persian month the name of which is written above, from $1-30$ and in the case of $\bar{A} b \bar{a} n$ 35, while the names of these days are recorded in column five.

Next come the names of the seven planets, and in each column under these are three rows, that to the right indicating the signs of the zodiac from $0-11$ in abjad letters (Teeing Aries, 1 Taurus etc.) that to the left, degrees and that in the middle, minutes. These three rows opposite a day indicate the position of the planet at midday for the locality for which the calendar is constructed and the amount of movement in degrees and minutes from day to day. If increase in these is continuous in the direotion of the signs then the movement is direct, if there is decrease, it is retrograde, while if there is neither increase nor decrease the planet is stationary either in the direct or retrograde course. Further there is a column for the ascending node of the moon (ra's), one for hours and minutes of the length of day, and a third for the altitude of the sun at midday. Sometimes a

column is provided for the latitude of the moon but this is of little use and as such is discarded. Thatever else is included in the calendar is provided for the people generally who regulate their work by the position of the moon in the signs, and its conjunction with the planets.

On the margin of the calendar to the right are placed the months of the various nations, their festivals, the conjunctions and oppositions of the sun and moon and the sign and degrees thereof where these occur, the time of day or night, and the ascendants at such times, the last being very useful for eliciting weather probabilities. Again the time is shown of the sun's entry into the various signs, and the ascendants at such times, except in the case of Aries where the ascendant is the ascendant of the year, and the calendar is adjusted from this point, the entry of the Sur into Aries.

They also show at the beginning of the calendar by a diagram how to equate the twelve houses, the position of the planets therein and the resultant prognostics for the whole year. Before this theme are given the dates of the prophets (on them be peace) and the dates of distinguished kings, because an intellectual pleasure is found in such things. Some people include pictures of the new moons which occur in the Persian year showing how each is going to appear when first seen whether erect or recumbent, also its relation to the point of sunset, so as to be of assistance to the observer looking for the new moon. Many other things are added for the most part useless. If however there is an eclipse of the sun or moon in the course of the year, this is indicated at the end of the calendar, because an eclipse is indicative of so many

disagreeable thinge that it 18 undesirable to have it at the beginning of the calendar.
In the case of an oclipse the date is fiven, the amount of night or day which wili have elapsed till the beginning, middle and end of the oolipse, the extent of delay if there is any, the amount if not total in l/izthe of the diameter of eun or moon and the colour of the eolipse whether usual.

And now wo add by may of an example a portion of a Persian month so as to facilitate the rading of the Calondar.

| Moridian <br> Altitude of Sun. | $\begin{gathered} \text { Hourg } \\ \text { of } \\ \text { Day } \end{gathered}$ | TES EIGETE MOATE ABAT |  |  |  |  |  |  |  | Tumes of Poralan Daya of Konth | numbers <br> of Per- <br> eiun <br> Daya of Yonth |  |  | $\begin{gathered} \text { Deye } \\ \text { of } \\ \text { noox } \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $\begin{gathered} 1800 \mathrm{nd}- \\ \text { ing } \\ \mathrm{Fode} . \end{gathered}$ | Mercury | Venue | Mara | Jupiter | Saturn | Hoon | Bun |  |  |  |  |  |
| $\begin{aligned} & 49^{\circ} 15^{\prime} \\ & 48^{\circ} 52^{\prime} \end{aligned}$ | $\left\|\begin{array}{l} 11.23 \\ 11.20 \end{array}\right\|$ | $\begin{gathered} 20^{\circ} 19^{\prime} \\ 20^{\circ} 16^{\prime} \\ 7 \mathrm{R}^{\prime} \end{gathered}$ | $\begin{aligned} & 3^{03} 31^{\prime} \\ & 4^{0} 55^{\prime} \\ & \approx \end{aligned}$ | $\left\lvert\, \begin{gathered} 26^{\circ} 42^{\prime} \\ 27^{\circ}{ }_{56}{ }^{\circ} \\ 7 y \end{gathered}\right.$ | $\begin{aligned} & 1^{0} 44^{\prime} \\ & 2^{0} 2^{1} \\ & m=s \end{aligned}$ | $\begin{gathered} 23^{\circ} 9^{\prime} \\ 23^{\mathrm{c}} 16^{\circ} \\ 3^{\circ} \end{gathered}$ | $\begin{gathered} 2^{\circ} 32^{\prime} \\ 2^{\circ} 29^{\prime} \end{gathered}$ | $\begin{gathered} 9^{\circ} 6^{\prime} \\ 23^{\circ} 18 z^{\prime} \\ \Omega \end{gathered}$ | $\left\lvert\, \begin{gathered} 17^{0} 54^{\prime} \\ 18^{\circ} 54^{\prime} \\ \xrightarrow{\prime} \end{gathered}\right.$ | Burmusd <br> Babman | $\begin{aligned} & 1 \\ & 2 \end{aligned}$ | $5$ | $\begin{aligned} & 23 \\ & 24 \end{aligned}$ | $\begin{aligned} & 1 \\ & 2 \end{aligned}$ |
| $\begin{aligned} & 48^{\circ} 29^{\prime} \\ & 48^{\circ} 6^{\prime} \end{aligned}$ | $\left\|\begin{array}{l} 11.18 \\ 11.16 \end{array}\right\|$ | $\begin{gathered} 20^{\circ} 13^{\circ} \\ 20^{\circ} 10^{\prime} \\ i \end{gathered}$ | $\begin{gathered} 6^{\circ} 21^{\prime} \\ 7^{\circ} 49^{\prime} \\ \Omega \end{gathered}$ | $\begin{gathered} 29^{\circ}{ }^{m} 0^{\prime} \\ 0^{\circ}{ }^{\prime} \\ \Omega 4^{\prime} \\ \Omega \end{gathered}$ | $\begin{aligned} & 2^{\circ} 18^{\prime} \\ & 2^{\circ} 34^{\prime} \end{aligned}$ | $\begin{aligned} & 23^{\circ} 29^{\circ} \\ & 23^{\circ} 24^{\prime \prime} \\ & \infty=0 \end{aligned}$ | $\begin{gathered} 2^{\circ} 26^{\prime} \\ 2^{\circ} 23^{\prime} \\ \text { II } \end{gathered}$ | $\begin{gathered} 77^{\prime 24} 4^{\prime \prime} \\ 22^{\prime 2} 33^{\prime} \end{gathered}$ | $\begin{gathered} 19^{\circ} 54^{\prime} \\ 20^{\circ} 54^{\circ} \\ \sim \end{gathered}$ | Ardibahisht <br> Shahrīmar | $\begin{array}{r} 3 \\ 4 \end{array}$ | 7 8 | $\begin{aligned} & 25 \\ & 26 \end{aligned}$ | $3$ |
| $\begin{aligned} & 47^{\circ} 44^{\prime} \\ & 47^{\circ} 22^{\prime} \end{aligned}$ | 11.14 | $\begin{gathered} 20^{\circ} 7 \\ 20^{\circ} 3 \\ r y \end{gathered}$ | $\begin{gathered} 9^{0} 21^{\prime} \\ 10^{\circ} 54^{\prime} \\ \bumpeq \end{gathered}$ | $\begin{gathered} 1^{0} 38^{\prime} \\ 2^{0} 52^{\prime} \\ \Rightarrow= \end{gathered}$ | $\begin{aligned} & 2^{\circ} 48^{\prime} \\ & 3^{\circ} 10^{\prime} \end{aligned}$ | $\begin{gathered} 23^{0} 29^{\prime} \\ 23^{\circ} 34^{\prime} \end{gathered}$ | $\begin{gathered} 2^{\circ} 2_{1}^{\prime} \\ 2^{\circ}{ }^{19}{ }^{\prime} \end{gathered}$ | $\left\lvert\, \begin{gathered} 6^{\circ} 491 \\ 21^{\circ} 25 \\ \Omega \end{gathered}\right.$ | $\begin{gathered} 22^{\circ} 54^{\prime} \\ 22^{\circ} 54^{\prime} \\ 2 \end{gathered}$ | Ia fandīnada Churdädh | $\begin{array}{ll} \text { an } & 6 \\ & \end{array}$ | 9 10 | 27 28 | 5 6 |

The agoendant of tha conjunction of the moon is $3^{\circ} 6^{\prime}$ of Aquarius, the hour, priday in 6m. and the degreo of confunction, $23^{\circ}{ }^{\circ}$, of Libra

Suppose we are asked as to the peneral oonditions on Tuesday the 25 th of Ramedan, wo look in the column of the days of the week for a 3 (Tuesday) whioh correaponds to the 25 th of iamaden in the arabic column, having found this we ses thet it coincides with the 7 th of the Syrian and greek months. If the name is

written above as in this case we at once know that it is Tishrin $I$, if not we turn to a table of Greek months and find that Tishrin I is written opposite it. We also find in the Persian column that it corresponds to the Ord day, Ardibahisht of the month ADan, which name is written above the table. If we wish to learn the date according to the era of Alexander, we find it on the margin of Tishrin $I$, of the Hijra beside Muharram and of Yazdigird beside Nauru the list of Farwardin, on the condition that Tishrin and Muharram are already pest; if not it will be necessary to deduct a year, the result is the date required, viz. Tuesday 25 th Ramadan $420^{1}$ A. H. , 7 th Tishrin I 1341 Alex. and Ardibehisht, 3 rd of $\mathrm{Ab} \overline{a n}_{\mathrm{d}}, 398$ Yezd. [7th Oct. 1029 A.D.]

When we look at the position of the planets and find the sun at midday at the locality for which the calendar is made is in $19054^{\circ}$ of Libra,
Friends

A common form for a figure of the heavens at a nativity, in which the degrees of the cusps and the situations of the planets are inscribed. The chief properties of the houses are here indicated, 461. Another form on next page which shows the inequality of the bouses in relation to the ecliptic.

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the moon in 7024', of Virgo, Saturn in $2^{\circ} 26^{\circ}$ of Gemini, Jupiter in $23^{\circ} 19^{\prime}$ of Gemini, Mars in $2^{\circ} 18^{\prime}$ of Cancer, Venus in $29^{\circ} 10$ of Virgo, Mercury $6{ }^{\circ} 1^{\prime \prime}$ of Libra, and ross in $20^{\circ} 13$, of Virgo. The length of the day is lh. IBm. and the altitude of the sum at midday $48^{\circ} 2^{\prime \prime}$, and so the conditions at midday have been arrived at.

322. Kaif yurraf mustaqimhä wa rājir hä. Both sun and moon are direct in their movements, there being no retrograde phase, and DIRECT AND similarly the ascending node has no RETROGRADE direct course, but it is necessary in the case of the other planets to distinguish between direct and retrograde movements. In the case of saturn, if we look at the day after that discussed, we find that it shows three minutes less, we know therefore that it is on the retrograde path. The same days, show in the case of Jupiter an increase of $5^{\circ}, 1$ and of Mars 16', both are therefore direct. as is Venus
V. p.


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 $\left.4 \begin{array}{l}4 \\ 4\end{array}\right)$



 راللع 6 -

Which increases by $1^{\circ} 14^{\prime}$. Her direct course is rendered more evident by the fact that she moves into Libra on the following day. Mercury is also direct and increases by 1028. A glance at the hour column shows that there is a decrease of two minutes per day, and that the day is shorter than the night. The altitude at midday is also seen to decrease from day to day.
323. Fakaif yurraf maudir al-kawkab liwagt mafrüd ghayr nisi al-nahtr. The following example will show CALCULATION POSITION how the position of a planet a STAR AT OTHER TIMES any particular time may be found as long as its position at midday is known. Suppose that 7h. 40m. of the day hours have passed, this being Tuesday; Fe divide the day hours into two equal parts, viz. Sh. 39m. the difference is 2h. lm. Neglecting the minute we can say that two hours after midday have passed by the time mentioned, because the number of hours up to midday is less, if'it were greater, these two hours would belong to the forenoon. Now two hours is the lith of a complete day, and we employ this to the motion of the sun, which we know progresses 10 in 24 hours, therefore, a lath of $1^{\circ}$ being $5^{\prime}$, this is added to the known position of the sun giving 19059' of Libra for its position after the lapse

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of 7 h ． 40 m ．of the day hours．If the time were two hours before midday the sun would be in $19^{\circ} 45$ ：of Libra，and its position that of Sh．40m．after sunrise．

## An example can also be taken from the moon．

 Suppose 2h．20m．of the night hours have elapsed on Wednesday，then we add the hours back to Tuesday midday，making 8 hours，the 3rd of 24．Now the progress of the moon $1314^{\circ} 39^{\prime}$ per day，and the 3rd of that $4^{\circ} 5^{\prime \prime}$ ，which has to be added to the position of the moon making $12^{\circ} 17^{\prime}$ of Virgo for its position at the time stated．The same process can be adopted with any planet which is direct in its movement，and any other item in the table which increases or diminishes．We take for example Saturn as an instance of a planet retrograding；its rate of progress is $3^{\prime}$ and consequently $l^{\prime \prime}$ in 8 hours，but as its movement is contrary to the direction of the signs，this minute has to be deducted from the position at midday， therefore $2^{\circ} 25^{\prime}$ of Gemini at two hours of the night of Wednesday．

So must one proceed by adding or subtracting with all the items of the table．
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324. Mar al asturlab. The astrolabe is an instrument of the Greeks; its name Asturlābūn 1.e. mirror of the Stars, Hámzah of Isfahan derived from 2 the Persian as if it were sitāra-yāb ${ }^{2}$ (star-finder). By its aid it is possible THE ASTROLABE tell to know the time, and how much of easily and accurately to know the time, and how much of many to enumerate.

The instrument has a back, belly and various separable parts, which are held together by a pivot in the centre. Various figures and ines are on the instrument, each of which has a technical name for purposes of distinction.
325. Man ardā al-asturlāb. The astrolabe is round except for the projection of the 'kursk' in which there is a hole for the swivel, ${ }^{3}$ rilaqah and is a hole for the swivel, oflaqan

## PARTS OF THE ring halgah. In the centre of the ASTROLABE astrolabe is a hole in which the pivot turns; the latter holds the various

 th the aid of a pin, the 'horse'. O parts together with the aid of a pin, the horse on the back there is a rule, one points, mari, and towards the pivot; its ends are shat centre from each end there projects a quadrangular piece (libnah, hadering as sights. back, is surrounded by a raised ledge, the hujrah, fitting accurately within which is a perforated plate, the rankabūt (spider's web), shabaka or rete. part of this plate is a complete circle on which are inscribed the twelve signs of the zodiac; beside Capricorn a sharp For two English works on the Astrolabe, of. Chaucer's Conclusions on the Astrolabe 1391 ed. Skeat, Early English Text Society 1812 and W.F. Morley, Description or a Planisphere Astrolabe, constructed for Shah usayn in 1712 A. D. London 1856.
Misspent in MS.
3 P has āmizah; Morley p. 8 uses rilãqah for the cord or strap from which the ring is suspended, and rurwah for the brass swivel between the ring and the kursi.

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point the 'mari', projects from the oirole and continually rests on the hujrah when the rete is turned on the pivot. pieces attached to the meshes of the rete pith the names of fired stars engraved on them - star-pointers. When the horse is removed from the pivot, the rete and the discs underneath it come apart; the latter are constructed for different latitudes, "climates", both surfaces of each disc being used.


In the larger astrolabes the back is not only used for measur ing altitude and shadow, but affords space for a great deal faces, terms and their lords, the sans ions of the Non the parallelogram of two shadows with a table or triplicities in the interior; sines, cosines in the upper left quadrant, and in the right, the parallels of the signs, the meridian altitude of the sun at various latitudes, egg. L, and its altitude at various places, when it crosses the azimuth of Mecca, e.E. M. When the ridadah is fitted to the back by the pivot and secured by the norse on the other side, the pointers ride on the fujrah, indicating altitude and shadow.
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The figure on the opposite vage does not represent the rumm, but a simple form of tise baok showing the quadrant of aiti tude and quadrant of shadow

The above shows a simple form of rankabūt or rete from PL without underlying discs, fitting snugly into the rumn bounded by the hujrah which is graduated to $360^{\circ}$ Grouped in $15 s=e q u a l$ hours, and in this osse shown with the kursi, rurwah and halqah attached. The rete can be rotated, its pointer traversing the degrees of the bujrah. There are shown 5 star-pointers within and 5 without the zodiac airole. When the horge is withdrawn from the plvot the rete and underlying discs can be removed from the fum. cf. flame overlesf, at its right the title of next paragraph.



A diso prepared for a oertgin latitude. The three great circles are from without, Troplc of capricorn, Fquinoctial, Tropic of Cancer. EW, East and West Line, HH, Horizon intersecting it and the equinoctial at A. The upper pert of the vertical line is the Line of Midheeven. Above ara parallel to 4 H are muqantaras in Bs anding at $Z$ the zenith. Jelow ane the ilnes of the unequel hours Irom 2-12. A projection in the rusta fits into notohes ot the bottom of the discs and keeps them in place.

326. Ma asāmi khutüt al-asturlāb. If the astrolabe be held with the back towards one and the kursi uppermost, the line which runs horizontally LINES ON THE from left to right is the horizon or ASTROLABE East and West line. The upper left and its margin is divided into ninety equal divisions grouped in fives or tens, beginning at the horizon inge and ending at the middle of the kursi. These degrees of altitude are numbered in 'abjad' letters. The opposite quadrant, the quadrant of shadow, is divided into digits or shadow beginning with a point diametrically opposite the middle of the kursi. There is no definite limit for these digits except what is brought about by the division lines becoming increasingly close as they recede from that point. (The artist in P. has, incorrectly divided the quadrant of shadow in the same way as the quadrant of altitude.)

On each of the discs under the rete (which are accommodated in the belly or mother of the astrolabe) are engraved three concentric circles, the largest and outermost of which is named the Tropic of Capricorn, the smallest and innermost, the Tropic of cancer and the middle one, the Circle of Aries and Libra or the equinoctial. Each disc is divided into four quadrants by two diameters, the East and West line and a second which intersects it at right angles, and is divided at the centre into an upper part towards the kursi - the midday line, and a lower, the midnight line, respectivefly known as the line of mid-heaven and that of the pivot of earth. The horizon is that arc of a circle which passes through the intersections of the circle of Aries with the East and West line; above it and similar to it are the 'muqantaras' or parallels of altitude. divided into East and West halves, by the meridian,

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as is the horizon．The smallest muqantara is that at the zenith marked， $090^{\circ}$ ．There are also the lines of the unequal or temporal hours below the horizon passing between the Tropics of Cancer and capricorn，and numbered from 1－12．

327．Pam远 al－asturlab al－t面mm wail－nisf wa ghayruhum．A complete $\frac{\text { astrolabe is one that has }}{\text { as }}$ ninety muqantaras numbered COMPLPTE AND PARTIAL in abjad letters 1 to 90 ASTROLABES rom horizon to zenith． If the instrument is too
small to contain all these，then only every second muqantara（half－size）or third，or sixth， or tenth is marked（but not fifth although this form should be made）．I In the smaller astrolabes the divisions of the zodiac are similarly treated． The expressions large and small refer to the number of divisions and the dexterity or otherwise of the artist．

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328. Ma al-aşfurlābāt al-mukhailiph lihadhihi alsifät. There are also astrolabes of different models from that described without unneces-

## ASTROLABES OF

 DIFFERENT FORM say detail, which is a northern as distinguished from a southern instrumont. In the latter Cancer occupies the place which Capricorn holds in the northern instrument, and is opposite to Capricorn, as is the case with the other signs which in their new positions are still opposite their former opponents. The disc bearing parallels of altitude is characterized by the fact that the ends of the horizon arc and of a few of the muqantaras are directed downwards with their convexithes towards the kursi, while the others are in the same position as in the nor therm instrument.Several varieties of these two forms aredistinguished,like the 'ai' whose muqantaras are like myrtle leaves in shape, the 'mutabbal' which is drum-shaped,and the 'musratan'. There is also the 'mubattakh' called so because the muqantaras and the zodiac ofrcle are flattend into an elliptical form like a melon. Again some instruments have additional discs, such as the tablet of horizons (sarinat al-araqiyya) and that of 'matrahu'lshurar (place to which the rays are projected $=$ aspects) and that engraved with azimuth oiroles passing through the zenith, lines of the equal and unequal hours, of the rising of the dawn and the descent of the twilight. Again on the back of the astrolabe ines of the sines, i of the shadow of the azimuths and of the midday and afternoon prayers are often indicated. When necessary the rule, divided into two halves, is also lettered, the crooked hour lines, the numbered divisions of sines and arcs being marked on it. gut there is no end to this chapter.

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329. Framä al-araqim rall al-zahr. The back of the astrolabe sometimes has the terms or limits of the planets, the faces and triplicities en-
INFORMATION graved on it; if there is room also the names of the planets, while these are generally indicated by the Greek marks $h$ Saturn; 4 Jupiter, $\hat{\delta}$ Mars, $Q$ Sun, ch Venus, Mercury, $\delta$ Moon. 1 D The Hindus, however, use the initials of their names for them.
330. Kaif yükhadhu al-irtifār bi'l-asturläb. In order to take the altitude of the sun with the astrolabe, suspend it firmly on a finger of
 the right hand, the face towards the sun, then move the rule until the shadow of the one libna nearest the sun falls on the other and until the rays of the sun pass through both upper and lower sights, then note the degree of altitude indicated by the point of the rule, and whether it is $\mathcal{E}$. or F . ice. before or after midday.
331. Marrifah al-zil wail-irtifär ahead hume min
al-akhir. When the altitude of the sun has been taken
and it is desired to know the
TO KNOW SHADOW AND length of the shadow of a gnomon
ALTITUDE, THR ONB (shahs) at that time, note how
FROM THS OTHER many fingers of shadow correspond

| (so the altitude in question, then |
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Fiedemann has reproduced those of AOl, Byzantine. Zeitsch. XIX p. 145.

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the length of the shadow is to the height of the gnomon as the number of fingers is to twelve. Conversely, if the length of the shadow be known and the number of fingers corresponding in accordance with above proportion, then the altitude can be determined by placing the lower end of the rule on the number of fingers in question.
332. Marrifah al-tailir min irtifār al-shams. To determine the ascendant from the altitude, select the 1180 constructed for the
 place of observation (or as nearly as possible) place it uppermost and ft the rete over t, then find and mark the muqantara, East or West which has the same number as the altitude (if the astrolabe is not complete its position must be estimated). Thereafter ascertain from a calendar the exact place of the sun at that time, and mark that point on the corresponding sign of the zodiac on the rete (this may have to be estimated if the astrolabe is not complete). Then rotate the rete


The translation of paragraph 332 has been condenied by the omission of the examples of estimation given in the text, if the Astrolabe is not complete. The altitude of the sun is e.g. $20^{\circ}$, and the 20 th muqantara has to be found. If the Astrolabe is a suds, it lies between the lith and the 24 th muqantaras, and consequently a third of the distance between these beyond the lith line. If it is a thulth, it lies between the 18 th and the $21 s t$ lines, two thirds of the distance between these beyond the lith line.

When the position of the sun has been learned from a calendar, this must be marked on the corresponding sign and degree on the zodiac ring, and this mark placed over the muqantara determined. The ascending sign and its degree will now be found at the East Horizon. If the East Horizon does not correspond exactli to one of the divisions of the sign, the degree of the Ascendant must be estimated from its position between two of these divisions.

This method of estimation must be adopted in all similar cases; it would be tedious to have to repeat the explanation in each case.
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until the degree in question is over the muqentare already marked, and examine what sign and what degree thereof coincides with the eastern horizon; this is the ascendant.
333. Kaif yurraf al-mätir min al-nah䒴r. When the degree of the ascendant has been placed on the east horizon, see what division of HOW MUCH OF the hujra the pointer beside capriDAY EIAPSED corn indicates, then move the rete from west to east (past the midheaven line in the direction opposite to the succession of the signs) until the degree of the sun comes to the east horizon, and then note where the pointer is on the hijra. The difference gives the number of divisions between sunrise and the time number of divisions between sunrise and the was taken, known as the devin of the the altitude was taken, known as the de'ir of the
sun ( 844 ), and as fifteen divisions are equal to one hour, and one division to four minutes, the result gives the length of the day that has passed in equal hours and minutes.
334. Fakaif jurat al-tāir wail-irtifar alshams min gibal al-medi' min al-naher. Given the number of hours of the day that have elapsed to find the altitude ALTITUDE FROM FOREGOING to find the altitude ascendant. Place the degree of the sun on the east

horizon, and note the division or the hijra on which the rete point rests, then rotate it to the west for the number of divisions corresponding to the number of hours elapsed. Then see what degree of a sign is at the east horizon; this will be the ascendant, and observe on which muqantara, west or east, the degree of the sun is, its number gives that of the altitude.
335. Fakaif turraf al-siarat al-muwajlah. How to know the unequal hours. When the ascendant is placed TEMPORAL HOURS nadir of the degree of the sun is among the unequal hour lines below the horizon, the nadir will be so many degrees of the seventh sign from it and will mark the hour in question. As we know whionlit is we are not concerned with how much of it has elapsed.
336. Fakaif turraf hadh1h1 al-ashyä' min sars al-la11. How to ascertain the foregoing - the ascendant ASCENDANT \& FPOM etc. from the hours of the night cannot be taken, if you know by observation how many hours of the night have passed, convert these into divisions of the bujra, then place the nadir of the degree of the sun on the east horizon (for the nadir is used by night instead of the degree of the sun by day) then rotate

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the point on the hajra to the division calculated and look at the east horizon, the sign there is the sign of the ascendant, and the degree of the sun is at the unequal hour.
337. Kaif vüjadu irtifā ${ }^{r}$ kawikib al-thabitah. To take the altitude of a flied star, suspend the astrolabe in the right hand, turn
ALTITUDI OF the particular star-pointer towards FIXED STARS the star in question till it is sighted, then note the degree of altitude mariced by the rule, and note whether it is east or west by its relation to the midday line.
338. Fakaif yarraf al-tālir minhu. To find the ascendant from the foregoing, place the tip of the star-pointer on the muqantara
ASCENDANT FROM ALTITUDE OF THESE corresponding to the altitude east or west as the case may be, then look at the east
horizon, where will be found the sign and degree of the ascendant, and at the degree of the sun, which will point to the actual unequal hour.
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339. Kaif yurraf al-medir min al-1ail. To know from the foregoing how much of the night has passed, note the position of the point of HOW MUCH OF the rete when the degree of the NIGHT RLAPSED ascendant is on the east horizon, then rotate the rete inversely till the nadir of the degree of the sun is on the east horizon, note how many divisions of the hijra it has traversed, and translate into hours.
340. Kaif yurraf wage tulur al-kawkab wa ghurdbhu. To find the time of rising and setting of

## TIME OF RISING AND SETTING OF STAR

 a star whether by night or day, place its pointer on the east horizon and see if the degree of the sun is above the horizon among the muqantaras, if it 1 s , it rises by day. Then note where the rete-point is on the hijra and rotate it backwards till the degree of the sun reaches the east horizon. Translate the amount of movement into hours; these are the hours of the day which have passed before the star rises.If the degree of the sun is below the horizon among the unequal hours, then the star rises at night. Note the position of the point of the rete and rotate it backwards till the nadir of the degree of the sun is on the east horizon, and translate the divisions traversed into hours, which are those of the night which have passed before the rising of the

star. If the time of setting is wanted, use the west horizon instead of the east and proceed as before.
341. Kaif taswiyah lil-buyūt al-ithnefashar To equalize the twelve houses, place the degree of ADJUSTMENT OF the ascendant on the east horizon the point of the ecliptic on the west horizon is the cusp of the seventh house. Then look at the meridian, what has arrived there is the sign and cusp of the loth house. M.C. - If what you find is also the loth sign from the ascendant, the angles are erect. When they are suoceedent, the point indicated on the astrolabe will be in the lith sign from the ascendant; although it must be written down as the cusp of the loth house. E.g. if the cusp is in cusp of the loth house. E.g. if the cusp is in squarius, the house will be formed of Aquarius and so many degrees of Pisces, while if the cusp is in the 9 th sign, the angles are cadent, and the capricornus. If Aquarius alone occupies the tenth house, then Leo is in the fourth, if Aquarius and Pisces, then Leo and Virgo, and if aquarius and Capricornus then Leo and Cancer. This relation applies to the rest of the houses; so if you know one house, you know its nadir.

To determine the cusps of the other houses, turn the rete inversely so that the degree of the asoendant

comes under the horizon, and is placed on the line indicating the beginning of the eleventh unequal hour, i.e. through two temporal hours $=1 / 3$ of the semi-nocturnal arc of the ascendant then look at the meridian line to see what sign is there and what degree; it will be the cusp of the ninth house and its degree, the nadir of mich is the cusp of the third. Then move the rete through two unequal hours so that the degree of the ascendant rests on the beginning of the ninth hour, the sign and degree at the meridian will be those of the eighth house, their nadir those of the second. Then turn the rete so that the nadir of the degree of the ascendant rests on the first line of the third hour under the west horizon, the sign and degree of the eleventh house will be at the meridian: the ir nadirs those of the firth: then turn the rete to the right so that the nadir of the degree of the ascendant rests on the first line of the fifth hour, the sign and degree of the twelfth house will be at the meridian: its nadir is the sixth. Thus all the houses will be equalized. 1 (Figs. on Pp. 150, 180, 191.)
342. Kaif yurcar altai' min wantad akhir. To determine the degree of the ascendant if another cardio is known, if the known degree ASCENDANT FROM is the western one, place it on the ANOTHER ANGIX west horizon, if M.C. on the meridian towards the kursi, if I.C. on the meridian below the horizon, and in each case look at the east horizon for the result.

1 Libros_del saber II, 274. As to another method of Al-Bīrūirs, see Sedillot, Materiaux II, 509.

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343. Marrifah Pard nair wa masefah ralall-ard yuhawilu baina misahatih ma baina Ql-masih hail.

WIDTH OF A RIVER OR river or a piece of ground the PIECE OF GROUND other extremity of which it is impossible to reach so as to measure it in the usual way, stand on the bank, hang the astrolabe on the right hand and move the rule till you sight the other bank; then turn round without changing your position and without altering the rule look through both sights for a mark which you can recogmise and measure the distance between your position and the mark, the breadth of the river is the same. The same method can be used for a piece of land.
344. Marifah rump al-bir. To find the depth of a well, stand on the margin with the astrolabe in the left hand, the quadrant of altitude towards you, and move the DEPTH OF WELL altitude towards you, and move t the water or the bottom is seen through both sights. Then note the number of fingers in the quadrant of shadow to which the rule points, place its tip at one finger less, and go straight up higher until the opposite margin is again sighted without



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disturbing the position of the rule. Measure the distance between the two points of observation, and multiply by the number of fingers of shadow noted. The result is of shadow noted. The result is the depth of the well, while t gives the diameter of the well. 1

345. Marrifah tull minärah au hā 'it mimas bumkin almusil ilaihi. To find the height of a minaret or wall the base of which it is possible to reach, take the altitude of the sun and continue observation till it attains $45^{\circ}$, then measure the shadow, this gives the height of the minaret. If the sun does not reach $45^{\circ}$ at the desired time, place the point of the rule at $45^{\circ}$ and move forwards or backwards till you find a point where the top of the minaret is sighted, then measure from that point to the base of the minaret and add your own height; the result is the height of the minaret.
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346. Marrifah tūl minārah au hāit lā yumkin al-wusū ilaihi. To Ind the height of a minaret,

HEIGRT OF MTNARET Column or mountain the base of

BAST OF WHICH INACCESSIBLE column or mountain the base of stand where you are and move the rule until you see the top of the object through both
sights just as you take the altitude of a star, then note the number of fingers in the quadrant or shadow to which it points and move forwards or backwards (according as the ground is most level), if forward place the rule-point at one finger less, if backward at one finger more, and walk till the top is again Visible through both sights. The distance between the two points of observation multiplied by twelve is the height of the mountain, wile the same distance multiplied by the number of fingers of shadow observed at the first point of
observation gives the distance between that point and the base of the object. Similarly the height of any object in the air, such es a bird or a cloud which is so stationary as to allow of the altitude being taken from two different points, can be determined by the same method, as well as the distrance between you and a perpendicular dropped to the ground from the object.

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And now that we have arrived at this point, having noted the terms used in geometry and arithmetic, called attention to the nature of the heavens, shown how to read the calendar and to manipulate the astrolabe, and have completed these subjects, it is time to deal with the expressions which astrologers use with regard to the decrees of the stars, and which are of interest to a querent. By the majority of people the decrees of the stars are regarded as belonging to the exact sciences, while my confidence in their results and in the profession resembles that of the least of them.

## ASTROLOGY

347. Tebāsir al-burūj kaif hiya. And first we shall deal with the relation of the signs to the character sics of the four elements, separately and in combination.
as to the nature and temperament of the signs if they are written down in two rows, upper and lower, the first sign above and the second below it, and so on to the last, all those of the upper row are hot and those of the lower cold, while the pairs so arranged are alternately dry and moist.

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|  | Dry | Moist | Dry | Moist | Dry | Moist |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Hot | Aries | Gemini | Leo | Libre | Sagittarius | Aquarius |
| Cold | Taurus | Cancer | Virgo | Scorpius | Capricornus | Pisces |

When therefore you know the ective virtues of a sign whether heat or oold, and the passive virtues, whether dryness or moisture, it will not be concealed from you what particular element of the world and what perticular humour of the body each sign resembles. Each sign that is hot and dry is related to fire and yellow bile, each that is cold and dry, to e日rth and bleck bile, each that is hot and moist to air and blood and each that is cold and moist to water and phlegm.

The Hindus regard as moist signs Plsces, the hinder half of capricorn and the anteriorihaif of Aquarius for reasons given above in speaking of their representations, viz. that the hinder end of Capricorn is fish-like, and that of Aquarius water. They do not however reokon Scorpius as belonging to the moist signs, but count it with the eerial ones, while Cancer holds an intermediate position, sometimes being regerded as watery, sometimes as aerial according to circumstances.
348. Famē al-dhakar minhē wa:l-unthé. All the hot signs are male and the cold femele. The planets are powerful in those signs which MALE AND FEMALE resemble them in neture and sez, but they pertake of the nature of the signs in wideh they are situated so that a planet obviously male shows a tendency to femaleness by being in a female sign. The Hindus sey that all the odd, i.e. male signs are unlucky and the femele signs lucky.
349. Fomā al-nahārI minhā wa mā al-la11I. There is a general agreement that all the male signs are diurnal and the female nocturnal. The DIURNAL AND NOCTURNAL diurnal planets are powerful in the day signs and the

[^73]nocturnal in the night ones. In the Greek bizidhajl it is stated that according to some Aries, Cancer, Leo and sagittarius are day signs and their nadirs Libra,
Capricorn, Aquarius and Gemini are night ones, while the remainder partake both of day and night. The Hindus believe the aries, Taurus, Gemini, cancer, Sagittarius and Capricorn are powerful at night, the six others by day.
350. Fame al-maqturah al-a rda. Aries, Taurus, Leo and Pisces are described as maimed, the first three because their feet are cut off at the hoofs MATMED and claws, and Taurus in addition because it is only half an ox cut in two at the navel, while Pisces is included on account of the absence of limbs.
351. Famā al-muntasibah wa ghayr al-muntasibah. Aries, Ii bra and Sagittarius are described as erect constellations in the books, the others are not referred to in this regard, but the Hindus always say that Aries, Taurus, Cancer, Sagitmarius and Capricornis are asleep and represent them recumbent, while Leo, Virgo, Libra, Scorpius and Aquarius are erect, 2 and Gemini and Pisces recline on one side. Their intention in this matter is unknown to me, for the position of the figures in the constellations is of no importance, and they offer no evidence to the contrary.
352. Famā al-insiyyah wa ghayrhā. The following signs are represented as human: Gemini, Virgo, Libra and half of Sagittarius and Aquarius. Such is
HUMAN AND the case in the figures shown above
OTHERWISE with the exception of Libra, but when Libra is represented in the act of weighing, a

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human or bird figure suspends the balance or simply a human hand. The four-footed figures are Aries, taurus, and Leo, while the hinder half of Sagittarius, sometimes the front half (of Capricorn on the analogy of Taurus ${ }^{A}$ ) are also so reckoned. Then of these Aries and Tams have cloven feet, Leo claws and Sagittarius hoofs. Again the people generally from youth up entertain certain ideas as to the signs, such as that Leo, Scorpius, Sagittarius and Capricorn (Pisce sn) suggest beasts of prey; Gemini, Virgo, Pisces and the hinder two-thirds of Capricorn, birds; cancer, Sagittarius, Scorpius and Capricorn, reptiles; and Cancer, Scorpius and Pisces, aquatic animals.

The Hindus have a redundancy of interpretations of this kind; they say that the human signs are Gemini, Virgo, Libra (the fore part of Sagittarius)A and the hinder half of Aquarius, all of which they describe as bipeds, while the quadrupeds are Aries, Leo, the hinder half of Sagittarius, and the fore part of Capricorn. Reference has already been made to their ideas as to watery and aerial signs.
353. Fame al-musawwitah minhā wa ghayr almusawnitah. Gemini, Virgo and Iibra are loud-voiced, VOTCED AND VOICEIESS of these Gemini is capable of speech; Aries, Taurus and Leo are half-voiced, Capricorn and Aquarius are weak-voiced, while Cancer, Scorpius and Pisces are voiceless.

knowledge as to voice and speech is essential as to whether in a difficulty indications in these signs are harmful or the reverse
354. Fam as al-walūd minhā wa'l-ragim wa ghayrhum Indications of the signs as to families. The watery signs Cancer, Scorpius, Pisces and the hinder half of Capricorn FERTILE AND BARREN and the hinder half of Caprice
favour large families; Aries, Taurus, Libra, Sagittarius and Aquarius small ones while the first part of Taurus, Leo, Virgo and the first part of capricorn indicate sterility. The production of twins is specially in charge of Gemini, but also is favoured by Virgo, Sagittarius and Pisces and sometimes by Aries and Libra and the last part of Capricorn. (The fore parts of Capricorn and Scorpius indicate hermaphroditism ${ }^{A}$ In consequence of what we have said Aries and Libra are described as being of two natures, as are also Capricorn and Sagittarius. Virgo is called mistress of three forms, and Gemini as many-faced, because they denote not only twins but three or more children
355. Fame al-halhë fi'l-nikäh. With regard to marriage, Aries, Taurus, Leo, Capricorn indicate eagerness therefor, for Libra and RELATION TO Sagittarius much the same can be said. MARRIAGE With regard to the conduct of women Taurus, Leo, Scorpius and Aquarius denote reserve and abstinence; Aries, Cancer, Libra and Capricorn corruption and bad conduct, while Gemini Virgo, Sagittarius and Pisces denote a mean in this regard; of the four Virgo is the most virtuous.
356. Famà al-burūj al-muzlimah dhawāt al-ham. Leo, Scorpius and Capricorn are dark and anxious,

DARK AND
ANXIOUS SIGNS
and there is a suspicion of trouble in Virgo and Libra.

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357. Fame dalälathā rale jihāt al-āam. Aries denotes the $\frac{\text { middle of the East, Leo a point to the left of }}{}$ that towards the North, and Sagittarius one to the right towards the South; similarly with each of the other triplicities. Thus Taurus indicates the centre of the South, Virgo a point to its left towards the East and Capricorn one to the right and West. Gemini occupies the centre of the West, Libra a
ant
358. Frame dal̄̄hathā rale al-riyāh. A wind coming from a quarter associated with a particular sign is also associated with that sign thus the
RELATION TO WINDS Bast wind with Aries, the Fest with Gemini, the South with Taurus and the North with Cancer. Similarly with the intermediate quarters, a S.E. Find is related to Virgo or to Sagitmarius according as it is nearer $S$. or $E$ Which is corrected Prom the figure in PL and PP where the fiery (E.), and airy (W.) triplicities have changed places. AO AO1 PL correct. (S) earthy, (N) watery.
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359. Fame daläătha ala ard al-insän. The following are the various parts of the body which are related to the several signs The head and face to Aries, the RELATION TO The head and face to Aries, the arms and hands to Gemini, the chest,
breasts, sides, stomach and lungs to Cancer, the heart to Leo, the womb with its contents to Virgo, the back and buttocks to Libra, the genitals to scorpius, the thighs to Sagittarius, the knees to Capricorn, the shanks to Aquarius and the feet and heels ${ }^{\text {P }}$ to Pisces.

In this matter there is much confusion in the books, for according to some, not only the head and face but also the bowels are governed by Aries. The analogy in this case does not seem to be clear. But it is clear in the saying of a Brahman that if we imagine the zodiac to be a man, with Aries the head and the soles of the feet directed towards it, then the allocation of the parts of the body according to the Hindus conforms with whet. we have said above except that the face is given to Taurus.

The signs are also indicative of the various diseases of man, of his complexion, figure, face, and the like, they also govern localities and countries, and denote various matters regarding animals, fire, water, etc. To facilitate study these are set down in the accompanying tables.

But God is All-knowing.


I The above matter is repeated in the column (360 ${ }^{\text {a }}$ ) adjacent to 360 which is not reproduced in translation.

360

|  | 360 | Dal̄̄ā̈t al-burūj ralē'l-akhläq wa:l-siyar. INDICATIONS OF THE SIGNS AS TO MORALS \& LANNERS |
| :---: | :---: | :---: |
| 3 |  | Laughing and talkative, kingly and haughty, fond of poetry, sharp-tongued, lustful, brave. |
| 2 | O | Of good judgment, negligent, a liar, a cheat, lustful and a fool. |
| 3 | II | Generous, chaste, excelling in games, fond of philosophy and astronomy, munificent, violent, and a hefiz (has the Qur ind by heart). |
| 4 | $\sigma$ | Indolent, dumb, Fiokle and changeable. |
| 5 | $\Omega$ | Kingly, formidable, sharp-tongued, hard-hearted, litigious, knaviah, many troubles, a sinner,forgetful, powerful by nature, bold. |
| 6 |  | Liberal, good manners, truthful, well-informed, pious, a judge, thoughtful, i1vely, playful, fond of dance and music, a bāfiz. |
|  | - | Thoughtul, polite, generous, indolent, cowardly, just judge, plebeian, excited in speech, a musician and singer, a , hăfiz. |
|  | $m$ | Generous by nature, anxions, deoeitful, bold, rough morose, sharp-tongued, a slayer, a pariz, a fool, indolent, pleased with himself, bold. |
| 9 | K | Eingly, reticent, liberal, tricky, pre judiced, a capable mathematician, surveyor, thoughtful about the next world, fond of horses, particular as to food, drink and clothing, virile. |
|  |  | Arrogant, false, choleric, impetuous, changeable, evil-thinking, anxious, quarrelsome, opinionative, fond of gemes and life, orafty,forgetful, shaqq, bold. |
|  | NTM | Well-disposed, ohaste, eager to accumulate riches, eager for magnificence and manliness, a gourmet, bad́hearted, inert, indolent, restful, too anxious about worldiy affalrs. |
|  | * | Good disposition, generous, elegant, lustful, unstable in bis opinions, of good faith, medioore in business, tricky and deceitful, liable to err, forgetrul, foolish, bold. |

The adjacent colum in text repeats part of 359 .




362-364

|  |  |  |
| :---: | :---: | :---: |
| 1 |  | White and reddish. Redeish white. Kings, benkers, colners, blacksmiths, coppersmiths, butchers, shepherds, spies and thieves. |
| 2 | $\bigcirc$ | White and brownish not shining. White. Sellers (TailorsA) and weighers of grain,fishermen, (cobblersA) agents and famers. |
| 3 | II | Greenish yellow. Pistachio breen. Kings, calculators, teachers, hunters, dancers, musicians, painters, tailors. |
| 4 | 5 | Smoke-coloured not quite black. Dark red. Sailars, (water divinera,swimners) A and canaldiggers. |
| 5 | $\Omega$ | Whitish red. Wite of clothes, withered vegetables. Horsemen, colners, falconers. |
| 6 | $7 x$ | Whitish yellow. Changing. Vazirs, eunuchs, secretaries, supervisors, ordinary people, dancers, singers, assemblies of men. |
| 7 | $\Omega$ | White tinged black. Black. Magnates and dignitaries, privy counsellors, merry-makers, philosophers ${ }^{\text {A }}$, geometricians, merchants, (grammarians) devotees. |
| 8 | $m$ | Vacant P.B. and MI Golden. Physicians,enchanters, megicians, sailors. |
| 9 | $\chi$ | keddish. Colour of palm fibres. Horse-deal-ers,middle-class people, busy-bodies, meddlers with other people's business, (who, al though with honest intentions, excite strife) undertake their burdenst. |
| 10 | $\gamma$ | Colours mixed like a peacock, brown and green. Piebald, black and white. Hunters and slaves. |
| 11 | H2m | Yellow, sapphire blue and verious colours. Eright red turning yellow. Servants, traders, ass-driversA, makers of glass and jewellery, uneducated people, grave-robbers. $P$ |
| 12 | * | White. Khaki. Most revered and religious people. The last part of the sign for blind men, those who operate on them for cataraot and sailors. |



[^75]|  | 365 | 「Aㄱá－＇l－b1lād wa！l－nawābi． AS TO CITIES AND TERRITORIES |
| :---: | :---: | :---: |
| 1 | $r$ | Babylon，Fars，Palestine，Adharbeijetn，Alan． |
| 2 | $\bigcirc$ | Districts of riraq，Mikin，Hamadhen，Mountains of Kurdistan，Ctesiphon，Cyprus，Alexandria，Constan－ tinople，Oman，Ra1，Farghana，and shares in the control of Herat and Sijistān． |
| 3 | II | Egypt，the cities of Barqa，Armenia，Gurgan，Grlan， Muqān and shares in Isfahen and Kirman． |
| 4 | 0 | That part of Ampenia Minor which is beyond Marwalmūdh，Eastern Khurisagn，and shares in Balkh and Adharbadgān． |
| 5 | $\Omega$ | Murkesten as far as Gog and Magog，and the ruined cities there，Ascalon，Jerusalem，NisIbis， the twin cities，Malatya，Sistan，idakrān，Dailam， Abrashahr，Ths，Soghdiana，T1rmidh． |
| 6 | $m$ | Andalusia，Syrla，Crete，the Euphrates and Meso－ potamia，Jeramaqa，the capital of Abyssinia， San＇a，Kufa，the oities of Fars in the direction of Kirman，and Sistan as far as the borders of India． |
| 7 | $\Omega$ | The Greek kopire as far as Tunisla，and upper Egypt to the confines of Abyssinia，Antloch， Tarsus，Mecca，Tāliqān，Tokhāristän，Belkh，Herat， SIstan，Käbul，Kashmir ànd China． |
| 8 | 7 | The Hijuz country，the desert of Arabia as far as Yemen，Tangier，Qiyād，Khazaria，Qümis，Amul， SEriah，Nahawand，Nahrewan，and shares in Turkish Soghdia． |
| 9 | 天 | Persian PIraq，DInawar，Isfahen，Ra1，Beghdad， Panbevand，Darband of the Khazars，Jundi－seburr， shares in Bukhara and Gurgen，the borders of the Sea of Armenia，and Barbary as far as Moroco |
| 10 | $\pi$ | Makran and sind，and the river Mihren（Indus） and the sea between Oman and Hindustan，Eastern China，Asia Minor，Ahwaz and Istakhr（Persepolis） |
| 11 | H | Southern firiq as far as kufa and Hijeza，the country of the Copts，the West of Sind and shares in Färs． |
| 12 | 天 | Tabaristan and the country north of curgan， BukhEra and Samarqend，shares control in Asie Minor：Qaliqajā as far as Syria，Mesopotamia， Egypt，Alexandria，the sea of Yemen and Eastern Hindustan． |


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|  | 366 | $\begin{aligned} & \text { FAla-1-amakin. } \\ & \text { AS TO PLACES } \end{aligned}$ |
| :---: | :---: | :---: |
| 1 | $\gamma$ | Deserts, pasturing places for beasts of burden. Wood-sheds, places where fire is used, thieves' dens, places Fhere jewellery is manufectured. |
| 2 | ర | Mountainous places,orchards,pasture land,storehouses for food, cow and elephant sheds. |
| 3 | II | lyountains, hills, mounds, hunting-grounds, riversides,resorts of acrobats and gamblers and musicians,kings' palaces. |
| 4 | 05 | Reservoirs, reed-beds, river margins, cultiveted places, trees, wells, rivers, and places of worahip. |
| 5 | $\Omega$ | Mountains,fortresses, high sanctuaries, kings' palaces, desert places, quarries, barren saltish ground |
| 6 | V10 | Divans, women"s quarters, musiolans" houses, threshing floors, cultivated fields. |
| 7 | $\Omega$ | Small mosques and places of worship, casties, cultivation, palm-groves, observatories, plains, orchards, tops of mountains which are cultivated |
| 8 | $m$ | ifigh places,pools of bad water,prisons,places of grief and mourning, scorpions' holes, deserted places, vineyards, mulberry-groves. |
| 9 | $x^{x}$ | Level plains, Magian temples, Christian charchesi arsenals, cattle-stalls, lime-pits, irrigated orchards. |
| 10 |  | Castles, ancient reservoifs, harbours, ilreplaces, (weepling pleces), $P$ slaves' sleeping places,holes of dogs and foxes, lodgings for strangers. The first part of the sign indicates stone and gravel and water wheels. |
| 11 |  | Running and standing water, heated bath-water, taverns,brothels,canals and ditches,birds neste and resorts of aquatic birds. |
| 12 | 大 | Abodes of angels,holy men, Magian priesta, mourning places, oane-brakes.lake shores, salt marshes, granarles. |

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370

|  | 370 | $\begin{aligned} & \text { Dalālāt ralā al-rillal wa'l-amrād. } \\ & \text { SICKNESS AND DISEASE } \end{aligned}$ |
| :---: | :---: | :---: |
| 1 | $Y$ | At firat very strong, afterwards weak and liable to disorders, espectally in the head such as baldness, blood to the face, rashes, lepra and scab, limbs worn out,phlegmatic, sweet-smelling. |
| 2 | , | At first very strong, towards the end lean and spare, only moderately subject to disorders,for the most part of the neck like scrofula, and quinsy and points to freckles,ozaena and marks on baok and breaat. |
| 3 | II | Healthy and sweet-smelling body, illnesses not serious, generally cetarrh or gout, not much distress. |
| 4 | 0 | Weak and sickly, gout, oatarrh, cancer, baldness, eczema, deafness, ringworm, dandruff, leprosy, pimples, piles, heaviness in left foot and fingers |
| 5 | $\Omega$ | At first strong, but afterwards weak and liable to disease, especially of the stomach and pain in the eyes,loss of hair; at first offensive breath. |
| 6 | mp | Strong, moderately loan, and slender, sickness moderate, loss of hair, sal'. |
| 7 | $\sim$ | Limbs strong, sound, midding slender. |
| 8 | $m$ | At first strong and thiokset but at the end of ilfe weak and sickly,illnesses chiefly deafness and dumbness, cataract, cancer, eczems, ringworm, leprosy, retention of urine, ounuchism. |
| 9 | $x$ | At first strong, at last weak and sickly, moderately thin healthy body, gout, catarrh, blindness, blind of one eye, baldness, epilepsy, superfluous fingers, headaohe, and marks on the legs. |
| 10 | $\%$ | Weak sickly but sound limbs, dear and dumb, ophthalmia, bleeding, itoh, sorofula, cancer, baldness, tumours; the tendency to baldness much stronger than under other signs. |
|  | \% | At Ilrst strong, at last weak and sickly, limbs sound, diseases of the tongue, jaundice, catarrh, gout, bilious headache, pain in the eyes, and veins, vertigo, rupture, epilepsy and ozaena. |
|  | X | Weak, thin, sickly, especially in limbs, (nerves aftb) gout, sleeping of the limbs, bilious, eozema, ringworm, dandruff, bald, sal r leprosy, catarrh and abundant hair, athith. 1 |



1 Such oontradictions not infrequent.

371-372


1 Al-afras al-sarbahwal gibar al-däriyah (iike hunting-ieopards). second of terion is given of this tablo. it is arrived at by tho The years and the months are equal in number to the minor years (437) of the lord of each sign (440) and the daye and hours are the same number multiplied either by $5 / 2$ or by $5 / 24$.
No reason is given for the two domiciles of Saturn being al otted different numbers. (They are the same (30) in the opus Introd. Venioe, 1506 where the four lest oolumns are unexpiained But Vettius Valens p. 164, gives a reason; he asaigna $1 / 4$ of the iducrpor icefig. 440 and the gum of these forms the great years of ai fósee os (reed npóvos, 57 ).
The rirst method allows a year for every degree of oblique asoension of esch sigm 1 ghy any climate and a month for every
five minutes. The numbers in
ive minutes. Fhe numbers in brackete are the aorrect ones.

373. ME al-nazar wa'l-suqut. As the complex must follow the simple we have now to consider the relations

## IN ASPECT OR

 INCONJUNCT of the signs to each other.Each sign is in sextile aspect, tasdis, to the third and eleventh left and right of it, and there is a sixth of the zodiac $\left(60^{\circ}\right)$ between any degree of that sign and the same degree of those named. Similarly the quartile aspeot,tarbir, is between a sign and the fourth and tenth left and right, separated by $90^{\circ}$, and the trine, tathlith, between the fifth and ninth, distant $120^{\circ}$ and the opposite sign, muqäbala,is the seventh, $180^{\circ}$. There are therefore seven signs to which the sign in question


The signs used are oonjunction, opposition, $\infty$ sextile, * quartile, $\square$ trine. $\Delta$
turns its
face and which are cone-quantdy considered o be bound in aspect to it. The two lens which are each side of the one in queslion and their opposites piz.the second and twelfth and the sixth and eighth are not in aspert and are known as inconjunct




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374. Max al-bumāj al-mimahābb1yah wa: l-matabāghdah wa'l-muta ayah. Signs what ere in sextile or trine UNFRTENDIY, HOSTIIE OpDOg1te inimical Thug Gemini sextile to Aries, Leo and Sagittarius in trine to it, and these are mutually friendly, while cancer and Capricorn being in quartile and Libra opposite are inimical. The inoonjunct signs to Aries are four, viz. Tams, Vigo, Scorpius \& Pisces.
375. Me tartib al-nazar. The following is the order in power of the various aspects. The most powerful 1 s conjunction,i.e. meeting in the same RELATIVE POMER sign, then the opposite, then the dexOF ASPECTS teri quartile, sinister quartile, demter trine, sinister trine, dexter sextile, sinister sextile. When there are two aspects the more powerful renders the weaker one incompetent and takes away its power.
376. Hal yuwäf1gūn al-h1nd II dhalika. The Hindus are partly in agreement and party dissent from this doctrine. They are in agreement in HINDU OPINION regard to the opposite, quartiles and trines, but they say that while a sign looks towards its third, the third does not regard it, and while it does not look to its sixth, the sixth does regard it. They do not apply the term aspeat to conjunction, for they say that when one stands ergot and looks ahead, one cannot see oneself. With regard to the relative importance of the aspects they say that from a sign towards the third and tenth signs there is a quarter of an aspect, and to the fifth and ninth, half an aspect (towards the 8 th and 4 th three quarters of an aspect and to the 7 th $a$ complete aspect) A. They describe the second and twelfth signs as inconjunct to the first and it to them.

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377. Hal lilburüj ittifagat ghayr al-nazar. Two signs equidistant from an equinoctial point fig. 242 are said

RELATIONS BESIDES ASPECT
to be equipollent, 1 because the day hours of each are equal to the night hours of the other, and their ascensions are equal 2 in all places, 242 such as Aries and Pisces, Taurus and Aquarius, etc. The correspondonce is by inverse degrees, one being north the other


The vertical lines join equipollent signs, the horizontal those corresponding in their course.
$A D C$. Northern half. $C B A$. Souther half. DAB. Ascending. BCD. Descending half.
The ascending signs according to wilson are Y $\gamma$ II, $\Omega m$ because when in them the sun's declination is increasing.
south, the first of Aries being equal to the twenty-ainth of Pisces, 3 and the luth to the 20th. Two signs revolving in the same parallel, North or South (equidistant from a solstice) are described as corresponding in course ${ }^{4}$ (in itinere), their day hours are equal as are their night hours, and their ascentpions are identical at the equator, such as Gemin 1 and caner, Taurus and Ie o. The
 2 iouvdpopa of Ptolemy.
3 The 30th degree being regarded as destitute of a companion so as to associate odd degrees with odd and even with even. 4 luttafigain firl-tariqa. ojégara at Demoph1lus ivoouvapoũvra of ptolemy.

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correspondence is also by inverse degrees, the beginning of Cancer corresponding to the end of Gemini, and the tenth of the former to the twentieth of the latter. The se two relations receive different names in the books, and there is no permanence in such names, but that term is best which corresponds to the meaning.
bu Marshar his called the two signs which have the same presiding planet ( $\mathrm{B}_{4} 40$ ) as concordant in itinere, and although this is different from the two kinds of agreement referred to above, it is a relation which has to be considered. With regard to the agreement which we have spoken of,abu Marshar calls the relation of Aries to Pisces, and of Virgo to Libra by power, and that of Gemini to Cancer and Sagittarius to Capricorn by course, as natural sextiles, although they do not regard each other, but since the nearest aspect to the inconjunct place is the sextile, he has called them by that name. Similarly the relations of Aries to Virgo and Pisces to Libra by course, and those of Gemini to Capricorn and cancer to Sagittarius by power, he speaks of as natural opposites, although there is here no aspect. But in the quartile aspect it occasionally happens from these agreements as in the case of Taurus to Aquarius and Leo to Scorpius by power, and in that of Taurus to Leo and Scorpius to Aquarius by course, that the disagreeable enmity of the quartile lessens and its evil influence disappears, so that the significance of the relation gains in power, just as the removal of the inconjunction, obscurity and evil from those sextiles and natural opposites also takes place.

From those two correspondences to which we have adverted, power and course, the zodiac is divided into two sets of halves, $1 /$ northern and southern halves, 2 / ascending and descending halves (sard and habit).
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378．Ma nisi al－falak al－sarid warl－häbit．The lat－ ter are marked out by the solstices，the ascending half
$\begin{array}{cl}\text { ASCENDING AND } & \text { comprising the following signs：} \\ \text { DESCENDING } & \text { Capricorn，Aquarius，Pisces，Aries，} \\ \text { Taurus，Gemini，and the descending }\end{array}$ HALVES OF ZODIAC half the nadirs of these．

The Hindus call these halves＇ayana＇，the ascending ＇uttareyana＇or north，because although the declination of the sun in this half of the ecliptic is south，yet the sun during the whole of the half keeps its face towards its northern goal．The descending half is called ＇dakshayana or southern by similar reasoning．

Signs of the ascending half are described as signs of short or crooked ascension，because their oblique es cension is shorter than that in the erect sphere，while those of the descending half are said to be signs of long or direct ascension，because their oblique ascension is longer than that in the erect sphere． 242

The crooked signs are also called＇obedient＇and this is due to concordance in course，because when you compare tiro signs on one parallel，the one belonging to the descending half comes first by the diurnal movement，and the one of the ascending half later；so the former commas the latter，which obeys the command and always follows．l

［According to Paulus Alexan－ drinus．Wittenberg． 1506 pe 3. The commanding signs are from Taurus to Virgo：the obedient signs are connected with them by vertical lines．The beholding signs from Gemini to Aquarius connected by horizontal lines to those they regard．So also Valens p．24．But Chaucer says lac． p． 38 ＂These crooked signs ben obedient to the signs that ben of rift ascension （Cancer to Sagittarius）．＂］

[^78] Bouche－Leclercq，L＇Astrologie Grecque，p．163，as in the diagram from Paulus Alexandrinus，Wittenberg， 1586 p．E 3. For Ptolemy＇s use of the terms commanding and obeying see Tetrabiblos I．17．The northern signs command because when the sun is on them，the day is longer than the night． Junctinus I． 69 adheres to Ptolemy＇s nomenclature．
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379. Max al-muthalla'thāt. Those signs whose nature as regards two qualities (E 347 ) is identical are situated in the zodiac at the angles of TRIPLICITIES right-angled triangles; they are consequently know as triflicities and are recognised as entities, although three in number, the offects of each being identical or similar. The first triplicity is formed of Aries, io and Sagittarius, all of which are fiery in their nature, withering and heavy, while the special domain of each is for Aries, fires in ordinary use, for Leo those present in minerals and plants, and for Sagittarius that which is distributed from the heart of animals throughout the body.

The second triplicity composed of Taurus, Virgo and Capricorn is earthy, generous with its wealth, and the interpretation of its effects is that Taurus is responseible for pastureland which is not sown, Virgo for plants which have neither berries nor seeds and small trees, capricorn for som crops and large and tall trees.

Gemini, Libra and Aquarius form the third triplicity which is airy in nature, sending winds abroad, and in detail Gemini is characterized by that quiet air which produes and sustains life, Libra by that which causes trees to grow, fertilizes them and produces fruit, and Aquarius by destructive storms.

The fourth triplicity of Cancer, Scorpius and Pisces is watery in sympathy, Cancer denoting sweet pure water, Scorpius that which is turbid and Pisces that which is stinking, distasteful and alkaline.
380. Mä al-murabberāt wa burūj al-fasūר. Quadrants of the zola and signs of the seasons. Aires, Taurus and Gemini are vernal, changeable, govern childhood, the east and the east wind, chest watch of day and night. Cancer, Leo and the first watch of day and night. Cancer, leo and and the south wind and the second watch, Libra,

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Scorpius and Sagittarius are autumnal, changeable, govern adult life, the west and its wind, and the third watch, while Capricorn, Aquarius and Pisces are hibernail, peaceful, govern old age, the north and the north wind and the fourth watch.

The first sign of each season is called tropical as it is the turning point, the second fixed, because when the sun is in it the season is established, and the third bicorporal. Each one of these is related by quartile to the others of $1 t \mathrm{~s}$ kind, and thus Aries, Cancer, Libra and Capricorn form the tropical tetragone, the indications of which are gentleness, purity and sociability with a tendency to science and details. Then Taurus, Scorpius, Aquarius and Leo form the fixed tetragone, the indications of which are mildness, thoughtfulness and justice, in many cases of litigiousness and pugnacity, and sometimes of endurance in adversity and patience in trouble and injustice. Gemini, Virgo, Sagittarius and Pisces, the bicorporal tetragone, indicate amiability, levity, playfulness, thoughtlessness, discord in business, capriciousness and duplicity.

The influence of the fixed signs according to what has been said is obvious, that of the bicorporal more obscure, and that of the tropical between the two.

We must now turn to the essential characteristios of the planets uncomplicated by any other influence, because the relation of the planets to the signs is such that when they enter them they undergo oertain alterations; for the planets like the signs are spiritual forces which change the nature of bodies submitted to their influence, a retrograde planet for example, may change a temperament into a choleric one, or a joyful or anxious one, according as one of the four elements becomes preponderant and alters the activities of the spirit and the conditions.
381. Kaif tiber el-kawakib. The planets always influence whatever is receptive under them. So the

> NATURE OF
> THE PLANETS results of the action of saturn are in the direction of extreme cold and dryness, of Jupiter of moderate heat and moisture, of Mars, of extreme heat and dryness, of the sun of not immoderate heat and

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dryness, less than characterizes Mars, the heat being greater than the dryness. The influence of Venus is towards moderate cold and moisture, the latter predominant, of Mercury towards cold and dry ness, the latter rather stronger, which influence however may be altered by association with another star. The moon tends to moderate cold and moisture, the one sometimes dominating the other. For the moon alters in each quarter in accordance with the extrinsic heat it is receiving from the rays of the sun. Comparing it with the seasons of the year, the first week has a spring-like character tending towards warmth and moisture, the second summer-like, warmth and dryness, the third after opposition, autumnal towards cold and dryness, and the fourth winter-like towards cold and moisture. Some people say that moisture always predominates in the moon whatever its station, but as a fact its moisture tends to warmth with the increasing light of the first half and to cold with the decreasing light of the second, because when the extrinsic influence ceases it can only return to its original condition
382. Fam ar hālhā fI'l-nuhūsah wa'l-sarādah. With regard to the good and evil fortune due to the planets, Saturn end Mars are
man and maleficent, the former especially BENEFICENT maleficent, the former especially
so; Jupiter and venus are bentficent, especially the former. Jupiter confronts Saturn in clearing-up unfortunate complications as Venus does Mars. The sun is both beneficent and maleficent, the former when in aspect

and distant, the latter when in conjunction and near. Mercury also $1 s$ either very fortunate or the reverse it assists whatever planet is near it, but when alone is inclined to beneficence, the more so in proportion to its proximity. In virtue of $1 t s$ own nature the moon is fortunate, but its position with regard to the other planets changes quickly owing to the rapidity of its motion.

On the whole the effects of the beneficent planets may be described as virtue, peace, plenty, good disposition, cheerfulness, repose, goodness and learning. If these influences are powerful, they are friendly to each other, if weak, they lend each other assistance. On the other hand, the maleficent effect destruction, tyranny, depravity, covetousness, stupidity, severity, anxiety, ingratitude, shamelessness, meanness, conceit and all kinds of bad qualities. If meanness, conceit and all kinds of bad qualities. If abandon each other, and when alone are active but cowardly.

Some people say that Saturn is at first inimical on account of Mars, and later fortunate on account of Jupiter because it accompanies them in all states. They say of Mars it is at first fortunate and later maleficent, and the same of the sun, but we know of no justification for these ideas, for the principle at the root of this matter is that any planet which has its two qualities in an extreme degree is maleficent; in a moderate degree, beneficent, and that if the qualities are unequally present, then it is neither called beneficent nor maleficent except under certain conditions.
383. Fahai lilia's wa'l-dhanab fy hadhā madkhal. Many astrologers attribute a definite nature to the

EFFECT OF
MOON'S NODES and denotes an increase in all things,
ascending and descending nodes, saying and the latter cold, maleficent, and accompanied by e diminution of influences. It is related that the Babylonians held that the ascending node















increases the effects of both beneficent and maleficent planets, but it is not every one who will accept these statements, for the analogy seems to be rather farfetched.
384. Fahal lil-hind If hade rail. According to the Hindus, Saturn, Mars, (the sun and the ascending node) ${ }^{P}$ HINDU are in general maleficent; (they do are in general maleficent; the Dragon's tail y. Jupiter and Venus are in general beneficent and Mercury increases the effects of both beneficent and maleficents. Of the moon some say that while waxing it is beneficent, and when waning, maleficent, while others assert that for the first ten days it is neither beneficent nor maleficent, during the second ten, beneficent, and during the third, maleficent.
385. Fame al-dhakar wa'l-untha. All the three superior planets and the sun are male, Saturn, among them, being like a eunuch (has no
MALF AND FBMALE influence on birth) ${ }^{\text {. }}$. Venus and the moon are female, and Mercury hemephrodite, being male when associated with the male planets, and female when with the female; when alone it is male in its nature. Some people say that Mars is female, but this opinion is not received.
386. Famā al-nehāri minhä we'l-laili. Saturn, Jupiter and the sun are diurnal and exercise their

DIURNAL AND power during the dey. Mars, Venus end
NOCMPNAL one or the rural and ing on the sin
in which it is, or on the planet with which it is associated. Every planet assists those resembling it, the diurnal asking assistance from the diurnal and the nocturnal from the nocturnal.

The sun is lord of the day and the moon of the night, because their influence is exerted during these periods. Every planet winch is under the horizon during its own period is without influence.

Sone people say that the. dragon's head is male and diurnal and the tail female and nocturnal, but this is quite illogical.

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387. Hal tabqI dalāāt al-kamāib. The indications of a planet do not always remain constant; they are ARE INDICATIONS various signs, to other planets and CONSTANT? to the fixed stars, to the position as regards the sun and its rays, and to distance from, or proximity to the earth. Thus Saturn which is dry as it rises becomes moist as it sets. The effects which are thus attributable to the various situations of a planet present themselves in two forms, the one fortunate, the other unfortunate. Saturn, for example, which governs matters of the land, if in conditions of power and beneficence improves the agricultural conditions, blessings and good luck ensue and increased profits are realized; but if the conditions are adverse, the farming operations are attended by disappointment, bad fortune and failure.

All the indications of the planetary influences which are described in the books are set down in the tables which follow.
388. LimE yatakarrar el-shai' wâhid al-madlut ralaihi indarl-kawkib wa lam yakhtalif Ii barging. It WHY ONE QUALITY REPEATEDLY

MTET QUALITY REFEATEDLL is made of several
ATPRIBUTED TO CERTAIN planets in connection PLANETS AND NOT TO OTHERS with one subject, when the same is not the case with others ${ }^{A}$ (the signs) ${ }^{\text {P. }}$. This is due first of all to cortain defects in the art, and to confusion of reasoning. The masters of astrology first agreed to arrange things according to their colours, smell, taste, special peculiarities, actions and habits and attached them to planets in accordance with the nature, beneficence or maleficence of these, but other associations were suggested by resemblance in time of appearance or of coming into action. It is rare that only one planet furnishes the indications for one subject or object, generally two or more are associated, as for example when two elementary qualities are present obviously related to two different planets. Thus the onion is related by its warmth to Mars and by its moisture to Venus, and opium by its coldness to Saturn, and its

[^79]
dryness to Mercury. So when any one speaks of Saturn as the significator of opium, it is merely its coldness that is referred to, and if Mercury is cited in the same capacity, that is due to its dryness. Those people who do not use discrimination in these matters are therefore responsible for the contradictions which occur in their books.

Again there are groups of objects mich have as general significator one particular planet, while other planets are associated with the individuals of the group. Thus Venus is the significator for all sweet-smelling flowers, but Mars in the case of the rose is associated with it on account of its thorns, colour and pungent odour which incites catarrh, while Jupiter shares with Venus in the case of the narcissus; Saturn in the case of the myrtle, the Sun in that of the waterlily, Mercury in that of royal basil, and the Moon in that of the violet.

Similarly the various organs of a plant are distribute to different planets. Thus the stem of a tree is appropriated to Sun, the roots to Saturn, the thorns, twigs and bark to Mars, the flowers to Venus, the fruit to Jupiter, the leaves to the moon, and the seed to Mercury. Even in the fruit of a plant like e melon the constituent parts are divided among several planets, the plant itself and the flesh of the fruit belong to the sun, its moisture to the moon, its rind to Saturn, smell and colour to Venus, taste to Jupiter, seed to Mercury and the skin of the seed and its shape to Mars.
389. Kaif dalalat ralE'1-jihat. I have not seen in the ordinary text-books any reference to a connection RELATTON TO POTNTS between the planets and the points of the compass except in Negrizi'si 'Book of Nature, 2 who in speaking of the four triplicit Les refers Saturn to the East, Mars to the Fest, Venus to the South and Jupiter to the North.

The Hindus, however, attribute to the planets certain powers which they call directional (jihati) this belongs to Mercury and Jupiter at the horoscope, I Suter Abb. Gesch. Math. VI, 67 is of opinion that several works attributed to Tibrizi should be credited to Nayrizi. Abu'l-Abbās P. has NayrizI. Nayriz is 130 miles E. of Shiraz.
2 Kitab al-mawalia, not included in the list of NayrizI's works given in Not. et Ext. VII p. 118.
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to the sun and moon at the tenth house, to Saturn at the seventh, and to Venus and the moon at the fourth. So it becomes necessary to associate the East with Mercury and Jupiter, the West with Saturn, the South with the sun and Mars and the North wi th Venus and the moon.

They have also an octagonal figure called ra's ${ }^{1}$ which they use in trying to secure victory in gambling. Here they place the sun at the East, Jupiter at the South, Mars at the South-East, the moon South-West, Saturn NorthWest, Mercury North, and Venus North-East, the West point being left vacant.
390. Kaif qismah al-ayyam bainahē. With regard to the distribution of the days of the week among the planets, it is natural that the PLANETS AS LORDS OF first hour of the first day HOURS AND DAYS OF WFEKK Sunday should be given to the
planet which is the cause of day and night, viz. the sun. The second hour is allotted to the next lower planet Venus, the third to Mercury, the Arc of day

Arc of night


Day of 12 unequal hours. $1 / 12$ th
Night of 12 unequal hours $1 / 12$ th arc of night $=100$

Diagram of equal and unequal hours with the Lords of the hours for a Sunday.

The Arabs divide the whole day from sunrise to sunset into 12 day hours and the night from sunset to sunrise into 12 night hours. In the diagram the day is much longer than the night, 16 of our hours to 8 . Therefore the Arab hours are very unequal to ours, and are al so unequal as the days vary in length. Here 2 spaces are given to Arab day hours and one to night hours, so 3 Arab day hours $=4$ or ours and 6 Arab night hours $=4$ of ours. HOne of the games of nard.

fourth to the moon，the fifth to Saturn and so on till the second day Monday whose first hour falls to the moon，second to Saturn，and so on in the same way until another Sunday arrives，when the first hour is again the turn of the sun．The lords of the hours having been determined in this way it was natural that the days of the week should be assigned to the planet associated with the first hour thereof． 1

Some people assert that the odd hours of the twenty－four are male and the even ones female．

391．Fahal iI hadha ikhtilaf．The Hindus deal with this matter in a better way．They reckon their day of twenty－four hours from sunrise to
HINDU DIFFERENTCE sunrise，and allot the mole day to one governing planet without making separate provision for the hours．Their night follows day，and their hours are equal which appears to be the most reasonable method．Our astrologers however，deal separately with day and night and divide them into un－ equal hours，so that the lord of the night which follows a day is the thirteenth planet counting downwards from the lord of the preceding day and（an easier calculate－ ion）the sixth downwards or the third upwards．

It is on account of this that the unequal hours are engraved on the astrolabe，but this method of division is contrary to nature．

392．Kaif qismah al－aqalIm bainahe．With regard to the seven ciliates tie first from the equator to 1 ts boundary is given to Saturn the first PIANETS AND and highest planet and the one with the CLIMATES widest orbit，because the first climate is the longest of all，the most generous in yielding the necessities of life，end its inhabitants resemble Saturn in colour and disposition．The second climate belongs to Jupiter and so on to the seventh which is allotted to the moon．Abut Marshar regards this as a Persian view，and says that the Greeks give the first climate to Saturn，the second to the sun，the third to Mercury，the fourth to Jupiter，the firth to venus，the sixth to Nears and the seventh to the moon．

1 For a memoria technica of the planetary hours see Skeat lac．p．23－7，and for the Semaine planetaire BL．p．480．Fig． 244.



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ASCENDANTS OF
CITIES, CLIMATES
LORDS OF THEIR HOURS or investigation and research LORDS OF THEIR HOURS scope or ascertain the lord of the hour for a the hour for a place, unless we know accurately the time of the beginning of its construction? And what city is there of which such a recollection is preserved? Even if e religious ceremony of its early conditions has passed into oblivion. Even suppose that is not so, and that we assume a certain date of its foundation, and draw a horoscope and calculate the lords of the hours in accordance therewith, how are we to do so for a well-known stream or a. great river, since we can know nothing as to when water began to flow in and excavate its channel? These questions are futile and their absurdity is obvious to the intelligent.
394. Ma sunup al-kawakib. The years of the planets are of four degrees, least, mean, great and greatest ( 8 437). The last are only used for mark-
YEARS OF THE PLANDTS ing certain time-cycles, el though some people say that in ancient days the planets granted such long years of life. Astro eger of the present day only use the three former deores for determining the length of life at a nativity, and the numbers which they thus elicit must not be interpreted literally as years, but freely, for sometimes they represent years, but sometimes months, weeks, days or hours.
395. Ma firagrat al-kanakib. The years of a man's life according to a Persian idea are divided into certain periods (firdār)l governed by the lords of these known as FIRDARIA OF PLANETS by the lords of these known as one period is finished another begins. The first period always begins with the sun in a diurnal nativity and with the moon in a nocturnal one; the second with Venus in the one case, in the other with Saturn, the remaining periods with the other planets in descending order. The years of each period are distributed equally between the seven planets, the first seventh belonging exclusively to the chronocrator of the period, the second to it in 2 partnership with the planet next below it and so on. I firdar, according to De Saumalse from $\pi \varepsilon \rho ; 0 \delta a p i o v, ~$
Bouché-Leclercq p. 491 n . The firdaria appear later a Bouché-Leclercq p. 491 n . The firdaria appear later
甲actdoia (Cat. cod. ash. graec. cod. Flor. p. 83). 2394 and 395 are more suitably placed before 436 in $\mathrm{PI}^{1}$.


396-401
306-401. Tabäri al-kawakib wa dalalatha. The general characteristics of the planets and their
indications as to 396 elementary qualities; 397 beneficence or maleficenoe; $398 \mathrm{sex} ; 399$ whether diurnel or nooturnal;
MATURES OF THE PIANE AND THEIR INDICATIONS 400 smell and taste; 401 colour.

Saturn is extremely cold and ary. The greater malefic. Male. Diurnal. Disagreeable and astringent, offensively acid, stinking. Jet-black also black mixed with yellow, lead ovlour, pitch-dark.

Jupiter is moderately warm and moist. The greater benefic. Male. Diurnel. Sweet, bitter-sweet, delicious Dust-colour and white mixed with yellow and brown, shining, glittering.

Mars is extremely hot and dry. The lesser malefic. Male
(some say female). Nocturnal. Bitter. Dark red.
Sun is hot and dry, the heat predominant. Maleficent when near, beneficent at a distance. Male. Diurnal. Penetrating. Pungent, shining reddish-yellow,its colour is said to be that of the lord of the hour.

Venus is moderately cold and moist, espeolally the latter. The lesser benefic. Female. Nocturnal. Fat and sweet flavour. Pure white tending to straw-colour, shining, eccording to some greenish.

Mercury is moderately cold and dry, the latter predominant. Beneficent. Male and diurnal by nature, but takes on the characters of others near. Complex flevour and colour, the latter sky-blue mixed with a darker colour.

Moon is cold and moist, sometimes moderate, changeable. Beneficent and maleficent. Female. Nocturnel. Salt or insipid, somewhat bitter. Blue and white or some deep colour not unmixed with reddish yellow, moderate brilliancy.


## 402-406

402-406. Dala'11ha al-mutlaqah Keifiyāt, ashkEl, eyyämhe ialimhe wa ejnas al-ard. Indications as to 4óz INDICATIONS form, 404 the days and nights of the CONTINUED week, 405 climetes, 406 nature of soils.

Saturn: Coldest, hardest, most stinking and most powerful of things. Shortness, dryness, hardness, heaviness. Saturday (and Wednesday night) ${ }^{\text {P }}$. First climate. Barren mountains.

Jupiter: Koderate, complete, pleasant, best and easiest things. Moderation, solidity, smoothness. Thursday (and Monday night)P. Second climate. Easily worked soil.

Mars: Hot, hard, sharp and red things. Length dryness anc coarseness. Tuesday (and Saturday night) ${ }^{P}$. Third climate. Waste, hard and stony land.

Sun: Most expert, noble, well-known and generous things. Revolution, mines, worn-outness, empty and vaoant places. Sunday (and Thursday night)P. Fourth climate. Mountains rich in minerals.

Venus: Most pungent, most agreeable and delioious, most beautiful, sortest and ripest things. Squareness, dispersion, smoothness. Friday (and Tuesday night)P. Fifth climate. Soils with abundant water.

Mercury: Mixture of moderate things. Compounded of two things of this nature. Wednesday (and Sunday night)? Sixth olimate. Sandy soil.

Moon: Thickest, densest, moistest and lightest objects. Denst ty, moisture, opacity, lightness. Monday (and Friday night)P. Seventh climate. Plains and level ground.


407-408. Mālahē min al-amākin FB :l-masākin. Indications as to, 407, places and bulldings; 408 ,

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BUILDINGS AND
    COUNIRIES
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Saturn: Underground canals and vaults, wells, old buildings, desolate roads, lairs of wild beasts, deserts full of them, stables for horses, asses, and camels, and elephants' houses. India, zanzibar, Abyssinia, Egypt, Ethiopia between the West and the South, Yemen, Arabia and Nabatea.

Jupiter: Royal palaces, mansions of the nobility, mosques, pulpits, Christion ohurohes and synagogues, soience, books, ordinary vessels, teachers' houses, hamlets of leadworkers. Babylon, Fars, Khurāsen, the country of the Teviks and the Berbers in Africa as far as the West.

Mars: (Fire-temples) ${ }^{P}$, fireplaces and firewood, roadside fires and the vessels neoessary for the art of the potter. Syria, Greece, Slavonia, North-Western countries.

Sun: Kings' and sultan's palaces. Hijjaz, Jerusalem, Kount Lebanon, Armenia, Alan, Dailam, Khurasen as far as China.

Venus: Lofty houses, vessels (roads) Thich hold much water, places of worahip. Babylon, Arabia, Hj juz and its neighbourhood, (1slands and sugar-plantations $p$, and cities of Mesopotamia and the Middie of the Marshos

Mercury: Bazaars and divans, mosques, houses of painters and bleachers and such as are near orchards, irrigation channels and springs. Mecca, Medina, riraq, DIlam, Gilen, TabaristEn.

Moon: Moist places, underground or under water briok-making, places to cool weter, streams and roads with trees. Mosul, Azarbaljan, the narrow streets of the common people everywhere.


1 zarf and turuq are confused in this paragraph.

409-411. Mälah百 min al-mardaniy辰, al-filizzāt wa' 2-Jaw RELATIONS TO ORES, METALS AND and precious stones. JEWELS, GRAINS AND FRUITS 411, grains and iruit.

Saturn: Litharge, iron slag, hard stones. Lead. Pepper, belleric myrobalan, olives, medlars, bitter pomegranate, lentils, linseed, hempseed.

Jupiter: Marcasite, tutty, sulphur, red arsenic, all white and yellow stones, stones found in ox-gall. Tin, white lead, fine brass, diamond, all jewels worn by man. Wild pomegranate, apple, Theat, barley, rice, durra, ohiokpeas, sesame.

Mars: Magnetic iron,shadnä (lentil-shaped stones) oinnabar, rouge and mosaics (fasifusā). Iron and copper. Bitter almond, seed of turpentine-tree.

Sun: Jacinths, lapis lazuli, yellow sulphur, orpiment Pharaonic glass, marble, re-algar, pitch. Gold and whatever is coined therefrom for kings. Orange and maize.

Venus: Magnesia and antimony. Silver and gold and jewels set in these,household vessels made of gold, silver and brass, pearls,emeralds,shells. Figs, grapes dates,origanum and fenugreek.

Mercury: Depilatory, arsenic, amber, all yellow and green stones. All coins struck with name and number such as dnars, dirhams and coppers,old gold and quicksilver, turquoise, coral, tree-coral. Pesse, beans, caraway, cordander.

Moon: Nabatean glass, whte stones, emerald, moonstone.S11ver and things manuraotured of silver, such as cups, bengles, rings and the like, pearls, crystal, beads strung. Wheat, barley, large and mall cucumbers,melons.

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412-413. M̄̄lah̄̄ min al-ashjār, al-nab̄̄t. Indioetions as to,4l2, trees; 413 , herbage and crops.
RELATIONS TO
TREES \& CROPS
Saturn: Oak-gall tree, citron or myrobelan tree, olive tree and also willow, turpentine tree, castor-oil plant, and all those which bear fruits with disagreeable taste or smell,or hard-shells such as welnuts and almonds. Sesame.

Jupiter: Trees bearing sweet frult without hard skin such as peach, fig, apricot, pear and lote-fruit, companions Venus as to fruits. Roses, flowers, herbs sweetsmelling or tall, such plants as are light and whose seeds fly with the wind.

Mars: All bitter,pungent and thorny trees,their fruit with rough skin, pungent or very bitter such as bitter pomegranate,wild pear, bramble. Mustard,leeks, onions, garlic, rue, roaket, wild rue, radish, egg-plant.

Sun: All tall trees which have ofly fruit, and those whose fruit is used dry, such as date-palms,mulberries and vines. Dodder, sugar-cane, manna, tarangubin and shIr-khisht.

Venus: All trees soft to touch, sweet-smelling, smooth to the eye like cypress and teak, apple and quince. Sweet and olly berries, fragrant and coloured herbs, spring flowers and has a share in cotton.

Mercury: Pungent and evil-smelling trees. Savoury herbs and garden stuff, canes and things growing in water.

Moon: All trees the stem of which is short such as the vine and the sweet pomegranate. Grass, reeds, oanes, flax, hemp, trailing plants such as cucumber and melon.


414-417. MāIaha min al-aghdiya wa'l-adwiya, $\bar{a} 1 \bar{a} t$ al-marash, ahwal, quwih. Indications as to, 414, foods and drugs; 415, household utensils; 416,states of
RELATIONS TO FOODS \& DRUGS, utensils; 4i6, stat
HOUSEHOLD REQUIREMENTS, being; 4i7, powers.
STATES OF BEING, POWERS
Saturn: Drugs cold and dry in the fourth degree, eapecially those which are narcotic and poisonous. Dwellings. Sleep. Retentive power.

Jupiter: Those which are moderately hot and moist and are profitable and agreeable. Fruits. clothing. Vital, growing nutritive faculties and the air in the heart.

Mars: Whatever is not poisonous but pungent and Werm in the fourth degree. Drugs. Business. Passion.

Sun: Whatever is warm beyond the fourth degree and is salutery and in general use. Poods. Eating and drinking. Youthful vigour.

Venus: Moderately cold and moist foods, useful and pleasant to the taste. Savoury herbs. Coition. Sensuality.

Mercury: Foods which are dryer than cold and are agreeable but rarely useful. Grains. Speaking. Faculty of reflection.

Moon: Foods which are equally cold and moist, sometimes useful, sometimes detrimental, and are not in oonstant use. Beverages. Drinking water. Natural power

418. Dalālät ralá dhawät al-arbara. Indications as to quadrupeds.

## INDICATIONS AS TO

QUADRUPEDS \&C
Saturn: Blagk animals and those living in holes in the ground; oxen, goats, horses, sheep; i ermine, sable, weasel, cat, mouse, jerbok,also, large blsck snakes, scorpions and other poisonous insects and fleas and beetles.

Jupiter: Man, domestic animals and those with cloven hoofs such as sheep, oxen, deer, those whioh are speokled and beautifully coloured, and edible, or speaking, or trained such as lions, chetahs and leoperds.

Mars: Lion, leopard, wolt, wild pig, dog, destructive or med wild beasts, venomous serpents.

Sun: Sheep, mountain goat, deer, Arab horse, lion, crocodile, nocturnal animals whioh remain concealed during the day.

Venus: All those wild animals wich have white or yellow hoofs such as gazelie, wild ass, mountain goat also large fish.

Meroury: Ass, camel, domestic dog, fox, hare, jackal, ermine, nooturnal oreatures, small aquatio and terrestrial animals.

Moon: Camel, ox, sheep, elephant, giraffe, all beasts of burden obedient to man and domesticated.

[^81]

419-422. Dalā1āt ralá al-tuyūr, al-anāsir wa:lakhlāt ashya: fi badan al-insan, fI batn aíinsagn.

INDICATIONS AS TO BIRDS, birds and other filers, 420 ,

ELEMENTS AND HUMOURS,
ORGANS OF THE BODY, VITAL ORGANS. the element the elements and humours, 421, organs of similar nature, 422, vital organs.

Saturn: Aquatic and nooturnal birds, ravens, swallows and flies. Earth, black bile and occasionally crude phlegm. Hair, nails, skin, feethers, wool, bones, marrow and horn. Spleen.

Jupiter: Birds with straight beaks, grain eating, not black, + geon, francolin, peacock, domestic fowls, hoopoo and lark. Air and blood. Arteries, sperm and bonemarrow. Heart in partnership with the sun.

Mars: Flesh-eating birds with curved bills, nocturnal, water hens, bats, all red birds, wasps. The upper part of fire and yellow bile. Veins and the hinder regions. Liver together with venus.

Sun: Eagle, ring-dove,turtie dove, cock and falcon. The lower part of fire. Brains, nerves, and the hypoohondria, fat and everything of this kind. P Stomach.

Venus: Ring-dove, wild pigeon, sparrow, bulbul, nightingale, locusts and inedible birds. -----. Flesh, fat and spinal marrow. Kioneys.

Mercury: Pigeon, starling, crickets, falcon, aquatic birds and nightingales. Black bile. Arteries. Gallbladder.

Moon: Ducks, cranea, cartion crowe, herons, chicks, partridge. Phlegm. Skin and everything related thereto. Lungs.


423-426. Mälahā min al-ra's, al-bawass, arøä' albadan. Dalalatha ralk al-asnan. Indications as to, 423,

INDICATIONS AS TO PARTS OF HEAD, SENSES, IAEMBERS OF BODY, TIME OF LIFE parts of the head; 424, sense organs; 425, paired and other orgens; 426 period of life.

Saturn: Right ear. Hearing. Buttocks, podex, bowels, penis, baok, height, knees. Old age.

Jupiter: Left ear. Hearing and touch. Thighs and intestines, womb and throat. Middle age.

Mars: Right nostill. Smell and touch. Legs, pubes ${ }^{P 1}$, gall-bladderA, kidrey. Youth.

Sun: Right eye. Sight. Head and chest, sides, teeth, mouth. Full manhood.

Venus: Left nostril. Smell and inhaling organs. Womb, genitals, hands and fingers. Youth and adolescence.

Mercury: Tongue together with Vemus. Taste. Organs of speech. Childhood.

Moon: Left eye. Vision and taste. Neck, breasts, lungs, stomach, spleen. Infancy to old age according to 1ts various quarters.

[^82]427-428. Mälaha min al-ansta, dalElat ralarlhilá wa'l二suwar. Indications as to, 427, relations RELATIONS AND CONNECTIONS ad connections, 428 FIGUFB AND FACE

Saturn: Fathers, grandfathers, older brothers and slaves. Ugly, tall, wizened, sour face, large head, eyebrows joined, small eyes, wide mouth, thick lips; downcast iook, muoh binok hair, short neck, coarse hand, short fingers, awkward figure, legs crooked, big feet.

Jupiter: Children and grandohildren. Fine ilgure, round face, thiok prominent. nose, large eyes, frank look, small beard, abundant ourly hair reddish.

Mars: Brothers of middle age. Tall, large head, small eyes and ears, and fine forehead, sharp grey eyes, good nose, thin lips, lank hair, reddish, long fingers, long steps.

Sun: Fathers and brothers, slaves. Large head, complexion white inclining to yellow, long hair, yellow in the white of the eye, stammers, large paunch with folds.

Venus: Fives, mothers, sisters, uterine kindred, delicate child. Fine round face, reddish-white complealon, double ahin, fat cheeks, not too fat, fine eyes, the black larger than the white; small teeth, handsome neck, medium tall, short fingers, thick calves.

Mercury: Younger brothers. Fine figure, complexion brown with a greenish tinge, handsome, narrow forehead, thick ears, good nose, eyebrows joined, wide mouth, small teeth, thin beard, fine long hair, well-shaped long feet.

Moon: Mothers, maternal aunts, elder sisters, nurses. Clear white compleal on, gait and figure ereot, round face, long beard, eyebrows joined, teeth separate crooked at the points, good hair with locks.

429. Mālahā min al-sifāt. Indication as to disposition and manners.

## DTSPOSITIION AND MANNERS

Saturn: Fearful, timid, anxious, suspioious,miserly, a malevolent plotter, sullen and proud, melancholy, truthtelling, grave, trusty, unwiling to believe good of anyone, engrossed in his own arfairs and consequentiy indicates discord, and either ignorance or intelligence, but the ignorance is concealed.

Jupiter: cood disposition,inspiring,intelligent, patient, high-minded, devout, chaste, administering justice, truth-telling, learned, generous, noble, cautious in friendship, egoistic,friend of good government, eager for education,an honourable trusty and responsible custodian, religious.

Mars: Confused opinions,ignorant,rash,evil conduct, licentious, bold, quarrelsome, unsteady, untrustworthy, violent, shameless, unchaste but quickly repentant, a deceiver, cheerful,bright,friendly and pleasant-faced.

Sun: Intelligent and knowledgeful, patient, chaste, but sensual, eager for knowledge, power and victory, seeking a good name for helping others, iriendly, hottempered but quickly recovering repose.

Venus: Good disposition, handsome face, good-natured inclined to love and sensuality, friendliness, generosity, tenderness to children and friends,pride,joy, patience.

Meroury: Sharp intelligence and understanding,affability, gentleness, open countenance, elegance, far-sightedness, changeable, deeply interested in business, eager for pleasure, keeps secrets, seeking friendship of people, longing for power, reputation and approval, preserves twue friends and withdraws from bad ones, keeps away from triokery, strife, malevolence, bed-heartedness and discord.

Moon: Simple adaptable, a king among kings, a servant among servants, good-hearted, forge tful', loquacious, timid, reveals secretsia lover of elegencestrespected by people, cheerful, a lover of women, too enxious, not intelleotually strong much thought and talk.
$\frac{1}{5}$ pure in heart. 2 nesi. 3 duplicated. 4 and amusement. 5 about them.

430. Nälahā min al-afrā wall-ghara'iz wailaknlag. Indications as to conditions of life and activities.

## ACTIVITIRS, INSTINCTS

AND MORALS
Saturn: Exile and poverty, or wealth acquired by his own trickery or that of others, failure in business, vehemence, confusion, seeking solitariness, ensleving people by violence or treachery, fraud, weeping and wailing and lamentation.

Jupiter: Friendiness, a peacemaker, oharitable, devoted to religion and good works, responsible, uxorious, laughing, eloquent, eager for wealth, in addition to affability some levity and reckiessmess.

Mars: Marriage, travelling,litigation, business gaing to ruin, false testimony, lustful, a bad companion, solitary,spiteful and tricky.

Sun: Longing for power and goverment, hankering after wealth and management of worldiy affairs, and imposing will on the ignorant, reproving evil-doers, harsh with opponents. If sun is in exaltation, the position is favourable to kings,if in fall to those in rebelilon.

Venus: Lazy, laughing, jesting, dancing,fond of wine, chess, draughts, cheating, takes pleasure in every thing, not quarrelsome, a sodomite or given to excessive venery, well-spoken, fond of ornaments, perfume, song, gold, silver, fine clothes.

Mercury: Teaching manners, theology, revelation and logio, eloquent, fine voice, good memory for stories ruining prospeots by too great anxiety and misfortunes, fearful of enemies, frivolous, eager to buy slaves and girls, busybody, calumious, thieving, lying and falatfying.

Moon: Lying,calumniation,over-anxious for health l and comfort, generous, in distributing food, too uxorious, levity in appropriate places,excellent spirits.


1 little conjugal happiness, too much marriage.

43I-432
431-432. l位 yansub ilaihā min al-rillal wa:lamraga, wa taba立t al-nás. Indications as to,431, diseases, 432, classes of AND CLASSES

Saturn: Sickness,affilction, poverty, death,disease of internal organs, gout. Owners of estates,kings' intendants, religious of various sects, devotees, wicked people, bores, the overworked, eunuchs, thieves, the moribund, magicians, demons, ghouls, and those who revile them.

Jupiter: Siokness,fatigue,fever, deeth in childbed, Caeserean seotion. Kings, vezirs, nobles, magnates, lawyers, merchants, the rich and their sycophants.

Mars: Fever. Leaders, cavalry,troops, opponents, disputants in assembly.

Sun: --n--. Kings, nobles, ohleis, generals, officials, magistrates, physicians, societies.

Venus: ----- Nobles, plutoorats, queens, courtezans, adulterers and their ohildren.

Meroury: --m-.. Merchants, bankers, councillors, tax-colleotors, slaves and wrestlers.

Moon: Disesses of many kinds. Kings, nobles, noble matrons? celebrated, and wealthy - aghnye oitizens.

[^83]

INDICATIONS AS TO RELIGIONS PICTURES OF PLANETS

Saturn: Jews and those who dress in black. 01d man seated on a wolf, in his right hand the head of a man and in the left a men's hand; or according to another picture, mounted on a bright bay horse, on his head a helmet, in the left hand a shield and in the right a sword.

Jupiter: Christians and those dressed in white. A young man with a drawn sword in the right hand and a bow and a rosary in the left, on horse-back; another picture: man on a throne, olad in variously coloured robes, a rosary in the left hand.

Mars: Idolaters,wine-bibbers,dressed in red. Young man seated on two lions,in the right hand a drawn sword in the left a battle-aze; another picture: mounted on a bay horse, helmet on head, in the left hand a spear adorned with red roses, pennon flag ${ }^{A}$, in the right hand head of a man, clad in red.

Sun: Wearing a crown; Magians, Mithraists. A man seated on something like a shield on wheels drawn by four oxen, in his right a staff on which he rests, in his left a macep gurz, beadgA kharaz; another picture: man seated, face like a circie, holding reins of four horses.

Venus: Isläm. Woman on a camel holding a lute phich she is playing; another picture: waman seated her hair unloosened the locks in her left hand, in the right a mirror in which she keeps looking, dressed in yeilowish green, with a neoklace, bells,bracelets and anklets.

Mercury: Disputants in all sects. Youth seated on a peacock, in his right hand a serpent and in the left a tablet which he keeps reading; another picture: man seated on a throne, in his hand a book mitich he is reading, crowned, yellow and green robe.

Moon: Adherents of the prevailing religion, Man with javelin in right hand, in his left thirty, you would think there were three ${ }^{1}$ hundred, on his head a crown, seated in a chariot dram by four horses. 1 'sisad P. 3000


Saturn: Building, paymaster, farming, reclaiming land and distribution of water, (fraudulent transactions, $P$ ) apportioning money and heritages, grave-digging; selling things made of 1 ron, lead, bone, hair; copper, black slaves; knowledge used for bad purposes, such acts of the government as lead to evil oppression, wrath, oaptivity, torture.

Jupiter: Noble actions, good government,religion, doing good; interpretation of dreams; goldsmiths work, banking;selling old gold and silver,white clothes, grapes and sugar-cane.

Mars: Law-making, selling and making armour,blacksmiths craft, grooms, shepherds, butchers, veterinary surgeons, surgeons, ciroumcisers, sellers of hounds, cheetahs, boars, wolves, copper, si ckles, beer, glass, boxes, wooden cups, brigandage, contention, housebreaking, higawaymen, grave-robbers and prison, torture,execution.

Sun: Receiving, giving and selling gold-brocades.
Venus: Works of beauty and magnificence,fond of bazaars, commerce, measuring by weight, length and buik; dealing in pictures and colours,goldsmiths work, tailoring, manufacturing perfumes, dealing in pearls, goid and silver 'ornaments, musk, white and green clothes, maker of crowns and diadems, accompanying singing, oomposing congs, playing the lute, feasts, games and gaming.

Mercury: Merchants, calculators and aurveyors; astrologers, necromancers and fortune-tellers, geometrician, philosopher, disputation, poetry, eloquence, manual dexterity end enxiety for perfection in everything, selling slaves, hides, books, coins; profession of barber, manufacture of combs.

Moon: Engaged in business matters,missions, agenoles, accounting; strenuous in religion and divine law, skill in all branches;practice of medicine, geometry, the higher sciences,measuring land and water; growing and cutting hair;selling food, silver rings and virgins,also indicates captivity, and prison for the deceptions of wizards.


436-437. Awämirhā min quadēm wa min kheif. Sinnūhà. The arbsi and years of the planets

ORES AND YEARS OF PLANETS

| Orbs |  | least | mean | $\begin{gathered} \text { Years } \\ \text { great } \end{gathered}$ | greatest |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Saturn | $9^{\circ}$ | 30 | 43, | 57 | 265 |
| Jupiter | 90 | 12 | $45 \frac{1}{2}$ | 79 | 427 |
| 1ars | $8{ }^{\circ}$ | 15 | 404 | 66 | 284 |
| Sun | $15^{\circ}$ | 19 | $39 \frac{1}{2}$ | 180 | 1461 (sothieo cycle) |
| Venus | 70 | 8 | 45 | 82 | 1151 |
| inercury | $7{ }^{0}$ | 20 | 48 | 76 | 461 |
| Moon | $12^{\circ}$ | 25 | $37 \frac{1}{2}$ | 108 | 520 |

438-439. Firdārāt wa muddah ai-sharaikah. Periods of life (firdaria) controlied by the planetsas chronoorators, FIRDIRTA AND THETR (sevenths of the afioas) of the ither ASSOCIATION MMRS planets with the general chronocrators,306 Chronoorators
In diurnel In nocturnal


Times of association

1. last six sevenths
$\qquad$
1 The orb of a planet is the distanoe within which its influence (amr) oan effect another when applying to conjunction or espect. The tigures are as in Porphyrius p. 204,but vary in modern books.
Cr. 394 and 5z2. The great years are the sums or the Egytion ptolemalc tesms of each planet 453; the lesst or h 4 and $b$ have been reiated to their periods of revolution, of 0 to the Metonio cycie, of $f$ to its orb, while those or $\delta$ and $\$$ and the greatest jeara remain unexolained. in the case of $Q$ and the mean is $\frac{1 e a s t+\frac{1}{2} \text { great }}{2^{2}}$ but ci. Vat.Val. p. 157 and B.L. 410
Fhere () and $D$ treated like other planets
3 Vettius Valens p. 164 hes another explanation for the greqt years ( $\tau$ éAeia ér $\overline{\text { I }}$ ) of the planets:-
$\eta \frac{1}{4}$ of $\odot$ great years $+\frac{1}{4}$ great $\rangle=57$ (note 372)

 $4{ }^{2}$ span of 75 years is thus provided for.

2. ME buyüt al-kawakib. We now proceed to discuss the relation of the planets to the signs.

The zodiac belt is divided into two DOAICILES OF halves, the first extending from the THE PLANETS halves, the first extending from the corn, and this half is given to the sun whose domicile is the first sign, viz. Leo. The other half $1 s$ given to the moon; it extends from the beginning of Aquarius to the end of Cancer in which sign its domicile is. As the other planets have two methods of movement retrograde and direct, so also they have each two domiciles one on the sun side and one on the moon side, at equal distances from the interval between Leo and Cancer. Beginning with Mercury the nearest planet, Virgo on the sun side and Gemini on the moon side' are assigned to it as domiciles, then Libra and Taurus to Venus, Scorpius and Aries to Mars

Sagittarius

$A B C$ - The Sun half. ADC - The Moon half.









441. Fahal yastawI häl al-kawkab. One of these domiciles is always more congenial to the planets and it is said that there they are more joyful DOMICILES on account of temperament, formation, and PREFERRED sex. The sun and moon, however, as they are not confined to one domicile find conditions in all. But of those which have two, Mercury presfirs Virgo to Gemini, Venus Taurus, ligers Aries, Jupiter Sagittarius, Saturn Aquarius.

The opinion of the Hindus agrees in sore respects and differs in others; they say that lars finds Aries more congenial, the moon Taurus, the sun Leo, Mercury Dirgo, Venus Libra, Jupiter Sagittarius, and Saturn Aquarius. They call such situations'mulatrikuna: j and assert that a planet occupying one of these has more influence than in its own domicile.
442. $\because \overline{\mathrm{a}} \mathrm{a}$ al-wabēl. The signs opposite to the domicines of the planets are said to be their detriments or DETRINENTS debilities (Arabic, iabāl,Persian,bityarah).

The Hindus

while recognizing the domiciles do not know this expression. The detriments are shown in the accompanying figure.

[^84]人



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443. Ma ashréa al-Ǩawakib wa hubüthä. There are certain signs which are described as places of exalts-
tron (sharif) of the planets, like FALL OF PLANETS positions. In such signs the exaltalion is regarded as specially related to a certain degree, but there are many differences of opinion in this matter, some saying that it extends to some degrees in front of or behind the degree in question, while others hold that it extends from the first point of the sign to that degree, and again others that it is present in the whole sign without any special degree. Below are the signs and degrees according to the Persians and Greeks.


The opposite signs and degrees are regarded as places of dejection for the planets, when in them, they are said to be in their "tali: (hubli), and are therein confined and their condition deteriorated.
444. Hal fir al-ashrat Khilat. There is no differonce of opinion as to the signs of exaltation, but the

Hindus differ as to the degrees in
'HINDUS DIFFER AS TO DEGREES certain cases. they are agreed th the exaltation of the sun lies in $10^{\circ}$ of Aries, of Jupiter in $5^{\circ}$ of Cancer, of Saturn $20^{\circ}$ of Libra, the others as above, except

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with regard to the Dragon＇s Head and Tail which are not mentioned by them in this connection as is quite proper．

445．Arbāb al－muthallathat ma hiya．Each triplic－ its，379，has a lord by day and another by night，also a third which shares this responsibil－
LORDS OF HIS qty both by day and night．Thus the TAIPLICITIES fiery triplicity has as lord the sun by day，and Jupiter by night，while Saturn is a partner both by day and night．The earthly triplicity has Venus by day，the moon by night，jars being in this case the partner．The airy triplicity has Saturn by day，Mercury by night and Jupiter as partner，while the watery triplicity has venus by day， Mars by night and the moon as partner．

Their Lords


However Hashwiyitel astrologers associate all three planets at the same time with each triplicity， and merely make the following distinction between day and night，egg．the lords of the fiery triplicity are the Sun，Jupiter and Saturn by day，and Jupiter，the Sun and Saturn by night and the rest on this analogy．${ }^{2}$ They do not desert their position（l．yarrūna）on con－ sideration，but have filled their books with decrees based thereon，and propositions deduced from these （1．tafrir）

446．Mun而zarah al－kawākib fī al－burüj kaif hiya． Whenever two planets are in signs which are in aspect to

1 Al－BIrini had a poor opinion of the Hashwiyites－$\nabla$ ． Chron．p．90，and 527 and 529．As to their doctrine，a creed of the common people as compared with the more as－ istocratic and intellectual lrutazilites，and the origin of the name $\mathrm{V}_{\mathrm{i}}$ Van Wooten－Hashwiya et Nabita．Inter． M ． Congr． 1897 and Goldziher－Livre de Ibm Toumert．p． 65. Alger 1903．Dict．sci．terms p． 396. 2 The first page of $\dot{H}$ has a table showing this arrange－ cent．
$\longrightarrow$ ．

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 6


## 446-447

ASPECTS OF PLANETS
IN SIGNS
each other 373, they also are said to be in aspect; if they are in the same sign they are describas conjunct mutamrin, while if they are at the same dearee the conjunction is said to be partile (muqtarin). If one of them is in a sign third from the other, they are in sextile aspect to the right or left, if in a fourth sign, to be in quartile, if in a fifth in trine, and if in the seventh, opposite. Should their degrees e equal they are styled muttasilin for then between these aspeots it is possible to construct either a regular hexagon, or a square or a triangle in the zadiac, or to divide it into two - 373.
447. Kaif gadägah al-kawäkib wa radāwathä. Friendship or enmity between the planets is, accoraing to us, based on what we have said as to their domiciles but astrologers have different theories on this matter. There are those who base ENMITY OF PLANETS them on the temperament and neture of the planets themselves, Saturn and Jupiter being regarded as inimical because the one is dark, maleficent and extremely distant, wille the other is shining, beneficent and only moderately distant. There are others who base them on their elementary qualities, those that are fiery being inimical to the watery, and the airy to the earthy, while there are still others who found them on the relative situations of their domiciles and exaltations,if the aspect of these is inimical then their lords are also inimical: further any planet whose domioile is twelfth from the house occupied by another planet is inimical to the letter. When the basis of enmity is arrived at In any of the ways we have enumerated, then that for eriendship and indifference becomes obvious.


The views of Abu il-Qesim, the philosopher, based on the foregoing considerations are shown in the colunins of the subjoined table.

| Planets | $\begin{aligned} & \frac{\text { mutually }}{\text { hurtful }} \\ & \text { with } \end{aligned}$ | $\begin{aligned} & \text { injur- } \\ & \text { ious to } \end{aligned}$ | $\frac{\frac{\text { offering }}{\text { fiendship }}}{\text { to }}$ | $\frac{\frac{\text { asking }}{} \frac{\text { rendship }}{\text { fromI }}}{\frac{1}{2}}$ |
| :---: | :---: | :---: | :---: | :---: |
| Satura | Sun and Moon | Jupiter | Mars | Venus |
| Jupiter | Mars Mercury | Mercury | Venus | foon |
| Mars | Jupiter Venus | moon | Sun | Seturn |
| Sun | Saturn | Venus | - | 1895s |
| Venus | Mars Mercury | - | Saturn | Jupiter |
| Mercury | Jupiter Venus | Vemus | neither offers |  |
|  |  |  | nor asks friend shıp |  |
| Moon | Satura | Mars | Jupiter | Venus |

The astrologers of our day however,lay little stress on the friendship or enmity of the planets in the matter of judicial astrology. The Hindus on the other hand regard them as equally important or more so than the domiciles and exaltations, we heve accordingly set down their opinions in the accompanying tabie.

| Planets | Friends | Enemies | Indifferent |
| :---: | :---: | :---: | :---: |
| 0 | $480$ | $h ?$ | 爻 |
| D | $\bigcirc$ | - none | h259 |
| $\hat{\phi}$ | 201 | ¢ | ho |
| ¢ | $\theta 9$ | D | $22 \pi$ |
| 4 | $\hat{\delta}$ | ¢ $¢$ | $h$ |
| $9$ | $2 ¢$ | $\bigcirc \mathrm{D}$ | $4 \hat{3}_{3}$ |
| h2 | ¢ 8 | ¢OD | 3 |

[^85]

As far as friendship or enmity is concerned，they are liable to change，be cause if a planet meets another In the lith，lith，lath，ind，Brad，or 4 th houses， 1 if friendly the friendship becomes complete，if indifferent becomes friendly，and if inimical indifferent．Also if it meets another in any of the other houses，the effects are precisely the reverse of these．

448．I自 al－nimbahr．We shall now seal of the different parts of the signs and the fate of the

> HALF-SIGN planets therein．

Half of a sign is called＇hour＇by the Hindus（niXon bohr in Persian）． 2 The first half of every male sign belongs to the sun and the second to the moon，and on the contrary，of every female sign the first half belongs to the moon and the second to the sun．Ry friends，in this matter contin－ we to obtain conclusions which differ from the above or are directly opposed thereto，and indeed the distinct－ ion between the two cannot be compared with that between light and darkness，as we have said and shall continue to say，but the people 如o have made use of this distinct－ ion are agreed upon its value，in spite of the opinions of others．

449．Ma al－wujūh．Each third of a sign－ten de－ grees－is called a face（wajh）and the lords of these races according to the agreement of the Per－ shans and Greeks are as follows：－the lord of the first face of Aries is Mars，of the second the sun，of the third Venus；of the first of Taurus， Mercury and so on in the order of the planets from above downwards till the last face of Pisces．

450．Ma al－ģumar．The so－called＇figures＇are in reality also the faces，but called so（suwar）because FIGURES ed with each face as it arose the figure of FIGURES ed with each face as it arose the figure of a personage human or divine， 3 and in the
l Cf．the statement India II 224，where a planet＇s nat－ use is said to undergo a change towards friendliness in the Eastern and towards enmity in the Western houses without reference to meeting another planet there． 2 Cf ．India I 843 where the centres of the signs；should be the＇half signs＇．
3 For a list of the Egyptian divinities according to Hermes，v．Ruelle，Rev．de Philol． 1908 p． 247.





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case of the Greens the faces were also associated wt th such of the other 48 constellations ascending at the same time. 1 But this duplication of constellations is mentioned in connection with affairs, designs and undertakings which are peculiar to the country in question, and is used to obtain decrees with regard to these. ire shall not undertake to give an account of it both to save space, and because it would be useless, as the astrological books we have are destitute of any instructions for using it.
451. Ne al-darijēn. By the Hindus these thirds of a sign are called darigān or Drikan (decenate), but their lords are different from those of DECANATES the feces, because the first decanate has as lord the lord of the whole sign, the second, the lord of the fifth sign from it, and the third, the lord of the ninth sign. 2 The lords of the faces and of the Hindu decanates are set down in the table.


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452. Hal istaramal Batlamīyūs athlāth al-burūj. Ptolemy has also made use of the thirds of the signs. He determined by experience and observe-

tion of the signs the changes in the at mosphere which are indicated by the signs as a whole, by the individual thirds in these in longitude and by their northern and southern parts in latitude. So whenever the action of the planets on the weather and of their situations at the planes on the and latitude when weather prognostics are sought it is and latitude when weather prognostics are sought it these influences, as well as of the association and sep aration of the planets and the fixed stars. The following table is taken from Ptolemy.

Indications of


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453. Ka al-hudūd. 1 These are unequal divisions of the signs known as terms, P.marz: with each one of them a planet is associated. people however differ TERMS in this matter, some holding to the Chaldean, 1.e. the ancient Babylonian method, others to that of Astaratūs, 3 wile others again adopt the scheme of the Hindus. None of these are employed by professional astrologers, who are unanimous in using the Egyptian terms, because they are more correct. Those who have expounded Ptolemy's works use the terms which he records having found in an old book, and which he has insorted in his Tetrabiblos. We have constructed a table showing both the Egyptian and the Ptolemaic terms: there is no use discussing any others.


1 The table from PL is substituted as an example of its calligraphy.
2 Vettius Valeas, p. 14 seq. for characteristics of each term. V . B.L.pp.206-210.
3 This form occurs in A and $P$ and in Aba Marshar's Madkhal,f. 190-3, also as Astartue in B.M.Add.23,399 of Abu'l-Hasan TAlI, and appears in the Latin translations of the "latter works as Aristotua (Albumasar, Introd.1489, V.8.) Attarathyh, (cf.Bouché-Leclercq,p. 215 n.) Asthoatol, (Bonatus, 1550 p.46) Professor Margoliouth suggested it Was probably the name of a Greek astrologer.
A variant in AB' $f 83 a^{\prime} 14$, Arastrātu points to (an) Erasistratos, who, Dr.Withington shows me, according to a list of books in a Greek translation of a work of Mashallah, (Cat.Cod.Astrol.Graec.Cod.Flor.P.81-2) was the author of several astrological books, among them one
 CV البالسط



454. Hudüd al-hindurān, The Hindus use only one series of ferias for all the male signs, and the same HINDU IERMS female signs. This is called their trioshänash, 1 or the divisions of the thirty ${ }^{2}$ degrees. The result of the arrangement is that the division of the sign is not the same in the two sets, and consequently when $1 t$ is desired to know which temp applies, it is necessary to reckon it out. The series is show in the annexed table as reported to us -

455. Al-nuhbahr, The Hindus regard the ninth part of a sign(nuhbahr)-3020. - which they all nuvanshaka, as very important. Then a planet is in its NINTHS OF OWn domicile and ninth, that ninth is called THE SIGNS "bargutam" or most important. The table shows the ninths of all the signs; the lords of the ninths are the lords of the signs concerned. The of the ninths are the lords of the signs concerned. The
first ninth of the tropical signs, the fifth of the fixed first ninth of the tropical signs, the fifth of the fixed
and the ninth of the bicorporal ones are called bargatam" (vargottama). 3 This is on entirely Hindu method on Which all are agreed. hiv friends have altered the order
$\pi \varepsilon \rho i$ qaprapiwv (cf. 395 n.$)$ In a similar list by Abd
 There is no hint in Hellman's article(Pauly, RealEncyk) of any astrological leanings on the part of the real Erasistratus, who flourished in the century after Ptolemy and Valens.

The terms of 'Astaretus' are distributed between the seven planets (Madkhal,f.193). The first term of each sign is devoted to the planet whose domicile it is $(f 1 g .447)$ and the following ones to the other $s 1 x$ in descending order: $\theta$.g.
© and occur only once in the first term, the other planets twice. There are slight mistakes in the terms Of $\because$ II 元 $\Omega \neq$
1 India II. 213, trihśāmśaka.
2 AO thaläthin $A O 1 A B A B I$ thulthain PL has siyak bury with marginal correction siyak.
3 India II 223:in INS. barguaim.

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455-466
of the lords of the ninths and have arranged them in the order of the spheres, but it is better that we abstain from using it.

| lst $3^{0} 20$ | Aries Mars | Capricorn Saturn | Iibra <br> Venus | Cancer l.5on | $\begin{gathered} \text { Tropicel } \\ \text { signs } \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $6^{\circ} 40^{\prime}$ | Taurus | Aquarius | Scorpio | Leo | Fixed |
|  | Venus | Saturn | Lars | Sun |  |
| $10^{\circ}$ | Gemini | Pisces | Sagtitar | Virgo | Bicor- |
|  | Mercury | Jupiter | Jupiter | Mercury | poral |
| $13^{\circ} 20^{\prime}$ | Cancer | Aries | Capricorn | Libra | Tropical |
|  | Moon | Mars | Saturn | Venus |  |
| $5 \operatorname{th} 16^{\circ} 40^{\prime}$ | Leo | Taurus | Aquarius | Scorplo | Fixed |
|  | Sun | Venus | Saturn | Mars |  |
| $20^{\circ}$ | Virgo | Gemini | Pisces | Sagttar. | Bicor- |
|  | Mercury | Mercury | Jupiter | Jupiter | poral |
| $23^{\circ} 20$ | Libra | Cancer | Aries | Capricarn | Tropical |
|  | Venus | Moon | Mars | Saturn |  |
| $26^{\circ} 40^{\prime}$ | Scorpio | Leo | Taurus | Aquarius | Fixed |
|  | Mars | Sun | Venus | Satura |  |
| $9 \operatorname{th} 30^{\circ}$ | Sagittar | Virgo | Cemini | Pisces | Bicor- |
|  | Jupiter | Mercury | Mercury | Jupiter | poral |

The lst 5 th and 9 th of these columns form respectively the fiery, earthy, airy and watery triplicities, 379.
456. Máalithná ashriyat. A sien may also be divided into twelfths (ithna rashriyaty 2ths of $2030^{\circ}$, each of which has a Lord, the first twelfth
THELFTHS OF having as lord the iord of the whole THE SIGNS sign, 440 the second, the lord of the the end of the series. As multiplication is easier than division, and it is difficult for any one to subtract by $21 / 2$ degrees, people simplify the calculation by multiplying the number of aegrees and minutes of the particular twelfth, the lord of which one wishes to know,

by twelve, and then for every $30^{\circ}$ counting one sign in the direction of succession from that in which the twelfth is; the last complete 300 indicates the sign whose lord is the lord of the twelfth in question. The lords of the various twelfths of the signs are shown in the table.

This is the division as to which the Greeks and the Hindus are in agreement, but I have always been surprised that my friends have not altered it according to the succession of the signs or some other scheme. For if you proceed according to such a method you do not commit other absurdities to mention which this is not the place.

| the 1/12 | 8 |  |  | Twe | ths | of |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Mars | $\underset{\mathrm{rst}}{\mathrm{r}}$ | ${ }_{12 t h}^{8}$ | IIth | $\begin{aligned} & 00 \\ & 10 \mathrm{th} \end{aligned}$ | $8 \mathrm{th}$ | $\begin{aligned} & 78 \\ & 8 t h \end{aligned}$ | $\stackrel{\approx}{7 \mathrm{th}}$ | $\begin{aligned} & \mathrm{m} \\ & 6 \mathrm{th} \end{aligned}$ | $\underset{5 \operatorname{th}}{\neq}$ | $\begin{gathered} \mathrm{t}_{\mathrm{t}} \\ 4 \mathrm{th} \end{gathered}$ | $3 \mathrm{rd}$ | $\begin{gathered} x \\ \text { 2nd } \end{gathered}$ |
| Venus | 2nd | lst | 12th | 11th | 10th | 9th | 8th | 7 th | 6th | 5th | 4th | 3rd |
| Mercury | 3rd | 2nd | lst | 12th | 11th | 10th | 9th | 8th | 7th | 6th | 5 th | 4th |
| Moon | 4th | 3 ra | 2nd | Ist | 12 th | 11th | 10th | 9th | 8th | 7 th | 6th | 5th |
| Sun | 5th | 4th | 3 ra | 2nd | 1st | 22th | 11th | 10th | 9th | 8 th | 7 th | 6th |
| Memrary | 6th | 5 th | 4th | 3rd | 2nd | lst | 12th | 11th | 10th | 9 th | 8th | 7 th |
| Venus | 7 th | 6 th | 5 th | 4 th | 3 rd | 2nd | 14t | 12 th | 11th | 20th | 9th | 8th |
| Mars | 8 th | 7th | 6 th | 5th | 4th | 3rd | 2nd | lat | 12 th | 11th | 10th | 9 th |
| Juptter | 9th | 8th | 7th | 6 th | 5 th | 4 th | 3 ra | and | 1st | 12th | 11th | 10th |
| Saturn 1 | 10th | 9th | 8 th | 7th | 6 th | 5 th | $4 . t h$ | 3rd | 2nd | lst | 12 th | 11 th |
| Saturn | 11 th | 10th | 9th | 8th | 7th | 6th | 5 th | 4.th | 3rd | 2nd | 1st | 12th |
| Juptter 1 | 12th | 11th | 10th | 9 th | 8th | 7 th | 6 th | 5 th | 4th | 3rd | 2nd | $18 t$ |



457．Max al－darajāt al－mudhakkarah wa＇l－mu＇annathah． lan controversies exist as to the sex of the various

MATE AND degrees of the signs，and these diff FKMALE DEGAEES Per very much as to their basis． Whatever decrees you elicit from a method founded neither on proof nor analogy nor on the order which the intelligence demands remain obscure until we cease to follow a path which leads nowhere．There is no sense in people who proceed on such lines，but，nevertheless，they accept indican－ trons from the sex of the signs in the same way as from the signs themselves．

Those people，however，who use a method based on order，whatever it may be，do not accept the indica－ tions from the sex of signs as a whole，but regard the first degree of a male sign as male，the second as female，the third as male and so on by odd and even， and similarly the first degree of a female sign as fe－ male the second as male，etc．as in the case of the male sign．Again there are others who proceed by

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etc., while some of our predecessors considered the first twelve and a half degrees of a male sign to be male, and the second, female, the next two and a half, male and the remaining two and a half, female; proceeding in the inverse manner with the female signs.

W1th regard to schemes not based on order, a table like that which we append, must be consulted (in which the female degrees are marked with an w).
458. Mä al-darafät al-mudiyah wa'l-muzlimah. The distinction drawn between luminous and dark degrees is like the last not founded on any system ARK DEGREFS to the subjoined tecour

Astrologers, however, use it for making decisions as to coloura, good and evil, strength and weakness, joy and sorrow, difficulty and ease. But no two books are to be found bhich agree on this matter, nor are they likely th be round.

The table shows several degrees of light and darkness, brilliant (b) naivix, luminous (L) mudi, dusky (d) gutmah, dark or shadowed (s) muzlim, while some degrees are empty or void (v) khāli.

| Aries | d3 | 85 | 88 | b4 | s4 | b5 | sl |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Taumus | d3 | 27 | d2 | b8 | V5 | b3 | b2 |
| Gemini | v5 | b2 | d3 | b5 | V2 | b6 | 17 |
| Cancer | d7 | b5 | d2 | I4 | s2 | b8 | s2 |
| Leo | b7 | 03 | 96 | v5 | b9 |  |  |
| Virgo | A5 | L4 | V2 | b6 | v4 | 87 | V2 |
| Libra | b5 | d5 | b8 | d3 | b7 | L2 |  |
| Scorpio | d3 | 15 | v6 | 16 | 82 | 15 | d3 |
| Sagittarius | b9 | d3 | b7 | 84 | d.7 |  |  |
| Capricormus | d7 | b3 | -5 | b4 | d2 | 1.4 | b5 |
| Aquarius | s4 | b5 | d5 | b8 | 73 | 15 |  |
| Pisces | d7 | b4 | V6 | 13 | 810 |  |  |

459. Nर̄ al-darajāt al-zäidah fin al-sa'ādah wa mes al-gbEr. There are also degrees which increase and diminish fortune. The former
DEGRESS IIFCREASING OR are those in winch if the lord DIUINISHING FORIUNE of the period whether sun or moon, or the degrees of the ascendant or the part of fortune is situated, the good luck and power of each is doubled. The latter are like pits, adar, in winch the planets are enfeebled in their action, being neither able to effect good if lucky nor evil if unlucky - the tendency is therefore towards peace. Both are show in the following table.

Degrees increasing fortune in the upper row, (pits abar, A chāhha P) in the lower.


The $\%$ indicates mistakes in MS: brackets omission.

1 lord of the ascendant $A B^{1}$.

 نزيكاتشبن: الغاس ولُسَلِ

460. Ma al-mawādir al-dāllah ralá al-afat fīalrain. There are certain situations which are said to be injurious to the eyes. These PLACES INJURIOUS have nothing to do with the signs, TO THE ETES although some people say that there is a hint of this action in Libra and Scorpius, but they are places which contain certain nebulous stars, or certain animal figures from other constellations which are able. to cause this injury. The really nebulous stars are four in number, one in the left hand of Perseus, and this one does not count because its latitude is high, and it is far from the course of the planets; a second, behind the aselli on the surface of Cancer, this has to be reckoned with; a third is behind the 19 th mansion of the moon, which is described in books dealing with the heliacal rising of the stars (Kutub al-anwar 166) as the venom (human) of the Scorpion, and this is of the number, a fourth, as is the tip of the arrow of Sagittarius; again small stars in a group have a cloudy effect such as Haqrah the 5 th mansion of the moon which is composed of three stars in the head of Orion. Ptolemy regarded them as cloudy, but they need not be included on account of their high latitude. The Pleiades also resemble Haqrah and belong to this series since their latitude is low, the moon passes by them and the sun also comes near them. Now those two luminaries represent the two eyes and their action vision.

The dangerous places in the animal signs are those like the sting of Scorpius, ishtar P, the (point of the P) arrow, nushàba of Sagittarius, and the shaukah sharp tail of Capricorn, because its hinder end is fish-like. The hinder end of Leo is also included, as is the star between the ayes of Scorpius and the water below Aquarius mas abb al-má. Tie know of no nebulous star towards the hinder end of Leo except the tuft between his tail and the Great Bear known as dafirah, which is composed of small stars non-luminous, looking like a cloud shaped like an ivy-leat; the hulbah of the Arabs, or

[^87]



 24: W號 e) وaxejillis. "



tuft of the lion's tail. Its northern latitude is twice as great as the south latitude of Haq'ah, and therefore we think that it cannot be reckoned in this series, besides the dangerous weapons of the lion are his teeth and claws, not his tail. The stars between the eyes of scorpius extend from the diadem to the heart, and are scattered luminous stars. The water under Aquaarius is composed of four small stars near each other situated below the point where the beginning oi the flow of water is pictured. Some people call this place the urn of Aquarius, but there are no stars there, and so an urn is assumed in the hand of the man from which the water flows, just as a sword is assumed in the right hand of Perseus.

Our foregoes settled the position of these stars in their time, since which 600 years have elapsed; we however show them in their present position ( 1340 of the era of Alexander) but it must be remembered that their position increases by a degree every 66 years, 1 ie. approximately a minute a year.

This is the table, and God is all-knowing.

1 About 72 - The addition of 12030 to the above figure gives approximately the present longitude of these stars.
, $12^{\circ} d \operatorname{cid} \|_{0}^{2}$



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460
Stars from certain signs which harm the eyes


We now proceed to consider the conditions in the signs from their relation to the horizon, which we have already referred to as the 'houses' and their adjustment 341 , and we adopt the same order as that used in discussing the indications of the signs and the planets, to facilitate the recognition and comprehension of the data ascertained.

## Inshallah ta' ale

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## 461

461. DE1E1Et allati takhus Su 11'1-mawElid

SPECIAL INDICATIONS OF THE HOUSES PECULIAR TO NATIVITIES

II

Soul, life, length of life, education, native land. Sucking, nutriment, disaster to eyes if overtaken by 111-luck, I1velihood, household requisites, essistants profession of children.

Brothers, sisters, relations, relations in-law, jewels, friends,migration, short journeys, intelligence, knowledge, expertnees in religious law.
parents, grandparents, descendents, real estate,
fields, houses, wa ter-supply, knowledge of
genealogy, what succeeds death and what happens to the dead.

Children, friends, clothes, pleasure, joy,little acquisition of property, accumulated wealth of father, what was said of him at his burialservice.

Sickness, defeots of body, overwork, if unfortunate accident to legs,loss of property, disease of internal organs, slaves, maids, cattle.

Women, concubines, giving in marriage,marriagefeasts, contentions, pertnership, losses, lawsuits

Death and its causes,murder, poisoning, evil effects of drugs on body, inheri tance, wife's property, expenditure, poverty, extreme indigence, reigning death.

Travel, rellgion, piety, fate, seriousness, attalnment of knowledge from the stars and divination, philosophy, surveying, sharp disoernment, trustmorthiness, interpretation of $\nabla 1$ sions and areams.

Rule of Sultan, government with counoil of nobles, absolute authority, success in business, commerce, professions, well-behaved children, liberall ty.

Happinesa, friends, enemies, concern for next world, prayer and praise, friendsh1p of women, love, dress, perfume, ornaments, commerce, longevity.

Enemies, misery, anxieties, prison, debt,fines, bail, fear, adversity, disease, prenatal fancies of mother, oattle, harbours, slaves, servants, armies, exile, tumults.

462. Dalālath̄̄ allati yataraüi ila'l-masāil.

## INDICATIONS REIATING TO HORARY QUESTIONS

Asking horary questions,important publio matters, nobility, advanoement in rank, witcheraft and speils.

Examining the querent,lending and borrowing, counting friends, arrival of stranger, enemies or friends, mandate of amir, winds when they blow.

Seorets and news and commentaries,well-born ladies, journeys by water.
old and hidden things, treasures, thieres ${ }^{\text {t }}$ hiding-places, schools, fortresses, fetters, [dismissal from office], opening abscesses,lancing and cautery, stepfather, prison.

Mossencers,right guidance, bribery, rectitude, distant places, poor harvests, securing the weal th of the ancients, feasts, food and drink.

Lost and escaped, some lost trifle which does not turn up,affairs of women and eunuchs, suspicion, hatred, oalumy, violence, dissipation, deceit, terrors, prison, enemy, poverty, moving from place to place.

The absent, thief,places where travellers assemble, treasure, death of contemporaries, forelgn travel, sudden murder [for a trifle], denial, obstinacy, claiming a right, oheapness and dearness.

Buried and hidden treasure, things ruined or lost or old, middens and rubbiah-heaps, siokness of friends, lawsuits without a oase, folly, contention, pride, dullness of the market,leisure.

Failure, abandoned business, books, information, ambessadors, miracles, roads, bro thers-in-law.

Kings, notables, judges, the celebrated in all olasses, amir and his conduct in office, things newly legitimized, wine, step-mother.

The treasury of the sultan,its officials, trouble in the office, foreigner's child, servants ohild, (read tabd) things whioh are sound, beautiful, advantageous, the beginnings of affairs, friendship of the great, bribery, food.

Fugitives, writers, those who negleat devotion, a precious gem, prisoners, the matter which preceded the question, oroperty of oppressors, thieves, lost property,scorn, envy and fraud.



473. Ahwäl ukhar mutaralliqah rala「-1-buyüt. CHARACTERISTICS OF THE HOUSES IN GROUPS OF THREE \& SIX

|  | I II III | IV V VI | VII VIII IX | X XI XII |
| :---: | :---: | :---: | :---: | :---: |
| Body and Soul | Body \& Soul: some say body Fithout soul because it is at a dark place until it emerges into light | Body without Soul: <br> some say body with Soul, because it is situated between light and darkness | Neither body nor Soul: because it contains the houses of death and travel | Soul <br> without body: <br> on account of rap1d ascension |
| Rlght or jert | 1ert | right | left | right |
| Colour | red | blagk | green | white |
| $\begin{aligned} & \text { W. } 2 \mathrm{st} \\ & \text { cr slow } \end{aligned}$ | moderate | 810\% | moderate | s10w |
| $\begin{aligned} & \text { good } \\ & \text { or bed } \\ & \text { luak } \end{aligned}$ | dericient | good | defiolent |  |
| $\begin{aligned} & \text { Direc- } \\ & \text { tion } \end{aligned}$ | N | 7 | S | E |
| Sex | Female | male | Pemale | male |
| $\begin{aligned} & \text { Temp- } \\ & \text { errament } \end{aligned}$ | $\begin{aligned} & \text { cold and } \\ & \text { dry } \end{aligned}$ | $\begin{aligned} & \text { cold and } \\ & \text { met } \end{aligned}$ | hot and *et | $\begin{aligned} & \text { hot and } \\ & \text { dry } \end{aligned}$ |
| Hindu 1deas as to halves divided by line MC to IMC | from III-I Ascending bow rising, for tunate. | from IX-IV <br> Descending bow falling, unfortunate. |  | from X-XII <br> Ascending bow <br> rising, <br> fortunate |
| Halves divided by line from Hor to oc. | nawa - ship underground night of planet allied to rightness and shortness. |  | ohatra = parabol above ground day of planet allied to leftness and length. |  |

1 India II 221.


474．Kaif hā al－bait idha ishtaraka fihi burjān． Then a house is formed of two signs，if these are about equally represented，the lords of WHEN HOUSE FORMED OF TWO SIGNS the signs are also the lords of the house，if both are in aspect if only one is in aspect it becomes the more important，while if both are inconjunct，that is superior which has the greater number of dignities． The victory must always be given to that one which has the highest number of degrees in the house．

475．造 sam al－saradah．The Part of Fortune 2 is a point of the zodiac，the distance of which from the degree of the ascendant in the PART OF FORTUNE direction of the succession of signs is equal to the distance of the moon from the sun in the opposite direction． 3 The method of determining this is to find the place of the sun（Place 1），then that of the moon（Place 2）；the ascendant is Place 3．Then subtract Place 1 from Place 2 beginning with the signs．If in place 1 this is a higher number add 12 signs to Place 2 and subtract．Next turn to the degrees and subtract as before，if impossible，deduct one sign from Place 2 and add $30^{\circ}$ and then subtract． When finished with the degrees，proceed with the minutes the result is the distance of the moon from the sun．Then add Place 3 by signs，degrees and minutes， and look at the result；if the minutes are more then 59 carry a degree to the degrees，if they are more than 29

1 According to modern astrologists to that sign which contains the cusp of the house．
2 Cf ．Bouché－Leolercq p． 299 seq．
3 Or the distance of the sun from the ascendant is equal to the distance of the moon from the part of fortune in the same direction．Fig． 341


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carry one to the signs, and if the signs are more than 11 , deduct li, the result is the Part of Fortune.

 the succession of the signs measured from the ascendant in the same direction,
 measured from the ascendant in the same direction. The Part of Daemon $Q$ (diurnal) f1g. 21 s the distanoe of From Dacoording to suocession and measured from the ascendant in the opposite direction; (noctumal) fig. i is the distance of $D$ from $\odot$ acoording to sucoession, and measured from the ascendant in the opposite direotion. The two inner innes refer to the part of Fortune; the two outer to the part of Daemon - modified from BL. fig. 35.


Take the following as an example. The ascendant is $8^{\circ} 20^{\prime}$ of Virgo, the sun is in $27^{\circ} 4^{\circ}$ of cancer, and the moon in 15025: of Taurus. These are placed in three rows as above described.

|  | Sun | Moon | Ascendant (1) |
| :--- | :---: | :---: | :---: |
|  | place | place | Place 3 |
| Signs | $0 \beta$ | 01 | 05 |
| Degrees | 27 | 15 | 08 |
| Minutes | 44 | 25 | 20 |

The number of the signs of the sun being higher than that of the moon, 12 must be added, making in, from which the 3 of tine sun must be deducted, leaving 10. The degrees of the sun are also higher than those of the moon, therefore 1 must be deducted from the signs, leaving ' 9 , and 30 added to the degrees, making 45 , from which 27 falls to be subtracted, leaving le. Similarly with the minutes 1 degree must be carried to them, leaving 17 and 60 added making 85 from which 44 subtracted leaves 41. The result of the subtraction of the sun's place from the moon's is therefore $9 \mathrm{~s} 17^{\circ} 41^{\prime}$, to Which the plage of the ascendant being added gives $14825^{\circ} 61^{\prime}$. From the last 14 gre 60 must be deducted and carried as 1 degree to the degrees, and from the first 12 must be deducted leaving 2 , so that the result, the Path of Fortune, is 2526001. viz. $266^{\circ} 01.01$ Gemini.

This is the method of calculation adopted by Ptolemy for the part of fortune which he never altered, but others proceed in this way for diurnal nativities while for nocturnal ones they put the moon ${ }^{2}$ in the first place, the sun in the second, and the ascendant in the third, whence necessarily many disputes.


2 In which case the $\theta$ would be in $M, 20^{\circ} 39$ at the same distance from the ascendant in the direction of succession - and in Fig. 341 in f $13^{\circ} 50^{\circ}$.





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476. Fa hal ghayr sahm al-saredah sahm akhir. Ptolemy reoognized only one part of Portune, but others have introduced an exoessive number

## OTHEF LOTS THAN

 PART OF PORTUNE of methods of casting lots at nativities. We reproduce in tables those wh10h Abu Marghar has mentioned. 1In each oase there are three things to be attended to, place $1 /$ the beginning, "mubde', place $2 /$ the end 'muntaha', and Place $3 /$ the casting-off point, 'malqá which are treated as in the preceding paragraph, the position in a flgure of the heavens of the fortune or lot in question being thereby determined. These three points are oalled respeotively, 'manqud' 'manqud minhu' and 'muzad ralaihi'. Sometimes the same arrangement is used for both diurnal and nooturnel nativities, but frequently points 1 and 2 are interohanged for nocturnal ones.

It is impossible to enumerate the lots whioh have been invented for the solution of horary questions, and for answering enquiries as to prosperous outcome or auspioious time for action; they inorease in number every day, but the following 97 different lots, 7 of which belong to the planets, 80 to the houses and 10 to neither are those most commonly in use.

[^89]

| Numbers | Names of the Fortunes | Dista tween $1 \& P$ | nce be－ Place ace 2 | $\left.\begin{aligned} & \text { Cast } \\ & \text { from } \\ & \text { Place 3 } \end{aligned} \right\rvert\,$ | Diumal or Noc－ turnal |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Fortunes of the Seven Planetsl |  |  |  |  |
| 1. | Part of Fortune or Lunar horoscope | $\bigcirc$ | ） | $\left.\begin{array}{\|l\|} \hline \text { Ascen- } \\ \text { dant } \end{array} \right\rvert\,$ | chance |
| 2. | Part of Daemon ${ }^{2}$ and religion | D | $\bigcirc$ | ＂ | ＂ |
| 3. | of friendship and love | $\oplus$ | $Q$ | $"$ | ＂ |
| 4. | Of äespair \＆penury <br> \＆fraud | $Q$ | （ ${ }^{\text {d }}$ | ＂ | $"$ |
| 5. | Of captivity，pris－ ons and escape therefrom | h | $\oplus$ | ＂ | ＂ |
| 7. | Of Victory，triumph and ald of valour \＆bravery | $Q$ | $\stackrel{4}{4}$ | ＂ | ＂ |
|  | Fortunes of the Twelve Houses |  |  |  |  |
| 8. | Of Life First House－ | Three | Fortun | ${ }^{\text {es }}$ | ＂ |
| 8. | Pillar of horoscope |  |  |  |  |
| 10. | Nativities，Perman－ ence Constancy | $\oplus$ | $Q$ | ＂ | ＂ |
|  | $\frac{\text { Reasoning \＆eloquence }}{\text { Second House }}$ | ¢ | 6 | ＂ | ＂ |
|  |  | Three | Fortunes |  | ＂ |
| 11. | Property | Lord of II | cusp of II | ＂ |  |
| 12. | Debt ${ }^{\text {Dreasure trove }}$ | $h_{\text {¢ }}$ |  | ＂ | same |
| 13. |  |  |  |  |  |
| 14. | Brothers Third House－ | $\begin{gathered} \text { Three } \\ h \end{gathered}$ | $\left.\right\|_{4} \text { Fortunes }_{4}$ |  | ， |


|  |  |  |  |
| :---: | :---: | :---: | :---: |
| 1. | ．Túxy | 2. | $\Delta \alpha i p u v$ |
| 3. | －Epos | 4. | －Aváy $\quad$ ¢ |
| 5. | ．Népeots | 6. | Nixy |
| 7. | ．Tó入j曰a |  |  |

of Trismegistos．B．L．p． 307.
2 The lot of the sun，which is the lot of the unseen and religion（sahm al－ghaib wall－dIn）и入ग̃pos $\Delta \operatorname{aif}_{\text {ifovos }}$ B．L．p． 295.
Al－BIrunI said that an illiterate soothsayer＇s
accurate prophecy was due to the coincidence of his $Q$ with his Asc．Chahar Maqala p．67．V．also p． 63.

| L＇y | （1） | ！ | － | xavily ${ }^{2}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
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| $2^{\text {lbll }}$ | － | － | المّ | － | $\rightarrow$ |
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| 21615 | －لk | Sin | － | － | 9 |
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| elblil | － |  |  |  |  |
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| ，${ }^{\text {blu }}$ | $\bigcirc$ | 号 | S＇011 | － 1 lob | 2 |
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| 2lbl | ｜ | ，＂，${ }^{\prime \prime}$ | Jo； | سهرالمصر | $\square$ |
| $2^{\prime 61 / 1}$ | － 6 | ersm | 20 | سم｜اللمّكر | $\pm$ |
|  |  |  |  |  |  |
|  |  |  |  | O\％x ${ }^{\circ}$ |  |
| clbill | \％ | Stin | \％ | سُهال｜ | 1 |

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| 15. <br> 16. | Number of brothers Death of brothers a slaters | $\bigcirc$ | $\begin{gathered} h \\ 10^{\circ} \\ \text { of } \mathrm{III} \end{gathered}$ | Ascendant | same change |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Fourth House | - Eigh | Fortur | es |  |
| 17. | Parents | - ( 4 ) | h | * | * |
| 18. | Death of Parents | $h$ | 4 | " | * |
| 19. | Grand parents | II | h | $\stackrel{ }{*}$ | " |
| 20. | ancestors \& relations | h | 6 | * | + |
| 21. | Real estate a/c Hermes | $\gamma$ | 2 | * | " |
| 22. | Real estate a/c some Persians | h |  | " | " |
| 23. | $\begin{gathered} \text { Agriculture, } \\ \text { tillage } \end{gathered}$ | 9 |  | " | same |
| 24. | Issue of affairs | h | Lord of or 8 | " | + |
|  | Fifth House | Five | Fortunes |  |  |
| 25. | Children | 2 (\%) | h | " | obange |
| 26. | Time and no. of sexes |  | 4 | " | same |
| 27. | Condition of males | " | " | " | " |
| 28. | Condition of females | D | 9 | " | " |
| 29. | As to whether expected birth male or female | D | Lord of house of $D$ | " | change |



| 30. | Sixth House <br> Disease, defecta, time of onset of them a/o Hermes | Four $\hbar$ | Fortune $\delta$ | $\begin{aligned} & \text { Ascen- } \\ & \text { dant } \end{aligned}$ | change |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 31. | Disease $a / 0$ to some of the ancients | $\%$ | $\uparrow$ | * | same |
| 32. | Captivity | Lord Of time | Lord of house of Lord of time of $10^{1}$ Lord |  |  |
| 33. | Slaves | ¢ | $\text { of } \overline{D I}$ | " | same |
|  | Seventh House | Sixte | $n$ Fort |  |  |
| 34. | Marriage of men (Hermes) | h | $\%$ | n | " |
| 35. | $\begin{aligned} & \text { Marrlage } a / 0 \\ & \text { walisi } \end{aligned}$ | $\bigcirc$ | 9 | " | * |
| 36. | Triokery and deoeption of men and women | " | " | n | n |
| 37. | Intercourse | $\downarrow$ | " | " | * |
| 38. | $\begin{aligned} & \text { Marriage of } \\ & \text { women (Hermes) } \end{aligned}$ | $9$ | $\hbar$ | * | * |
| 38. | Marriage of women (Valens) | D | $\xi$ | " | n |
| 40. | Misconduot by women | * | " | " | $\cdots$ |
| 41. | Trickery \& deceit or men by women | 7 | $n$ | " | " |
| 42. | Intercourse | 1 | " | " | " |
| 43. | Unchastity of women | " | " | " | " |
| 44. | Chastity of women | " | 9 | \# | " |
| 45. | Marriage of men \& women (Hermes) | \% | Cusp <br> VII | " | \# |
| 46. | Time of marriage (Hermes) | $\bigcirc$ | D | " | * |
| 47. | Fraudulent marriage \& facilitating it | h | $\bigcirc$ | " | " |



1 OUd̉ns. Vettius Valens.



## 476

65. 

Sultans victory
66．of conquest
of those who rise in station
67．Celebrated persons of rank
Armies and
police

10 Sultan．Those concerned in nativities archants and their work buying and selling Operations and orders in medical treatment
73.

74
75．F＇riendsh1p and enmity
known by men and revered， constant in affairs

## Success

Success
Forldiness

## Hope

Friends
Violence
Abundance in house


| C先 | 5 | Coi | 8 | T－ | d |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 2（b） | C／4 | 伿 | － | \％${ }^{5}$ | g |
| （\％）$/ 1$ | \％ | 山 | \％ | － |  |
| 为 | Li | 安 | $\stackrel{\square}{4}$ | beb ${ }^{5}$ | E |
| C／3／3 | \％ | －\％ | $)^{\prime}$ |  |  |
| － $46{ }^{2}$ | －$/ 4$ | －${ }^{\text {¢ }}$ | ${ }^{3} / 8$ | － |  |
| （1／3） | j6 |  | 5 | －سما | $\underline{L}$ |
| $20^{\prime \prime}$ | － | Si | － |  |  |
| C1／4， | －16 | － | ej | 5888\％ | $f$ |
|  |  |  |  | heicjeldrioscoll |  |
| $\sim$ |  | ह\％ | ${ }^{6}$ | － | 18 |
| C／b， | 26 |  | $\bigcirc$ | － | dc |
| （160） | 宊 | 8 | ${ }^{1} \mathrm{C}^{3}$ |  | ع |
| （ $7 / 8$, | 36 | a， |  | E1， | 厚 |
| （6） | \％is | $\dot{j}^{\circ}$ | ${ }^{0}{ }^{0}$ | عكّ | E |
| C／4／3） | $3{ }^{16}$ | ${ }^{3} 8$ | $y^{\prime}$ | \％ | $b$ |
| \ $(\vec{\prime}$ | －0＇2 | ，$\downarrow$ | 40 | （\％） | － |
| C／bs） | \％${ }^{6}$ | ${ }^{5} \mathrm{C}$ | （s） | Sthiorm | 6 |
| $\cos ^{6 \prime \prime}$ | \％ | 503 | C－\％ |  | － |



| ${ }^{*}$ | ilias | 2 |
| :---: | :---: | :---: |
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|  | dxame |  |
|  | Luabir |  |
| - $\square^{3}$ | ack |  |
|  |  |  |
| 445 |  |  |
|  | 4, |  |

 hal yataraga ithnin minna. There are people mho adopt some circumstances; e.g. with regard the lot of parents when Saturn is under the rays of the sun, they take from Jupiter to the sun by night or vice versa by day, and cast from the ascendant. Again in the ass of the lot cor grandparents, if the sun is in Leo, they take from the beginning of Leo to Saturn by day, and by night in the opposite direction: and if it is in the domicile of Saturn then from the Sun to saturn by day, and vice versa by night, in both cases cast from the ascendant even if saturn is under the rays or otherwise afflioted. 1 Should two lots indicate the same point, it is regarded as very fortunate. In some of these

1.6. BL. 305 n. 3.
cases the instructions for day and night are the same, in others different as may be seen from the table, in the former event there is no advantage to be derived from a separate calculation.
478. Fahal ghayx hadhini min siham. This matter of casting lots is a very long one, so that one might
think there is no end to it. For instance
there are those which are cast at the OTHER LOTS there are those which are cast at the
turn of the year (the entry of the sun into Aries) on worldly matters and affairs of empire, and those which are cast at conjunctions and oppositions of the moon to elicit prognostics as to weather, as to success of ventures, and other horary questions. We append in tables the opinions of others on these matters which we have derived from books on the subject.
479. Fahadhiht sihām ta sta rama if tahēril sin a1-rälam warl-qiranat.

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In is. Pal cultivation.


I PL' has gap here to 489.

Lots as to prognostios regarding crops \&c.

1. Wheat
2. Barley,
meat
3. Rice, millet (P. gāwars)
4. Maize
5. Pulse
6. Lentils and iron
7. Beans,
onions
8. Chick-peas
9. Sesame,
grapes
10. Sugar
nostios regaraing crops \&c.
0
$\eta$



| $3^{6}$ | 为 | 5 | Me， | س | U |
| :---: | :---: | :---: | :---: | :---: | :---: |
| C | 50 | 40\％， | ${ }^{\text {匂 }}$ | سّهمرالمُهنـ، |  |
| ） | 涴 | ＂＇$\dagger$ S | ＋ | س | 1 |
| C／8） | －${ }^{6}$ | Yë， | ，济 | سهالزبٌون | $\lrcorner$ |
| $\sqrt{2}$ | － | 污 | 合 | سهرلفتمْ | d |
| \％／8） | $2^{3}$ | ＂ | cis |  | لو |
| $5^{5}$ | e／es | 站 | ¢ぐ， | س | － |
| C／e | $2^{6}$ | cé | $\xi^{\prime}$ | mivers | 2 |
| $e^{b}$ |  | $\ddot{\varphi}_{2}^{\prime}$ | $Y_{1}$ |  | 2 |
| C／E， | $216$ | － | 2t | سم | $\leq$ |
| 泡 | ¢ | $\text { e } e^{2 j\rangle}$ | ${ }^{3}{ }^{-1}$ | سهم | $\omega$ |
| （\％／3， | $26$ | く | $)^{+6}$ | A | $\leq$ |
| －6＂ | と边 | そ¢ | 人3 |  | 5 |
| $4 r_{8}^{2}$ | $=\rho^{\sqrt{6}}$ | $\because i$ | $y^{\prime}$ |  | 5 |

Lots cast in conneotion with horary questions

| 1. | Secrets | Lord o Asc. | Cusp X | Ascen. | same |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 2. | Urgent wish | Lord hour | $\begin{aligned} & \text { Lord } \\ & \text { aso. } \end{aligned}$ | $\cdots$ | change |
| 3. | Time of attainment | Lord hour | Lord $\mathbf{x}$ | " | " |
| 4. | Information true or not | $\Varangle$ | $D$ | * | \# |
| 6. | Injury to business | Lord asc. | * | $\cdots$ | same |
| 6. | Freedmen and servants | $4$ | $\pi$ | ' | \% |
| 7. | Lords and masters | 4 | " | D | \% |
| 8. | Marriage | 9 | Cusp VII | Ascen. | " |
| 9. | Time for action (WalIs) | $\bigcirc$ | 4 | $\cdots$ | " |
| 10. | Time ocoupied therein | 1 | 7 | $\cdots$ | \% |
| 11. | Dismissal or resignation | 4 | 4 | 2 | * |
| 12. | Time thereor (walls) | Lord of the affair | $\oplus$ | $\begin{aligned} & \text { Cusp } \\ & \mathbf{X} \end{aligned}$ | * |



480. Famā al-sahmän wa'l-bahimatān. On the practice of sortilege by two arrows and the interARROWS AND ANIMaLS

The book of Hermes known as the 85 Chapters discusses the indications derived from both. As to omens from two animals, Mesheillah mentions that a black animal should be interpreted as Saturn and a yellow one as the Sun. As to sortilege by two arrows none of the interpreters has been helpful in furnishing an explantation with regard to them except Mishallah whose examples are founded on the lives of kings. Other members of the profession are inclined to adopt long calculations by many and devious methods neither restricted nor free from error. Some of them at the entrance of the Sun into aries in discussing the permanence of empire and the probability of rebellion take the first arrow as equivalent to the distance of the sun from the middle of Leo, and the second to that from the moon to the middle of cancer, both cast from the ascendant, and the same for day and night, while others who have studied the subject most earnestly assert that the first arrow represents Saturn himself and the second Jupiter. What has been written on this subject alone would make two large books.


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481. Famä el-tasmim wail tashriq wail taghrib. We now proceed to deal with the various positions of CAZIMI the planets in relation to the sum,

ORIENTALITY
OCCIDENTALITY why ch are responsible for the most conditions. 152

If a planet should be within less than 16, of conjunction with the sun or have passed it by less than the same amount, it is designated as 'samim', The superior planets, however, are only in such a position in the middle of their direct course, while the inferfor planets are in it in the middle of their direct and retrograde courses. In regard to 'tashriq' orientality, the inferior planets in the middle of their retrograde course resemble the superior in the middle of their direct course. If the superior planets and the inferior ones in the middle of the retrograde course exceed the minutes of tasmim all ${ }^{2}$ are said to be 'muhtariq', combust, until their distance from the sun is $60^{\circ}$; thereafter they are no longer so styled but are said to be under the rays. In this condition they remain like prisoners in confinement until the distance of Venus and Mercury from the sun amounts to $12^{\circ}$, of Saturn and Jupiter to $15^{\circ}$ and of Mars to $18^{\circ}$. This point is described as the beginning of 'tashriq' orientality, ${ }^{3}$ but they are not necessarily visible at this period, for the time of visibility varies with each country and climate. But the term tashriq is properly limited (to the heliacal rising) and after this they are designated 'musharriq', which the Persians call 'kanar-i rūzI' Thereafter the higher planets differ from the lower, for the former continue tending eastward till they are $30^{\circ}$

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from the sun, and after which they are said to be weakly oriental till a distance of $90^{\circ}$ is attained, and the name tashriq does not cease to be applied for at sunrise they are in the eastern quarter, while whenever the $90^{\circ}$ is exceeded the ter orientality ceases to be applicable. Thereafter the first stationary point is reached, after which the retrograde movement sets in; when this is concluded there is again a stationary point before the direct course is entered. Arrival at opposition to the sun occurs in the middle of the retrograde path, which is thus divided into two sections, list and and.

The higher planets after their station until they are distant $90^{\circ}$ from the sun are in the east at sunset, but when less than $90^{\circ}$ incline to the west, and when the distance is $30^{\circ}$ this situation is called the beginning of occidentality (taghrib), till Mars is $18^{\circ}$, Saturn and Jupiter $15^{\circ}$, and thereafter they are under the rays, until only $6^{\circ}$ separate them, when they are combust, until only 16 remain when they are again in tasmim.

In the Almagest the opposition of the higher planets to the sun 13 called the beginning of the
 it is a situation which is peculiar to the higher planets, for under it they rise at sunset. The Persians however, are in the habit of using the expression Kanara shat for both higher and Lower planets, but that condition which they call the beginning of the night is really oocidentality, therefore they add west, so as to distinguish between the two.

[^91] visible at night and visible in the morning.
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## 482-483

482. Hal-1 sufliEn az pas tashriq. We said the the orientality of Venus and Meroury occurs on the retrograde path and is not completed till a distance of $30^{\circ}$ from the sun in both cases. Thereafter they are stationary and then comes the direct course to their greatest (wester) elongation, after which they again begin to approach the sun. All of these situations are called oriental, until $12^{\circ}$ separate them from the sun, the beginning of their matutine occultation in the east. They are under the rays until 70 from the sun and are then combust till they reach the limit of samim and conjoin with the sun in the middle of their direct course. 2 Thereafter they pass out from samJm, when their situation in the west resembles that of the higher planets in the east to the extent which has been noted of them in regard to combustion and being under the rays and visibility at evening twilight. Then they gain their greatest eastern elongation and stop before they again retrograde, passing through all the stages the distances of which we have noticed till they return to tasmim on the retrograde course.
483. Bahai yanfall al-zulirah II dhalika ran rutarid. It is necessary to distinguish be tween Venus and Mercury as regards

## HOT VENUS DIFFERS

 orientality and ocoidentalityFROM MERCURY HERE as has been done between Mars on the one hand and Saturn and Jupiter on the other, (astronomers are agreed that no such distinction is necessary between these two planets) for Venus has a very high latitude, and sometimes conjunction occurs when it has attained its highest north latitude, ${ }^{3}$ it then remains visible, so that the expressions combust and under the rays cease to be applicable, although the planet is in those positions; similarly at tasman when the north

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Latitude exceeds $7^{\circ}$, it must not be described as samimah nor muhtariqah but simply as accompanying the sun, muqErinah.
484. Fame hal al-gemar min al-shams. The position of the moon with regard to the sun 98 to tasmim and combustion is similar to that of RELATIVE POSITION the other planets, as long as the SUN AND MOON distance is less than 7 east or west of the sun; beyond that it is under the rays till the distance increases up to 12 which is approximately new moon; thereafter the variours distances described as phases (254) which produce the quarter, half, three quarters and complete illumination succeed, and are followed at the same distances on the other side of opposition by similar figures.
485. Fame al-tayämūn ran al-shams wall-tayäsur. Astronomers agree that all three higher planets from the time of conjunction to POSITION RIGET opposition, and both lower planets AND LBPT OF SUN from conjunction on the retrograde to that on the direot course, and the moon from opposition to conjunction are to the right (west) of the sun, while the higher planets from opposition to conjunction, and the lower from conjunction on the direct to that on the retrograde course, and the moon from conjunction to opposition are on the left (east) of the sun.
486. Hal tataghayyar taithirat al-kawEkib bitaghagur ahwalha. It may be asked whether with the changes in situation of the planets described, their action also changes. If their action did not change, there would be no advantage in paying attention to these situations. Astrologers are hoverer agreed that the maximum influence of the planets is at tasmim, and during this the indications are of
happiness and good news; they are also agreed that such influence is at its minimum in combustion, until it arrives at a point where unluckiness changes to ruination. However, distinctions are made in accordance with the concord and discord of the nature of the
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planets, as e.g. heat may become increased and moisture diminished, consequentiy the injurious Influence of oombustion is less with some planets and greater with others. After oonjunction, the planet, when under the rays, is like a sick person advancing to convalescence, and when oriental attains full strength and is in a position to beston all its benefits. The Peraians call this its vazirate, (and any one who wishes to do a good act, does it at this time.) ' They extend this name to the whole of the position right of the sun, until at a distance of $30^{\circ}$ from the sun the benefioial action begins to stop, and the indioations of happiness to beoome moderate, till at $60^{\circ}$ the action changes, this point is called the minor unluoky point, $75^{\circ}$ the middle unluoky point, and combustion (on the retrograde)P the major unlucky point. The planet at the first resting place appears strangled, hopeless, in the first seotion of the retrograde course sluggish and depressed, while in the seoond section hope of suoooux is given, which is confirmed in the second station, delivery being near at hand, while the direot course indicates, as its name suggests, prosperity and power. Similarly the neture of the planets alters from their rising to their setting in the excentric orbit, being dry during the former and moist in the latter, without however the nature of their aotion belng affected. Also from rising to setting in the orbit of the epicycle, for from the oriental phase to the first stop they are moist, then to the middle of the retrograde course warm, then to the second stop, dry, and back to orientailty cola. The reason of the ohange in the orbit of the epioyole is that the action of the latter is bound up with the sun, and it is said that nearness to the sun means dryness and distance moisture. Combustion also changes the nature and other conditions like rising and setting which bring about

[^93]action in the epicycle different from that in the exoentric orbit. The circumstance that the planet is posited in moist places of the signs or terms gives friendliness; again, in the matter of maleness and femaleness they change, becoming male when oriental and female when occidental.

Again among the signs the planets also are affected by the indications of the whole sign, just as the soul depends on the condition of the body, and so a male planet becomes effeminate when in a female sign, and $1 s$ even affected by the male and female degrees of a sign, so that there are mixed indications of eunuohism and hermaphroditism, effeminate men and masculine women.

So also in quadrants of the sphere in relation to the horizon the planets may change in the matter of sex, and also at the cardines. The effect of situation at the cardines however is simply to increase the influence of the planet, so that good fortune at a cardinal point is increased, especially if the sign be a fixed one. Calamity and adversity are also intensified in a fixed sign especially if cadent to the sardines, while they are weakened in a tropical sign especially if not ardent.

Some people assert that the west is favourable to the lower planets, and the east to the higher, but you must understand that this is derived only from the analogy of maleness and femaleness, the east being male and the west female, while the oriterion of the difference between them is distance from the sun.

It has been shown that the orientality of the superior planets occurs on the direct course after combustion, on this account they are then more powerful because as it were, they are escaping from distress and calamity; comparable to this 18 the vespertine visibility of the inferior planets, which also occurs after combustion on the direct course.
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The oocidentality of the superior planets occurs likewise on their direct course as they proceed to combustion, so to this is comparable the matutine occultation of the inferior planets also on their direct course. The orientelity of the inferior planets resembles that of the superior ones in as much as in both cases it takes place after combustion: $1 f$ the inferior planets were at that time direct there would be entire agreement of all in the matter of orientality. But the occidentality of the inferior planets, when their movement becomes slow, is a much more injurious and weakening influence than the ocoidentality of the superior ones because the former have now turned their faces both towards the retrograde course and combustion; so the superior planets in their ocoidentel phase are safer than the inferior, because it is only succeeded by their occultation.

We have extracted from Ya rqüb $b$. Ishāq al-Kinail 211 that a beginner requires to know with regard to the different indications of the planets as to their powerful influence in orientality and their weakness in oocidentality, although these differences do not amount to being exact opposites.
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[^94]487. DalălathE wa hyya musharrigah.
INDICATIONS WHILIX ORIENTAL
488. Dalälathā wa h1才a mugharribah.
INDICATIONS WHILI OCCIDENTLL

| $h$ | Beginning of old age, happy in rarming and art of irrigation, profound and orfeotive <br> judgment, sharp and authoritetive dispatoh of all business matters. | Advanoed old age, misorable standard of Ilving, bu:iness mean and amall in extent, work in connection with irrigation and wells, poor food, fraud. |
| :---: | :---: | :---: |
| 4 | Beginning of manhood and meturity, good conduot, beauty, elegance, desirous of offios as vizir or qual so as to insure justice,many possessions good reputation, joy in ohildren. | Advanced middle age, oocupations of moderate 1.mportanoe, position as prefeot or law-agent, and all things conneoted with religion such as oopying books of traditions; immoral aots, pilgrimage, sufficient wealth. |
| $\uparrow$ | Leading in battle, commanding armies, reputation for oourage eagerness for conquest; quickness in business; success in mining. | Mean positions in the army such as butoher, 000 k , amith, farrier, surgeon; theft; wark to do with fire and 1 roa. |
| $\bigcirc$ | Tashriq and taghrib indicating position relative to sun are inapplicable to the sun itself. |  |
| \% | Aotions when oriental are hess effeotive than when ocoidental. | Beauty, hatred, lova, joy, gladness, pleasure, marriage, gifts; as to orafts,forbidden pleasures, work with oolours, piotures, brooades, embroidery. |
| $\underline{\square}$ | Intelligence, reasoning power long consideration, fise decisions, poetry, eloquence, olerk of taxes, surveyor, orderliness, affability, predicine, astrology. | Same as under tashriq but less efficient; oocidentality ocoasions little harm to 1t and to Venus. |
| D | From middle of month to 22nd denotes mature manhood, thereafter to conjunction, pld age. | From oonjunction to 7 th day, ohildhood, from there to opposition, youth; when the moon is under the rays it points to things seoret and conoesled, and espeolally it points to the 111 oondition of creatures resembling the light at that atage. |


489. Ma al-ittisal wal-insirat. The terms application and separation (ittisal and insiraf) refer to the formation of aspects between
APPLICATION the planets and withdrawal from such AND SEPARMTION positions. These are dependent on the signs, and the same names are employed which we have already explained in regard to the aspects of the signs, 37.3 viz . conjunction, two sextile, two square, two trine and opposition. When tron constellations are in aspect, planets within them are also in aspect, when the former are not in aspect, the planets in them are inconjunct and concealed from each other. When two planets are in the same sign or in two signs in aspect to each other and at the same degree, they are said to be conjoint in reality, and the one whose orbit is lower is said to apply itself (ittasala) to that whose orbit is higher, because the lower one is swifter and constantly overtakes the slower one. Consequently the moon applies itself to all the planets and is applied to by none; Meroury applies itself to all except the moon, Venus to all except the moon and Mercury, the sun Mars and Jupiter to those above them, Saturn alone applies itself to no planet because all are below it. When of two planets in aspect, the degrees of the inferior one are less than those of the superior planet, the inferior one is said to be proceeding to conjunction and when greater to be separating from the superior. At the time of conjunction the lower planet is said to be conferring counsel (dafir tadbir) on the higher and the latter receiving counsel from it (madfūrilaihi). This is conjunction in longitude.
490. Pahal limabā̈' al-1tt1sāl hade. As application is like meeting, and separation like parting, so an inferior planet when it enters a sign BEGINNING OF where it comes into aspect with a APPLICATION superior one, begins to show its movement towards conjunction, which
Increases till conjunction is completed, unless
something else intervenes such as 1 ts being outstripped by another planet, or deserted by the superior planet

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leaving the sign in which it was before completion，or by itself becoming retrograde and thus frustrating completion．But there is much difference of opinion as to the amount and limits of completion．Some people say that it begins at 5 degrees and continues till the degrees are equal，the 5 dead＇degrees， 491 ，being made the basis of this interpretation．Others say 6 degrees， because it is the fifth of a $s 1 \mathrm{gn}$ ，and the average of the planets＇terme，455．Others again say 12 degrees， the distance at which the light of the moon is obsoured by the sun，and still others， 15 degrees，the orb of the sun，while others say the average of the respective orbs of the planets in question（436）．Again many assert that only complete conjunction need be attended to．

Separation begins when the degree of the inferior becomes even a minute higher than that of the superior but，on account of the trace of influence which remains， the completion of separation should be determined by the amount assigned to the beginning of application．

491．Fame ni－darajāt al－maypitah．The＇dead＇ degrees referred to are rive degrees beyond the ascendant in the direction opposite to the succession of the signs．Ptolemy does not reckon THE＇DEAD＇DEGREES the ne as belonging to the twelve houses，and does not regard them in them he associates it with the ascendant．

492．Fahal 1111ttis到 naut ${ }^{+}$gneyr al－tūII．There are two other kinds of oonjunotion besides that in longitude，viz．in latitude and in

CONJUNCTION ONLY IN LONGITUDE？ nature The former ocours when the latitude of two planets is the same either north or south，and the
degrees of latitude are equal．Then they are said to be conjoint by latitude．If the degrees are not equal one must look whether that of lower latitude is rising in the quarter in question，and whether that of higher latitude is setting in the same quarter，if so，they are said to be moving towards conjunction．If the
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latitude of the setting planet is lower than that of the rising one, they are separating. If both are rising one must see whether the extreme latitude of the lower is not less than that of the higher one, if so, they are moving towards conjunction; if less, that cannot occur. If both are setting, and that which has the higher latitude is quicker in setting, they are said to be proceeding to conjunction, whether that is completed or not, because that of lower latitude may move to the other side (or the other may overtake it)?.

The superiority of conjunction by latitude to that by longitude is due to the fact that it does not occur except when the planets are in aspect.

There is another advantage $\nabla 1 z$. that suppose an inferior planet applies itself to a superior in longitude and then to a third in latitude which is inconjunct to the superior one, then the latter does not continue in conjunction by longitude at the same time.

Conjunction by nature occurs when two planets are in equipollent $s 1 g n s, 377$, and takes place when they arrive at corresponding degrees in these. Jupiter is in $20^{\circ}$ of aries and the moon in $5^{\circ{ }^{\circ}}$ of Pisces, when the latter has attained to $10^{\circ}$ of pisces, which is the corresponding degree to $20^{\circ}$ of Aries, the conjunction by nature is completed. The condition becomes fortified if the planets are in aspect during this conjunction in nature. Similarly if two planets are in corresponding degrees in signs correspondent by direction, the conjunction is complete; egg. Jupiter is at $20^{\circ}$ of Aries and the moon at $5^{\circ}$ of Virgo, then complete conjunction Will occur at $10^{\circ}$ of Virgo. Aspect here also improves the condition.







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493. M $\vec{a}$ al-mushāhadah wa'l-muz $\bar{a}$ rama. The expressions testimony and dignity (shahädah va muzāramah) 1 are synonymous terms and are applicable to a

TESTIMONY
planet in two different ways. One concorns the fortunate position which it may occupy, nasib, haze: (bahrap) if es. it should be lord of the house, 440, in which it is situated, or be in its exaltation, 443, or in any other position congenial to $1 t$, it may have one or more of these dignities. If however it is not in a favourable situation it is said to be peregrine (gharib), while if either in 1 ts detriment, 442 , or its fall, 443 , calamity is added to the alien situation.

The other kind results from something outside the situation of the planet, and is of three varieties. last, when it is in a situation favourable to another planet and on this account has the advantages of that other attribute to it, whether that be lordship of a house or exaltation; 2nd, depending on the disposition or essential nature of the planet, as e.g. the testimony of Mars is conneoted with war and lawsuits, of Jupiter with riches and estates, of Venus with amusement and marriage; Ord, dependent on time, such as day for the sun and night for the moon, or the lordship of the day or hour or the ilk.
494. Hal lilshahadat tartib. The dignities have a certain order of precedence, Most important is the
lordship of the house, next,
ORDER OF PRECEDENCE
OF DIGNITIES
exaltation, then, term, then triplicity, lastly, face; and so, a certain scale of numbers 1 Verbal noun of zafama III to become chief apo Jane $=$ muzāhamah the $\mathcal{E}$ replacing the $Z$ (as in 502 AB .) but Muzaram a dignified planet and muzaramiyyan dignity in the abstract also occur. D.S.T. p. 618 muzeramah is the claim of a planet for dominion (zaramah) in a sign in which it has a fortunate position (Khat for pare) and such a planet is called the muzaram of that sign or shāh1d, witness. Mill p. 229 nruzaramah 1.e. gaz such as lordship of house, exaltation or the liken. Dozy I 593 gives a faulty definition of muzram with a partial quocation from Sane Proc. II 219 n .1 as a promittor (which need not be a dignified planet or a planet at all) and as occupying the second place in the zodiac in the direction of the Succession of Signs - a definition of promittor, in connection with the operation of direction V. 521. $A O^{1}$ and $A B^{1}$ have muraghame (alienated) by mistake.



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has been assigned to them, Viz . 5 to the house, ${ }^{1} 4$ to exaltation, 3 to term, 2 to triplicity and lo face. The dignities of the various planets may therefore be added up and compared with each other, so as to see which is preeminent. It is related that an authority on this subject assigns 30 to the lordship of the asoendant, 20 to exaltation, 10 to lordship of face, 5 to that of term, $31 / 2$ to that of triplicity, $41 / 2$ to that of the hour, and finally to the ain or moon, whichever is lord of time, as much as to the lordship of the ascendant. The figures are then added and compared. This is the practice of the Astrologers of Babylon and Persia, who regard the lordship of the face as very important. But among the Astrologers of the present day, the triplicity is regarded as having precedence over term and face, and indeed the latter is often considered of no account. Further in certain circumstances changes may take place in this order, egg. the lord of exaltation may take precedence over the lord of the house in matters of empire and government in high places. It is necessary to know that the se dignities are strengthened by aspect, or by other conditions which replace aspect, because if the numbers of two planets add up equal, one of which is in aspect end the other inconjunct, the former is preferred even if its favourable positions and testimonies amount to less than those of the latter.
495. Ma al-mubtazz. ${ }^{2}$ The word 'mubtazz' means a

IYyar al-bait, a standard allowance to the house. 2 One of the meanings of bazza is to gain the mastery, Lane. The derivatives in the Tarim are not recorded in the ordinary dictionaries, but the Mafietn al-rulum p. 229 has al-1btizaz, the possession by a planet of many digunities in a sign, the planet itself is called mubtazz ralaini. The Tarim has ibtizaziyyahralaini, thee mastery or a sign. The word has undergone a considerable change in the Medieval Astrologies. bu Narahar $A^{2}$ al-mubtez, Hall, 22 seq . al-mutez, Alcabitius $p$. 81. al-mutem. Junctinus I, 1307. Al-mutaz, id st planet quit habuerit digitate in ascendent gradus. 523.
id... 141. Al-muten, hoo est Vincens, havens plumes dignitates. Wilson, Almuten, The strongest planet in a figure in essential or accidental dignities. The change from $z$ to $m$ or $n$ is probably due to the oircumstance that isis frequently used as a contraction or substitute for $m$ and $n$. cent. Dict. and N.E.D. Almuten for O. Fr. al-mutaz = al-mu'taz as if from azza VIII - ingenious but not in accordance with the history of the word.
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498. Ma Paraph al-kawkab. The planets are said to be joyful, powerful, happy and in good spirits when they are in congenial sections of the signs 449-453, in their hal or hayylz; the quarters friendly to them N. S. E. or W. 389, and also when far from the sun those which were previously in distress, like the superior planets when oriental and the inferior when occidental in their direct course. They are also in their joys in those preferred houses which we discussed (469) - this $1 s$ the best known of all - and finally they are joyous in those quadrants depending on the horizon; the superior in the inoreasing quadrants the inferior in the decreasing ones (203).
499. MK al-igbal wail idbar. Prosperity (iqbal) is associated with the cardines,as these indicate a happy mean; adversity (idbar) ${ }^{\perp}$ with the

## PROSPERITY <br> AND ADVERSTFY

 cadent houses, which point to destruction and excess. Being in those houses which are suocedent to the angles 18 beyond the half-way line to prosperity, for they are the paths leading there from adversity. But this prosperity and adversity are not all alike, just as the ordines are not alike but are higher and lower in glory and dignity. And indeed the cadent houses are not alike in their destructive influences, because although the 3rd and 9 th houses are cadent, the 6 th and 12 th are not only ardent but are also inconjunct to the horoscope.500. Ma al-hisär. A planet is said to be besieged (hisār) when situated between two others, as egg. when a BRSIEGED planet in sign 1 is surrounded by others in
signs 2 and 12 . It also occurs when three
planets are in one sign, the middle one
Whose degree is less than the one and higher than the other is said to be corporally (bi'l-jirm) besieged. Again a planet $1 s$ described as besieged by the rays, when in front of $1 t$ is another in sextile or quartile and another behind it in like aspect. When besieged by two infortunes $382^{2}$ the influences are extremely bad, while if between two fortunes, they are extremely good. 1 Wiedemann IXIV, 208 has noted the astrological meaning of these words usually associated with the trepidation theory 196.
2 In the Mafatin al Minim isar is restricted to this condition. (K1 miyān Ishan dustist yt muzaram-i $\mathbb{Z}$ bashadimin muşdaçahau min muzahamah AB) part note 310.
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501. ME al-tuhmah. A planet on which a number of unfavourable conditions is heaped, and in evil case on account of being combust or retrograde, or
SUSPICION in its detriment or fall or in a cadent fortunes or house, or inconjunct,or antagonized by in suspect (muttahim) in 1 ts significance. (If it shows any promise, it is unable to carry it out. P)
502. M al-inram wall-mukarat. If a planet is in its fall or in a pit, 459,orina $\operatorname{sign}$ in which it has BENEPPACTION no proper section, it is as it were conAND REQUITAL one of the planets friend iv, 447 , to it or its sponsor applies itself to it, and gives a helping hand to deliver it from its calamitous situation, it is described as conferring a favour on $1 t$, and is called a benefactor (mu rim). Again if the benefactor arrives at a similar disadvantageous situation, and is applied to by the first planet, this is called requital (mukarät).
503. Ma ahull-yamInain wa dhull-yasarain. Then a planet is In the cardio of mid-heaven and its sextile and quartile rays fall together above TWO RIGHT AND earth,it is said to have two right TWO LEFT HANDS hands, if these fall below earth two left hands. The indications of the former are success and victory.
504. Ma kale al-sair. If while within a sign a planet does not enter into conjunction with another, although in aspect to other planets, VOID OF COURSE it is said to be void of course (khāif's-sait), and is regarded as having separated from conjunction whether in that sign or not. (This name is given to it because the field is empty and it moves without any companion. P)
505. Ma wahshi al-sair. Then a planet is in a sign and no other planet has been in aspect with it from the time of its entry to that of its exit 1 it is
FRRAL said to be feral in its course (wahsh1 is-sair) This is practically impossible with the superior planets and the sun, and can rarely occur, but with the moon it is necessarily the case and frequently occurs. If the moon with its rapid motion did not exist,

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this might very well happen to the inferior planets, one of them moving rapidly the other slowly. Some people say that en the moon is feral, this is a substitute for conjumotion with the planets in whose terms it happens to be within the sign, but this opinion is trivial (muhalhal) and quite unsupported.
506. Bimah dhā yatimm kan al-ittis̄̄̄l. That a - familiarity 1 or the various forms discussed should be completed between the inferior planet COMPLBTION OF conferring counsel (al-däfir) and the CONJONCTION superior receiving it (al-madrür illaihi) 489, there must neither be return (rad) nor evasion (Taut) nor intervention (1rtirad) nor refranation (intikāth) nor abscission or light (qatial-ntr) nor prevention (man). Each of these will be distinguished and interpreted.

1. Return. This happens to a superior planet when retrograde or under the rays, for from weakness it is unable to hold what is offered to it, therefore returns and does not accept it. If the situation is such that there is reception between them, or if the inferior planet is at an angle or both of them are at angles, or suocedint houses, the end of such return is satisfactory. If however the inferior planet is in the weak situation described, and the superior one at an angle or in a succedent house, the result is destructive even if at first hope was indicated. If both are in a weak situation from the beginning to the end there is nothing but destruction and ruin.
2. Evasion. This occurs when an inferior planet is about to conjoin with a superior one; before this takes place the latter moves out of the sign, and the inferior planet applies itself to another planet either in the same or another sign, the first aspect never having been completed.
3. Intervention. This occurs when an inferior planet tends to become conjunct with a superior one, in the latter part of whose sign there is posited a third planet lover than the superior and higher than the inferior planet. Before the inferior planet completes

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conjunction, the third intermediate planet retrogrades towards the superior planet and passes it by, till the inferior inevitably conjoins with it and not with the superior one.
4. Abscission of light. If it should happen that the intermediate planet is not in the same sign as the superior one, but in the next and retrogrades into it, this intervention is one of two methods of cutting off the light. The second method is when an inferior plariet tends to conjoin with a higher one and a third still higher is situated towards the latter part of the sign, then before the inferior planet can conjoin with the intermediate one, the latter moves to the higher one and passes or conjoins with it. The inferior planet does not conjoin with the intermediate one but with the superior later.
5. Refranation. If an inferior planet tends to conjunction with a superior one but before completion becomes retrograde the familiarity is said to be frustrated by refranation.
6. Prevention. When there is a third planet in a sign between the inferior and superior ones, it prevents the conjunction of the former with the latter until it itself has entered into conjunction. Then two planets tend to form a familiarity with a third at the same time, the one by means of corporal conjunction, the other by aspect, the former renders the latter vain if their degrees are equal; but when their degrees are different, and the one casting the aspect is nearer to completion than the one tending to conjunction, the former is preferred. (When however two planets apply themselves by aspect to a third at the same time, that is preferable, whose reception occurs first. ${ }^{\text {) }}$ ) Certain aspects must have an advantage over others, just as corporal conjunction has over aspect, so that the more powerful aspect should interfere with the weaker, but astrologers have not pronounced on this matter.
507. Max al-qabūl. Reception, then an inferior planet arrives in one of the dignities proper to a RGGEPTION relation thus established, there is an exchange of compliments such as your servant, or 'neighbour'. If further the superior planet happens to be in a situation proper to the inferior one, mutual reception takes place, and this is fortified, the richer the situation is in dignities,

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especially when the aspects indicate no enmity nor malevolence．When reception does not take place the result is negative．

508．Ma al－daf1＂．We have already stated 489－506 that al－defir 18 the application of one planet to another and is described as bill－ THE DONOR tadbir．The inferior planet making application is not specified as dafir unless it is in a dignified situation proper to it without regard to the situation of the superior，the madfurilaihi，this conjunction is called daft ai－ qüwwah，and if in one proper to the superior planet， daft al－tabiran，which is the same as qabal described above，or else the inferior planet is in a place proper to itself which also happens to be congenial to the superior planet；this is called daft＇al－tabiratain， because the natural properties of both are united．The same expression is used when one（an inferior P）planet in its hayyiz conjoins with another（a superior one ${ }^{P}$ ） in its payyiz，the planets being both either diurnal or nocturnal，for the hayyiz requires two conditions to render it complete，496

509．的 al－murgidafah．When a retrograde inferior planet follows and overtakes a retrograde superior one the situation is called＇muradarah＇．Here there is no return on account of the sims－ larity of their situations but 11 there is reception the indication is for the successful terming－ action of business which was threatened with ruin．How－ ever this conjunction，although there is no refusal，is not equal to one in the direct course but is far inferior in signifioanoe．

510．Hal yagūm maqäm al－ittisal wa＇l－nazar shat＇ There are other conditions which are efilcacious
besides aspect and conjunction．When
SUBSIITUTES FOR an inferior planet and an interned－ CONJONCTION AND late one both apply themselves to a ASPECT superior planet，the latter is celled superior planet，the latter is called the light of the others．If these are in aspect to each other，this is just as good as conjunction with the collector；if they are not in aspect，that collection
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of their light by another planet is effective in place of conjunction although they are inoonjunot.

If an inferior planet separates from an intermediate one which is inconjunct to a superior planet, and thereafter conjoins with the superior one the light of the intermediate planet is transferred to the latter. This is called 'iraqi' or translation and occurs between two planets which are (inconjunct or between two which are) in aspect but far from conjunction. This condition is effective in lieu of conjunction.

There is another form of translation, when the inferior planet conjoins with the intermediate one, and the latter has already been in conjunction with the superior planet; $1 t$ is just the same as if the inferior had applied itself to the superior. This occurs when the inferior planet is inconjunct to the superior one because, when in aspect, it is swift in arriving at the conjunction with the superior one

In the books, one always finds the naql of Mars by the sun to Saturn described as the greater nail and that of the moon by the sun to Saturn as the lesser naql. If two planets are inoonjunot to a third or to a certain place in the zodiac, and then both conjoin with one which is in aspect to both and also to that third or that place, the result is like mirrors refleoting from house to house. This has also been called rad but in view of what we have said before about rad, the use of that word is ambiguous. There is also another aspect of real translation which is not much enlarged upon, except in relation to separation; they say that when an inferior planet withdraws from conjunction with a superior one and conjoins with another then nail occurs, light being transferred from the one to the other and as this translation is an effective substitute for conjunction, it follows that it should not be void of the effect of separation. However some other word than 'red' should be used for this condition perheaps sari or araks (conversion or inversion) to remove the ambiguity.






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511. M fath al-bab. When two planets whose natures are opposed conjoin, this is called opening the doors. OPENING THE DOORS MOOn rain, Ane drizzle or snow-storms, that of venus and Mars torrential rain, hail, thunder and lightning, and that of Mercury and Jupiter the opening of the doors of the winds. 2
512. Kaif yakan quwwah al-kawahib wa du fie. In dealing previously with the relations of the planets to the sun, to each other, to their OF THE PLANETS own orbits, to the zodiac, and to the horizon, we have discussed as far as possible the good and evil effects of each, as well as the summed effects of more than one. Each planet has a most favourable situation, and when some advantage is lost, its power is diminished to a like extent. The converse is true with regard to unfavourable situations. A planet is at the height of its power when the following conditions are present. Motion direct, rapid and increasing, far from the sun's rays, oriental if superior, ocoldentol if inferior, in aspect to both sun and moon, and these in a fortunate state, besieged by fortunes or aspecting them, relieved of infortunes, associated with fixed stars of the same character, rising In its own orbit, passing above the infortunes ard below the fortunes, north latitude increasing, happening to be In domiciles of the fortunes, or their huzū or in a place resembling its own nature, or in houses most congenial to it, in its own hayyiz, at an angle or

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## 512-513

suocedent thereto, in a quadrant of the same nature, and increasing, elevated high above the malefics and conquering.

But when slow, [retrograde, under the rays,oocidentail if superior, and if inferior moving slowly] westward towards retrograde, inconjunct to sun and moon, or in an unfriendly aspect to them, wi thou reception, the infortunes in an inimical aspect, or besieged by them, associated with ilxed stars of a contrary nature, setting in own orbit, so that the malefics pass above and the benefios below, decreasing south latitude, in unlucky houses, in parts of signs foreign to them, in detriment or fall, in a contrary payyiz, distant from the angles or succedent houses, in a quadrant of different nature, at the nadir of their joys, and conquered by the malefics high above them; this is the acme of weakness. But in all conditions there is always an admixture of good and bad, often difficult to interpret, and requiring all the resources of the art as well as experience and industry.
513. Fahal tanfasil al-nayyiran fid dhalika raja al-kawabib. In regard to the foregoing there is on-
siderable difference be-

HOW SUN AND MOON
DIFFER FROM THE PLANETS
IN THIS REGARD
siderable difference be-
tween the sun and moon on
the one hand and the other planets on the other. When both of the luminaries are in aspect to each other, and to the benefice, and are in their own sections of the signs or those of the benefice, both of them are strong. But if they are in situations unsuitable to them, and the malefic, full of enmity are above them, and the benefice below, or are eclipsed, or near the dragon's head or tail. especially the latter by less than $12^{\circ}$, both of them are weak. The moon is especially so when near (muheq) or in conjunction, or on the wane, or under the

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earth, or in the combust way, 514, all of which increase its weakness.

Many people include among the inauspicious situations for the moon the being in the last part of a sign, and in tree laths of both malefics, setting in the south, and being in the ninth house from the ascendant, all of which are not exclusively applicable to the moon, especially the last part of the signs, where $9 l l$ the terms belong to the malefics, $45 \pi$, a situation bad for all the planets, as are the laths referred to. There is also to be considered the quarter of tie heaven, and the fact that the ninth house from the ascendant is the nadir of the joy of the moon, 469, and this is peculiar to it.
514. Ma al-tarigah al-muhtarigah. The combust way is the last part of Libra and the first of Scorpius. These two signs are not congenial to the sun and moon on account of the THE COMBUST WAY the sum and moon on account of the them, and because each of them is the fall of one of the luminaries,443. They also contain the two malefios, the one by exaltation (Libra, Saturn), the other by house (Scorpius, Mars). The peculiarity however which has given the name muhtariq is that the exaltation of Saturn is near, the fill of the sun being on the one hand and that of the moon on the other, while the adjacent parts of both signs are occupied by terms of Mars. 453.
515. Ila kan sinf tancasim ankem al-nujum. There are as many divisions of astrology as there are lemints in the universe. These may

DIVISIONS OF JUDICIAL ASTROLOGY te either simple or compound and on both the influence of the planets is active. The former on the whole do not submit to such influence, nor to any change, except where they come into contact with each other, when, because they are mutually opposed and violent, they are always in strife. Such admixture does take place on the surface of the earth, but is only completed by the heat of the sun's rays. So all four
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elements become united, and the surface is the place appointed for the action of the planets, which extends as far as the power of their rays penetrates by reason of the presence of interstices. Then these rays return by a contrary motion and carry with them the aqueous vapour which they have produced, and they rise from the earth until they reach a point where the power of such movement becomes weak. So this motion and agitation is the cause of all the vioissitudes and disasters of nature, the resultant phenomena being either permanent or temporary.

Anything therefore in the way of heat or cold or moderate temperature, of moisture or dryness owing to movements of the atmosphere, or of the various forms of moisture carried by the winds such as oloud, rain, snow; everything that is heard in the air such as sharp claps and rolls of thunder; everything that is seen such as lightning, thunderbolts, rainbows, halos, meteors, also shooting stars, comets and similar atmospheric phenomena; everything that occurs in the earth in the way of tremors, and subsidences, and in the water as tempests and floods, and the flux and reflux of the tides -all these form the subject matter of the first division of astrology. These phenomena are not permianent or rarely so; rain, snow, comets and earthquakes are those which have the longest duration; were they not sufficiently widespread their concentration in one spot would be disastrous.

A second division is that which is concerned With the mixed elements, such as occur in plants and animals, and is of two kinds, affecting the whole of a population or only a part thereof. Famine may be

taken as an example of the former, due to failure of crops or drought, and epidemios such as spread from country to country, like the plague and other pestilences which depopulate cities.

The latter variety is more localized and seattered in its appearances, it results from psychical phenomena, such as battles, struggle for power, change of dominion from one land to another, deposition of kings, revolutions, emergence of new religions and seats, so that this chapter is a long one and this variety the more important of the two.

The third division is specially concerned with the environment of the individual human or other, the events which affect him in the course of his lIfe, and the influences which remain behind him and in his progeny, while the fourth has to do with human activitlies and occupations. All of these are founded on beginnings or origins 'mabādi possibly trivial.

Beyond these there is a fifth division where such origins are entirely unknown. Here astrology reaches a point which threatens to transgress its proper limits, where problems are submitted which it is impossible to solve for the most part, and where the matter leaves the solid basis of universals for one of particulars. Then this boundary is passed, where the astrologer is on one side and the sorcerer on the other, you enter a field of omens and divinations which has nothing to do with astrology although the stars may be referred to in connection with them.
516. Fame al-mabādi' allati bona turraf durūb algism al-awwal. The fundamental principles which are

> PRINCIPLES BY WHICH
> INQUIRIES BELONGING
> TO THE FIRST DIVISION ARE KNOWN
applicable to enquiries in the first and second of these divisions of astrology are substantially the same. They are based on the greater, intermediate and lesser conjunctions, 1 the exact places at whit oh these occur and the ascendants at these times; further on the thousands known as hazärät, hundreds, tens and the firdaria. There I Al-kindi conceived that these played the same role for events in the macrocosm as does the horoscope for the life of the individual.
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are people who take from the conjunction and opposition of the moon which preceded the enquiry, and substitute this for the above, and there are others who depend on the nearest eolipses past or future, of which the most hurtful are those of the sun, especially if of considerable extent.
517. Ma tafsil dhallika wa tafsirhu. The degrees at which Saturn and Jupiter meet in conjunction, together with the ascendant of that time, and the ascendant of INTHERPRETATION OF THESE the year of the conjunction INTERPRETATION OF THBSE the year of the conjunction the succession of signs through a whole sign in a complete solar year. The point arrived at is called a terminus (intine:); moreover this terminus of each year is in the sign next after that in which it was the year before, and in the same degree thereof, egg. if the terminus of the first year was in $10^{\circ}$ of Cancer, that of next year would be in $10^{\circ}$ of Lea. The matter of the thousands and what follows them is in the like case, and there is no difference between them except in the different amount of time allotted to the degrees and signs. This is a usage of the Persians and became known to us through their language. 1

We have stated before that according to $A b \bar{u}$ Ma'shar the years of the universe are 360000,2 the deluge being in the middle of these. This statement occurs in his book called 'The Book of Thousands' Where the degrees of the zodiac are each made equal to a thousand years, so that the fraction belonging to a year is $33 / 5$ seconds. This is the great division; secondly, the signs are made equal to a thousand years each; this is the term of thousands. Thirdly the signs are made equal to single years, the terminus of years being thus produced as we said before. Fourthly the I According to Aba Marshar in his Kitab al-ular, when the heavens were first set in motion all the planets, the sun included, were in conjunction; when the same phenomenon again presents itself, which may not occur for millions of years, the world will enter on a new period. Reinaud, Abuil-rida, I. CXCI. The Book of the thousands on religious houses treats of birth, duration and and of the world, and fixes the times when great changes in empires and Religions will take place. d'Herbelot, IV. 695. 2204.
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degrees are made equal to single years, and this is the small division.

Between the units and thousands two other terms are introduced, one in which each sign equals a hundred years and another in which each is ten. Nothing is said with regard to the share of the degrees in the ouse of the tens and hundreds such as we have spoken of in the case of the thousands and units.

We have previously discussed the extent of the irderia, and placed in a table their order at nativties (438-9). But here the order changes and that of the signs which contain the exaltation of the planets is adopted (443); viz. list Aries which has the exaltation of the Sun; and Taurus of the Moon; 3rd Gemini of the Dragon's Head; 4 th Cancer, of Jupiter fth Virgo, of Mercury; fth Libra, of Saturn; fth Sagittarius, of the Dragon's Tail; Eth Capricorn, of Mars; th Pisces, of Venus 443. The order is therefore, Sun, Moon, Dragon's Head, Jupiter, Mercury, Saturn, Dragon's Tail, Mars, Venus, and then back to the Sun. The distribution of partnersinips is as before, but the lords of exaltation have precedence over the lords of the firdgria, which however preserve their own order and the partnership in their own sections, except in the case of the Dragon's Head and Tail, which do not enter into partnership and are therefore alone in their firdaria.

These are the principles which must be relied upon and used at every anniversary of the world-yearl and its quarters, also at every conjunction and opposition of the moon, especially those which occur immediately before the anniversary and the quarters.
518. Fam al-adwEr al-madhkurah ind al-qirgnat wa arbirha. The revolutions which are mentioned in con-

REVOLUTIONS REFERRED
TO AT CONJUNCTIONS AND THEIR QUARTERS neotion with conjunctions, 517 $n$. 2 , have a duration of 360 solar years. They are divided alferently into quarters, by some people equally into 90
The entrance of the sun into Aries. But in 1020 the Perigee must have been some $14^{\circ} \mathrm{E}$ of the winter solstice in which case the relative duration of the Seasons would be $592.8, \mathrm{Sp} .91 .4, \%$. 88.6 , Au. 88.12.
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years each as if quarters of the ecliptic, by others, substituting the relative duration of the seasons of the solar year into a first quarter of 80 years, a second of $851 / 4$, a third of 90 and a fourth of $943 / 4$.
519. Famā al-mabadI' allatti binE yakhtass al-qism al-thani wa yatamayyaz min al-awwal. In addition to the

PRINCIPLES SPECIAL TO THE principles laid down SECOND DIVISION AND DIFFERENT FROM THOSE OF THE FIRST
cor dealing with questions of the first order, the following are adopted for those of the second. The turn of the solar year and of its quarters, the conjunctions, oppositions, quarters and other phases of the moon, also the experiences of people in all places as to the rains (anwar, 166) on the days of the past year, further, the eclipses, combustion, oonjunotions, retrograde movements of the planets which have occurred in the year. There are astrologers who note the ascendant at the time of the entry of the sun and moon into the signs, and deal in the same manner with the live planets, but this is obviously going out of the way without advantage.
520. Fame al-sālkhudath. That planet is known as the Salkhude (Persian for) lord of the year which, at the anniversaries of the world-year (solar year), is at the ascendant or LORD OF THE YBAR (solar year), is at the ascendant or
one of the angles with dignities in its own degree, or if there is nothing there, that there also, then it is that planet which is not inconjunct with the ascendant or its lord. According to the Hindus it is that planet which is next in order of the lords of the days; to each planet a year being given. They make a great deal of this.
521. Famā al-mabaí' allati bins yatararraf alglam al-thalith. The principles adopted for questions of the third order are as follows: For every creature there is a time of its first appearance, and decrees are then sought from the ascendant
PRINCIPLES OF THE THIRD DIVISION and the figure of the heavens as to its condition. This section is exclusively devoted to man, and must not be Hall p. 255, VI. 3. alcalcadeny; cell id est annas et cadent id est dominus. A jot ry










employed for plants, crops or animals. 1 There are two initial pointa, sowing or conception, and time of appearance (wagt al-nujum) or birth. From the arrangement of the stars, the haylifit beoomes known, and the kadkhudng the ruling planets of the houses, (mubtazzat) 4 the gifts (allowanoes of length of lifeh ratayn, the additions, zivedat and deductions nuqsant therefrom, and the murderers (gawatir)5 whioh put an end to it.

At the anniversaries of the birth there beoome known the progressions (intina'at), the apheses (tasyirat), ${ }^{6}$ the lord of the revolutionary figure (sãhib al-dawr), the divisor or distributor of the for tunes of life (janbakhtar or al-qTaim) ${ }^{7}$ and the mudabbir 1 ts partner 8 in administretion, the lords of the weeks, and the firdaria.
These are included in the persian varsion.
2 Hyleg of the Latin and Finglish renderings, Greek aqétラ. Aocording to Vullers the derivation of haylaj is uncertain. It is equal to the Pers. Kadbanu (mistress of a fanily) interpreted by astrologers as signifying the body of the 'native' as opposed to Kadkhuda (master of a family) signifying the soul. Onder the root 'hly' Lane mentions the myrobalan frult (Pers. halila, arab. halilaj) whioh in the stomaoh is like a good housewife in the house. Bonatus p.677. Ylam v. note 495 MV. Both hayla a and Kadkhuds are significators and their marriage determnes the length of life but of. Nall. II 355. For an inoorreot definition of haylāt see Fagnan. Add. aux diotion Arabes. 3 Persian for head of a household (in Turkish pronounoed Kiaya, a stewarid) ; translation of oikodérótas ) Trs YEvEOENG), the alcoohoden (atelchodela, acolpodebia seo for other renderings see Abu Marshar E IIII) of the translations. 4 v. 495. 5 plural of qatir, translation of araipetar - 6 The aphetio theory rests essentially on the assimilation of the Zodiac to a roulette on which the life of the individual is projeoted with more or less force from a certain point of departure (an aphetio place) and is arrested by certain destruotive (anaeretio) places before having passed a quarter of the oirole. B iL. p.411. Tasyir $=$ difeois - direotio derined by Junotinus p. 379. v. 523. Athazir Haly p. 157 v. 254.

7 'quen Arabes vero Algebutar, Persae autem zamootar appellant' Junot.p.1068. Both (and numerous other veriants such as alieriustar Hely p.157, algerbutaria, Abu Maishar E IIII De mag. oonj. Ven. 1515) represent the persian
 Suter suggested should be janbakhshen, probably influenced by the Arabio \& Latin terms. Wiedemann p. 242. 8 Partioeps Junot. 1.0.
522. Ma tapsil dhālika wa tafsirhu. As to the analysis ana interpretation of these, the infant (alINTPRPRMATION mauled is at first delica te and weak IN DETAIL a unfavourably affected by the least change in its condition, and it is ampossible to have confidence in its survival until it has attained the age of four years. These are called the years of rearing by the astrologers. The first thing they do in thess years is to ascertain whether it is going to survive or not, and when in their opinion it is sufficiently strong to be reared, they look whether there is a haylaj or not. This they search for in five places; $1 /$ the lord of the time, day or night; $2 /$ the moon by day and the sun by night; 3/ the degree of the ascendant; 4/ the part of for tune; 5/ the degree of conjunction or opposition of the moon preceding the birth. The haylaj is one of these. After it has been de termined according to the proper rules, l then the most powerful planet as regards dignities (muzak ramah) of those in aspect ${ }^{2}$ to it is the kadkhuda. If it is at an angle a large number is assigned, if sucoedent an intermediate one, and if in a cadent position a small one. These are the numbers winton we discussed under the years of the planets (437) and according to the condition of the kadkhude as regards power or weakness, these mumbets Indicate years of life or months or days or hours.

These are the gifts or allowances (ratilya) of the kadkhudā. In the event of 1 ts being in a maleficent or weak position, every for tune which is in a friendly aspeat to it, or is in reosption with it, adds its smallest number to the allowance, in the form of years or months according to the strength or weakness aforesaid, while every infortune in inimical aspect deducts such a numbbur. These are styled the additions and deductions. The result is the longest period of life to which the native can attain, if one of the enaeretai ${ }^{4}$ does not interfere. Sometimes in a nativity there is no haylaj, In wish case the length of life must be estimated from the numbers of the fortunes present. The anaeretal are moreover malefic in themselves and their rays are nimfoal like certain fixed stars which are known for their I The haylaj must be in an aphetical place, either near the East or West Angles or in the IX,X or XI house. 2 An alternative definition is given by. Junct. p. 141 "the most powerful planet in an aphetical place" 3 Chron. p. 90.78 on the length of human life. 4 Saturn and Mars.


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evil effeots 460. When the direction arrives at them, at the time when the half-year or quarter or yearly allowance is due, disaster results and then the fortunes can do nothing against the unfavourable situation.

There are astrologers who regard the situations at the thirds of the year as gifts of the kadkhude in place of the positions at the quarters. But there are many anaeretai, among them the degrees of the ascendant and of the moon, if one of them interferes with the other, and again the cusps of the 4 th, 7 th and 8 th houses. These are separately dealt $W 1$ th in the books. 1

Each year the asoendant is ascertained when the sun comes round to the same minute of the ecliptio in which it stood at the birth,i.e. the anniversary (tahwil), 2 and also every month when the sun arrives at the same degree and minute it occupied in the radioal or revolutionary figure. The lord of the escendant at birth is the lord of the first year, that of the second, the planet next below in the order of the spheres, and so the lords of the revolutionary figures for succeeding years are reached in the same fashion as you proceed with the lords of the hours, 390. The Babylonians adopt the same method, but start with the lord of the hour of birth,instead of that of the ascendant, the second being next in order below.

The termini of the years are determined as follows; a sign being given to each year, the end of the second year is in the second sign at the same degree as the ascend ant, and so with the third. When the signs and degrees of the yearly terms have been learnt, each year is divided into (thirteen) months of 28 days 1 hour 51 minutes and a sign to eaoh given, so that the last month ends at the same degree as the radical ascondant has I Apparently Capsila was regarded as one. Then Abü Sail on leaving Khwarizm with Avicenna was overtaken by a sandstorm he foretold his death within two days because the direction of the degree of his Ascendent would then_reach Capella (not Capricorn as in translation) 'va àn qütirastr, Chahār Maqāa p. 87.
2 At which time a theme of the heavens or revolutionary figure is construoted in the same way as the 'radical' figure 'asl' at the birth.
3 According to Hermes, De revol. nativ. II p. 218 and Junot. p. 1051 the dominus anni is the lord of the sign of the year (as distinct from the Salkhuda of worldyears), and to Wilson p. 280 that planet whioh has most dignities and is strongest in a revolutionary figure.

the same sign as the first, while the first month of the next year has the same sign as the year; similarly a sign is given to each of thirteen periods of 2 days 3 hours 50 minutes, the end of the last of the se periods coinciding with the end of the monthly term. 1

The lord of the week is determined as followa:take the days elapsed since birth and divide by 7, note the product, and count on the same number of signs from the ascendant of the radix, the one you arrive at is the sign of the week. ${ }^{2}$ Then count the remainder which is less than 7 from the lord of the ascendant in the direction opposite to the succession of the signs, the sign you thus arrive at is the lord of the day or the week in question. "There are astrologers who proceed in the direction of the signs, not contrary thereto.
523. Fam stir al-mardudEt mariE. We have referred previously to the Apheta and its direotion in regard to termini, the thousands and cyoles. OTHER THINGS TO EXE Here its meaning requires to a RECKONED WITH certain extent to be explained, because in nativities the aphesis is not calculated by the equal degrees of the ecliptic but by degrees of ascension. Jo the aphesis from the degree of the ascendant and the planet which is situated there is calculated by oblique ascension at the locality in question, one year for each degrees. So also the aphesis of the planet at the occident angle will be according to 1 ts descension at the locality, because the setting of any sign at a locality is equal to the ascentsion of its nadir. However with regard to the M.C. and I.O. and any planet situated there, the aphesis is in all localities by ascension in the right sphere. So if a planet is not transiting one of these four degrees but ICI. Junctinus p. 1138 Who is more do curate. The year is divided into 13 months of $28 d 2 \mathrm{~h} 17 \mathrm{~m} 38^{\mathrm{m}}, 9 \mathrm{~m}, 14^{m \mathrm{~m}}$, and the month into 30 days of $22 \mathrm{~h} 28^{\circ} 35^{\prime \prime} 18^{m 1} 18 \mathrm{~mm}!$
Z Of the last complete meek.
3 But probably not its real lord, 390.
4. This is Ptolemy's method of determining the length of life by the time taken by one planet to reach a oertain point of the zodiac or the former position of another planet by the diurnal movement calculated in planetary hours (1) 1 th of its diurnal arc) vara riv dpipaidr or degrees of oblique ascension. A year being assigned to each degree, 90 years would be the allowance if the points were separated by the semi-diurnal arc, which convert ted into degrees of right ascension might be considerably more.




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a point between two angles, its ascension is compounded of those of the adjoining angles, and the calculation is a long and difficult business.

An arc of direction is always calculated from the haylaj, the significator of life, and never from any other point except in special cases. The Kadkhudè is the significator for the length of life. The degree of the ascendant is always made apheta whether there is a haylaj or not. When at an anniversary or any other time there is ascertained the point at which the direction of the haylaj has arrived, the lord of the term in quesion is called qäsim or divisor, in Persian, fān-bakhtä, bringer of the fortunes of life. The name qasim comes from the circumstance that because lie is situated between the radical place of the haylāj and the anaeretio point (qatar), the interval is divided into sections by the terms of the signs, and the lords of the terms become the lords of these sections. Any planet which is in the term of the apheta or directs its rays to it becomes associated $W$ th the administration of that section.

With regard to the ruling planets (mubtazzãt): in the various houses of the planets are numerous dignities and associated therewith preeminence in the possession of these (ibtizaziyya). The mubtazz without qualifioation is that planet which at a nativity is predominant (mustauli) by virtue of numerous dignities at the aspendan or its lord, or at the five aphetic points in the radix (asl al-maulid) and similarly at its anniversaries. The firdaria we have already discussed both in relation to the years of the world and to nativities.
524. Fakaif debt al-mawlid wa ramalha. Procedure to be observed at a birth.

Then the child is born you must
PROCEDURE AT take the altitude of the sun if it is
A NATIVITY day, and work out the ascendant and 1 ts degree. This is the horoscope of the nativity. If it is night, then the altitude of a wellknown fixed star which is on the rete of the astrolabe must be taken. Do not concern yourself with the planets which would only involve you in difficulties, nor with the moon, for working with it would be a mistake unless it is necessary. Further if by day or night the condiction of the heavens is such by reason of cloud or the 1 The divisor is important for indicating the profession a native should enter. Junot. p. 1070 from Albohazen Hall f. 95 and also to a certain extent 'aloeloadeny', 520. p. 255, see VI. 3.





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like, that you cannot get an observation, then only the determination of the time remains.

When you know how much of the day or night has passed, the ascendant can be oaloulated by the method we have described. The number of hours. elapsed can be determined in two ways, the first by having a water-clook or other apparatus for measuring time going before the labour comes on, the clock having been set by sunrise or sunset or the like. When the birth takes place, the hour must be noted. The other way is to set the cloak going at the time or birth if previous notice has not been received, and watch it until it is possible to take the altitude of the sun or a star. It is then possible by counting back the numbers of hours shown by the clock to get the exact time

If there is no olock available, ell that is neoesaary is a coup of any material which will hold water; a hole must be made in the bottom of any dimension you please, and when the child is born you may proceed in one of two ways at ohoice,first by letting water into it and second by allowing water to escape from it. If you choose the former, place the coup on the surface of clean water, watch till it fills and sinks. Immediately take 1 t out and empty $1 t$, and place on the water again, and count the number of times it sinks until the sun or a star is visible. A mark must then be made at the point the water has reached, to indicate the fraction to which it had sunk. Then take the altitude and note the time, and proceed as before till as many sinkings, together with the fraction marked, have taken place as noted. Then take the altitude again and determine the number of hours from the second time the cup was placed on the water, and count back the same amount from the time the sun became visible, which gives the time of birth.

If you choose the second way, place the coup on something like a trivet, and take a pitcher full of water, and fill the coup, when all the water has poured or trickled out, fill again and count the numbers of pitchers used till the sun or star is visible, if there s water in the cup make a mark, and proceed as before With the determination of the time
525. In lam yatahagaq rasad al-wagt madhā yupal. Should no observation have been made at the time or
birth, the determination of that
IF TIME NOT NOTED time is beyond the reach of Boience,
USE OF 'ANIMODAR' for there is no way of knowing it,

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but astrologers by estimation and conjecture arrive at one little different in the sign of the ascendant, when an attentive observer employs cautious questioning. But it is neoessary that there should be a certain degree for the ascendent, so they find a way, by using an indioator (namudar) which famishes one which they assume to be the degree desired. The indicator most in use is that of Ptolemy, 2 which if it does not disclose the exact degree, is the best substitute. The method in question is to ascertain as acourately as possible the time comaunioated to you, and determine the ascendant, the cardines and the places of the seven planets. Then find the degree of the conjunction of the moon which occurred before the birth if that was in the first half of the month, or else the degree of opposition, if in the latter half. Then determine which planet has the most dignitLes and testimonies, then the one that comes next, and so proceed with the others till the last and note the result. The most important testimony is being in aspeat to that degree, for when two planets are equal in the number of their dignities, the one in aspect whatever that may be, is preferable. Then examine which of the two most dignified planets is nearest to an angle by counting the number of their degrees. Thereafter transfer the angle to the degres of the nearest planet and derive the ascendant from that. If the degrees of the two planets are very distant from an angle, take the next planet in order of dignity, and examine the others till you find that which is nearest to an angle and proceed as before.

There are astrologers who do not attach any impportance to the relative distance from or nearness to an angle but simply make the degree of the angle which is nearest to the most dignified planet 3 the place (from which to derive the ascendant) without altering its degree to that of the planet and proceed as we have said.
526. Fakaif yurraf masqat al-nutrah. The essential condition which makes it possible to discover the temperament, constitution and form TIME OF CONCEPTION of a native as well as the conditions which take place in him T The animodar of the Latin translations 'Rectification'; on the use (and futility) of namūdars (numūañe) in relation to the Nativity. Chron. p. 290.
2 Tetrabiblos. BK. III, op. III.
3 P. has 'the same as the degree of the latter'.

during life within the mother's womb is the ascertainment of the time of conception. Authorities insist of use being made of this. It is possible to learn from the mother or the father if they agree the beginning of the phenomena of pregnancy, the direction of which they have month by month or week by week ascribed to saturn or Jupiter and so down through the spheres.

The procedure adopted by astrologers is founded on two principles either of winch is satisfactory if properly executed: $1 /$ it is assumed that the degree of the ascendant at birth is the same as the degree at which the moon stood at the time of conception, and $2 /$ conversely, that the degree of the ascendant at the time of conception is the same as that in which the moon stood at the time of birth. In the first place it is desirable to ascertain from the mother whether it is the 7th, eth, $9 t h$ or 10 th month of pregnancy, having done so look at the ascendant and the configuration of the heavens at the time which has been approximately arrived at; it the moon 18 at the degree of the ascendant, give to the ascendant of conception the same degree. Then the child has completed so many full revolutions of the moon before birth, either 7 (191 days 6 hours) 8 (218 days 13 hours) - here be careful not to say that an 8 months child is not viable - 9 ( 245 days 21 hours) or 10 ( 273 days 5 hours).

If the moon is not at the degree of the ascendant, whether above or below the earth, if above, look how many degrees separate them, and take a day for every $13^{\circ} 11^{\circ}, 1$ and for every decree 1 hour and $5 / 6$, and every minute of a degree $15 / 6$ minutes of time, and subtract the result in days hours and minutes from the days of that month of why oh you have been informed. If the moon is below the earth, take the distance from the ascendant to the moon, and proceed in the same way, but add the result to the days of the month in question. So the greater or less number which you


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arrive at is the time spent by the infant in the womb. Count back therefore from the time of birth the number of days and hours, the result is the time of conception. Thereafter ascertain the position of the moon, and when you know its degree make this the degree of the ascendant, for this is approximately accurate from the data available.
527. Fame al-aism al-rabir. For horary questions of the 4 th order, the ascendant of the beginning of the matter in hand must be ascertained, whether that be determined already as in the case of a
TH S FOURTH DIVISION
nativity, and therefore known, or whether a time has to be selected or chosen as a starting point. The purpose of this section is to select a suitable time for carrying out some business so as to insure the presence of fortunes and the absence of infortunes, just as we proteat ourselves on the surface of the earth from the rays of the sun, by selsoting northern aspects, and shady spots and using moistened punkahs and icehouses ${ }^{1}$ In this m matter pay no attention to the silly talk in Which the Heshwiyites persist and their denial of what we have accepted in this matter of 'elections' (1khtiyar). ${ }^{2}$

The essence of this section 1 s so to adjust the cardines that the malefios are as distant as posibible both in themselves and their rays, while they are to be kept illuminated by the benefios and their light, especially the ascendant and its lord, also the moon and the lord of 1 ts house, and the significator of the business which is the subject of the inquiry. Also see to the moon and the lord of the ascendant and the signifioator that they are in aspect to each other, and place them in such a position that they all oast an aspect to the ascendant lest the election should turn out to have bad effects. This is a long and wide field of enquiry into which it is impossible now to penetrate further.
528. Fame al-qism al-khaimis wa mabд्यdihu. Rules for questions of the fIfth order.

THE FIFPH DTVISTON AND ITS PRTNCTPLRS the fact that THE FIFH DIVISION AND ITS PRTNCIPLRS the fact Khaish hEr tar va yakhhe zix-1 zamia agandaP. 2 . has 'who are always crying out "Would that a miracle could happen to us that this calamity should be frustrated and that we should be made happy"'.

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the nativities of querents regarding various contingendies are for the most part unknown, astrologers deal with the statement of the querent as a starting point just as if it were a nativity. The ascendant of the time is taken and investigated, as well as 1 ts lord and the moon and that planet which the moon is leaving. These are used as significators for the querent, and as the matters on who guidance is sought belong for the most part to the 7 th house and 1 ts lord, or to such other house in which the question is comprised,461, and its lord, also to that planet with which the moon is about to conjoin, there is no reason why with a little care and attention an answer should not be found somewhere among the twelve houses. This division is known as that of the questions.
529. Fame al-masialah al-bikariyyah. In case of an del request or one for a general prognostic the oustom IDLE AND GENBRAL follow the same procedure as in otter of the majority of astrologers is to QUESTIONS questions, namely to ascertain the ascendant of the time of the query. They then examine the aspects as they would at a nativity and make conclusions ide. as to the remaining period of life and the conditions therein

There are however astrologers who increase the range of horoscope inspection by claiming to elicit the past life of the querent. Hashwiyite astrologers, inclined to falsification, when such a question is asked bid their clients return and sleep on the matter for three nights and concentrate their attention on it during the day, and then question them. After satisfying myself as to their writings I know of no method of dealing with them except insisting on exposing their vicious decrees ${ }^{2}$ and their leading the querent in to crime by the bad advice given him. 530. Fame al-khabI' wa'l-damir. KhabI' refers to hidden objects (concealed in the hand) and damar to seoret thoughts reserved by the secret thoughts reserved by the is likely to be the part of Astrologers
THOUGHT READING
than that resulting from hasty dealing with such I bikari is a Persian word.
2 Which he appears to have done in his "Kited al-tanbin rale sink rat al-tamwin"
3 For instances of successful thought-reading of. -the tales of Al-Kindi and Al-BIruni in the Chari Maqeia p. 84 , from which the meaning of damir may be gathered That given in Prob. I. 233. 'pensee secretes du destin' is too restricted.


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questions and in comparison how numerous are the lucky hits of Magicians who keep up a patter while they are on the look-out for tell-tale indications and actions!

Now we have arrived at a point of the science of the stars which I have regarded as suffloing for the beginner; any one who exceeds the limits set out above exposes himself and the soience to derision and soon, For such are ignorant of the further relations of the art and especially of those which have been ascertained with certainty.

Conclusion of the Book of Instruction on the
Elements of the Science of Astrology
Composed by ab al-Rainān Muhammad b. Ahmad al-BIruni. May the Mercy of God be upon him. Abundant Mercy. And His blessings on Muhammad, his descendants the pure in heart.

All glory be to God first and last.
As the Colophon has no date, the following from the first fly-leaf of the MSS are added.

By the acoident of time this book came into the possession of the poor dependent on Allah the allsufficient Auhad b. Assad b. Mihria'r al-Mustaufi. May the Most High God improve his circumstances, and favour the realisation of his hopes in this world and the next. May he cause him to select aright the winning arrow from the quiver. In the month of allah, Rajab the Deaf, 839 AH. (Jan. 1436 A.D.).

He, the Guide. This book came into the possession of the poor slave in need of the Mercy of our Lord the Creator tala b. Al-Hunain b. Tala al-Sahqi. May God overlook his sins by Muhammad and his family and his generous associates. In the year $889 \mathrm{AF} .(1485 \mathrm{~A} . \mathrm{D}$. Praise be to God first and last and may He bless our Lord and prophet Muhammad, the best of mortals, and all prophets and saints.

Well endowed $1 s$ he who with sufficient humility
unites intellect and Soul
For these two form a fortunate star-oonjunotion which has an enduring influence with the people.

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(Prepared by Mrs. P.G. Gardner)

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[^0]:    It a later period of his life he must have met odede grandson, Ongur, author of the QEbus namah who was companion of Mas rud from 422-432 and married his sfater, Yon Dlaz, Buch des KEbus, $9.13 \delta \mathrm{seq}$.
    3 Wiedemara, Beitraege, LX, P. 6, No. 4.
    4 Purma b, Subuktige ${ }^{2}$ LX, p. 61, No. 5.
    married to Subuktigin, Mapmad's sister was first also marcied a and subsequently to Ma'man. Mapmid (Zembaur Menuel a sister of Ma'man, name not reoorded.
    © Zambaur, Manuel de Genealogie et de chronologie, 1927 . this.
    ©. nows p. 325.

[^1]:    2 Wledemann, Beltraege, LX, p. 6l, No. 6.
    ₹. Chahar liaqaiah, XXIII; Bromis, Lit. Fist. of Persia, II, 97; D'Herbelot, under abu Rihan.
    3 saohau, prefeoe to cbron. Tert. pp. X-䴔VIII and Wiedemann, 1.c. pp. 71-77 and notes to $p .98$.
    4 I BE sbilged to H.A.R. G1bb for the rest of the quotation from the Leiden RS., and to Dr. Fotheringham for calculating the cusps of the houses from the data there given.

[^2]:    The roots sty and bit both mean spread out, so that seth may be a pavement as well as a roof.

[^3]:    ${ }^{\text {Ibarabar yak Cigar. P The translation by Isheaq in }}$
    Hunayn of Euclid's definition is preferable; ' the plane surface is that which conforms everywhere to the straight lines upon it'.

[^4]:    $l_{\text {The figure on }}$ the left illustrates 'perpendicular' and right angles, that on right 'not perpendicular' and obtuse and acute angles.

[^5]:    $1_{\text {According to }}$ Steingass, "the eye in which the tongue of the scales plays", but here used as the equivalent of A. rayn,"the inclining of the balance", Lane, p.2, 217. 2Exemple of explanation of difficult Arabic words in

[^6]:    $1_{A L}$ has hidithah.

[^7]:    lThis is numbered 27 in PI, while under 28 are,out of place, numbers $36,37,38$, of the table of contents.

[^8]:    1 I.al-awwal Khoums al-thEnI wall-thān K hums althälith.

[^9]:    vertently.

[^10]:    1. The sixth form of karI does not occur except when used for kafa'a, so that the form takafu is preferable which contains the two meanings of eqaility and inversion. 2. From xapiorituv; v. Lane under tyr Qabben from P.kapan. 3. A pomegranate; P.nära;a stone weight oi this shape. 4. A hind of backgenmon: v. Hyde, Historic Nerdiludif, p. 250.
[^11]:    1 It will be observed that paragraphs $1-64$ are substantially from the definitions of the first six, and the lith and lith books of Euclid.
    2 The Persian rendering.

[^12]:    The spherical transversal proposition was of fundamental importance in the evolution of spherical trigonometry; Al-Bíruni develops it in the Mas rudi Canon, and wrote a separate work on the subject. v. Bjornbo, Thābit's Werk uber den Transversalensatz, Erlangen, 1924, p. 84.

[^13]:    $\frac{1}{3}$ For mhāl read mujallā. 2pishiz P: v. ied. Beitr. XIV. 3 Jar何, measure of corn and of land sown therewith, 3,600 sq. cubits. The rashIr, 60 sq. cubits is one-tenth of a quite which, therefore, is here one-sixth of a jarib. Gar $P$ is any standard of measure, also of time, as in India ghari, 24 minutes, $1 / 60$ of 24 hours. The fifths up to the tenths are specified, khawämis, sawādis sawäbir, thawämin, tawāsir, rawäshir, all on measure fawril instead of the usual aral.

[^14]:    1 The plane numbers are important because the ancients in multiplication considered the factors as lines, the products as planes. Wiedemann.

[^15]:    An abundant number on the other hand, zálid, is one whose component fractions amount to more than the number itself, like twelve; for its half, six; and its third, four; and its fourth, three; and its sixth, two; with its twelfth part, one, add together to sixteen.

[^16]:    $I_{\text {All }}$ the MSS reproduce this figure which when completed is evidently a summation of the od a numbers as seen in the successive squares. One MS gives an elegant conical figure here reproduced, which however, like the other

[^17]:    1 The MS has 8 for 9.
    2 The MSS have nazk or tank. Sankalita means addition; vara, square; ghana, cube.
    3 tad rif is not confined to doubling, but extends to trebilng, four-folding, etc.

[^18]:    In the table of contents of PL tarfir occurs under 105 PL. The term is a synonym of bardishtan-i radad under which title raf al-radad is discussed in PL 106. The numbering of the paragraphs readjusts itself, PL 108 being 107 \& 8 .
    Wiedemann refers to this passage in act. Oriental.V, 153, where he observes that Reduction is expressed by forms of bat VII.

[^19]:    I The Persian expression is navardidan which is a translation of A. al-fayy, folding (into the smallest compass).

[^20]:    1 Zero, as well as cipher, is derived from self, empty; cipher being afterwards extended to the nine digits. Cara de Vax, Penseurs de l'Islam,II,109, suggests that cipher in its other meaning is traceable to sir, a book, or writing, with sin instead of feta.

[^21]:    1 จ．Muhammad b．Māsa al－Khwarizmi；Colebrook，Algebra From Sanskrit，1817，p．LXXV；and Karpinski，Univ．Mich． Stud．，XI，1915，p． 71.
    The solution of these is arrived at as follows：－
    $* x^{2}+10 x=39 \quad x=\sqrt{5} 2+\frac{39}{2}-5=3$.
    $x^{2}+30=13 x \cdot x=6 \cdot 5 \pm \sqrt{B \cdot 5^{2}}-30=6 \cdot 5 \pm 3-5$ ． $x^{2}-5 x+6 . \quad x=\sqrt{2 \cdot 5^{2}+6}+2 \cdot 5=6$.
    In his last example $A$ and $P L$ have 10 instead of 5 ， and PP dah pang！Karpinski remarks on the persist－ once of this example＊from Khwarizmi，borrowed by Al－ Bīrunf 200 years later and by Omar Khayyam 100 years after him．
    ${ }^{2}$ In early books of algebra translated＇res＇；the trans－ iteration into Spanish＇xei＇has been suggested as the source of the modern＇x＇．（Arabic words in Spanish such as shard（sherbet）were formerly spelt with an initial $x$ ，now II th $j$ ，jarábe．）

[^22]:    ${ }^{1}$. Colebrook, 1.c.p.139. For akhab read ashhab. 2 Cara de Vair quotes an example from Al-khwnizmi, l.c.II,117. $x-1 / 3 x-1 / 4 x=8$. Try 12 , result 5, (-3); try 24, result $10(+2)$; $12 \times-3$
    diagonally, result 24, and -72; add, because contrary, result $96 / 5=191 / 5$.

[^23]:    1 memoria technical is made by the insertion of vowels as indicated in the transliteration above. Pococke, Spec. Hist. Arab., p. 308, refers to the use of the first six words for the days of the week from Saturday to Thursday, Friday being al-Tarubah.
    2 The Muslims of Morocco make the last four words, sarfad, qarasat, thakhadh, zaghash.

[^24]:    1 Ukar, pl. of ukrah; unusual as pl. of kurah. $V$. Dozy, I, 30 .
    2 brahmânda means the ait'f with all the products of creation in it. India, $I, 221$.

[^25]:    1 Dr. W.D. Ross informs me that the words quoted occur in De Caelo, $278^{\circ}$ 21, and 279 11. Bar-Hebraeus follows Al-BIruni in referring to the same passage. The external surface of the ninth sphere is in contact with nothing, because beyond it there is 'ni vide ni plein' $v$. Nav. p. 11.
    2 Translation of the Persian etymological pun.

[^26]:    1 By way of declivities and fissures and ditches, ba suI shivhā va gauhā va maghākhā. P

[^27]:    1 al-BIrūn says, India, I, 277, that all astronomical phenomena can be equally well explained by the theory $8^{f}$ the rotation of the earth.
    See Lane under hirba. Brehms VII, 245 says that though its colouring varies with the intensity of light the chameleon is the most sedentary of animals. Mahk in Persian, misspelt in PL, PL', and PP. AO has sūsan, lily, for sūs.

[^28]:    1 nike a ship floating downstream, a passenger may walk in the opposite direction, so that he is at once moving both forwards and backwards, but the direct movement is more effective than the contrary one. nP

[^29]:    Zakhmgan, usually the seat of a mound, but zakhm is
    'ictus as well as 'vulnus'.
    2 The Indian Circle. See Wiedemann, Alta Oriental.V. 156 3 Plummet, shaqū.

[^30]:    The copyist is unhappy in his nomenclature of the quadrants.

[^31]:    tali rah, talāyahP.
    2 säqah.

[^32]:    Literally, write the number in two places, double the one, halve the other and add the results.
    India, I, 338. Therefore, not always forty-e1ght minutes, but $1 / 15$ of day or night.

[^33]:    1 For mutagantarain read mutagatarain.

[^34]:    1 So A and P. - 115:360 would make $\pi$ 3.13. $v$. India $I$, 168 Where the proportion used by Pulise is stated to be $\frac{1}{2}: 3177 / 1250=3.1416$.
    read sharinah - a slice.

[^35]:    1 P. kabūd̄̄, A. lāzmardiyyah, from P. íjward, lapislazuli.

[^36]:    1 Modified by the substitution of parallel reys for the sun, and by the representation of the real conditions of illumination, together with the appearance of these from the Earth.

[^37]:    1 The Arabic names of the constellations are followed by the Persian ones, separated by a semicolon - these only occur in the Star-tables of the Persian MSS, ff. 37-38 PL. 25-26 PP.

[^38]:    1 būlah a short sworả，auk ${ }^{P}$ ．for beak or nib．

[^39]:    iq．P．khIk．

[^40]:    1 Fomalhaut omitted, already assigned to Aquarius.
    2 The tables are identical with Ptolemy's except that
    1/ Hercules and Libra have respectively 6 end 2 stars of the third mag: instead of 5 and 3 ; $2 /$ outside Libra there is an additional star of the 3rd and one of the 6 th lacking, 3 / that Argo hes 10 of the 3rd and 20 of the 4 th instead of 11 and 19 respectively.

[^41]:    1 diminutive of jedi.
    2 supply al-farqadan before kawakib.
    3 bant is generally interpreted as plural of int, daughter, but Lane points out that when ion, son, is applied to an inanimate object, its plural is also bant.

[^42]:    1 biniyash PL．PP has pIsh．
    2 and had al－najm，the leader．tābir also occurs as diminutive tuwaibir v．Philby，Arabia of the Wahabis， p．60．Ptolemy calls it inurasías
    3 The measures rump，dhirär and shibr，spear，cubit， span，appear in $P a s$ nlzah，ersh，and bidast．

[^43]:    1 as in $\mathrm{PL}^{l}$ and Be 2. Kharātan in PI and PP. Kharathān
    in $A O$ and $A O^{1}$. v. Lane II p. 717.
    2 quai rumh.

[^44]:    1 According to Ideler p. 186, na räm unlikely, probably originally aram, cattle; but Brehm, VI, 198, speaks of troups of Ostriches watering daily.

[^45]:    Plural of chiba' a tent, khiba'a, to conceal.
    2 The crossed pieces of wood which prevent the leather bucket from collapsing.

[^46]:    1 The root of nay' pl. anwa' is nara to rise with difficulty, but the word has come to mean the setting of a star in the morning twilight, while at the same time another rises opposite to it in the east. The setting of a mansion is supposed to be more significant from a meteorological point of view than its rising, which perhaps explains the change in meaning of nan?.

[^47]:    Fiedemann LXIV. 207
    2 Apparently Al-BIruni shares Al-BattänI's view of the falsity of the trepidation theory.

[^48]:    1 PL, PP have bhutif for bhukti. Bhakti, faith, devaion; enjoyment ac. to Burgess, surya siddhanta I.27. 2 bhakti madhyama and sphuṭa. India II, 195.

[^49]:    1 Saturn in MS. has 268 for 263.
    Venus in MS. has 263 for 268.
    Venus in MS. has 263 for 268.
    Mercury in MS. has 264.59 for 266.58.
    The figures under the and and 4 th nitäqs should add to

[^50]:    I See Manitius II.414. The second correction of the argument (the equation of the anomaly, 185) has to be added to the true longitude of the centre of the apicycle to obtain the true position of the planet when it is in the last and and nitaqs of the epicycle, deducted when in the 3rd and 4 th - whatever the position on the deferent. $G^{\prime} K^{\prime}+G^{\prime}$ gives $K^{\prime} \cdot G^{\prime} L^{\prime}-G^{\prime}$ gives $^{\prime}$.

[^51]:    1 This paragraph is at the top of $37^{\circ}$

[^52]:    1 This figure which oocurs in all the NiSS. has apparently dropped an initial five, see 209, p. 121 where it 1s given as $5,305,498,5894 / 5$ parasangs. The copyist of AO has alone noticed the mistake for he has here a note giving musá b. Shākiris rule for volume of a sphere:diam. $2 \times 3^{1 / 7} \times 1 / 6$ diam.
    24 stands in severel MSS. in this place. Perheps the initial figure in a volume calculated from 45.

[^53]:    1 Wledemann quotes a parallel passage from the Mas midi Canon. Beitrage XXIX.

[^54]:    1 Bahr Zughar, instead of Bahr Lit derived, from the town Zoar or Lot's daughter. Barsukhān, v. Tarikh-i Rashidi 350․

[^55]:    1 Canaries？Palmais some 400 miles from the coast． Al－BIrdini does not distinguish between the Fortunate Islands（Isles of the Bless）jazā ir al－sarādah and the Eternal Islands jazā＇ir al－khāildāt．
    See Blochet－Les sources orientales de la divine

[^56]:    1 Chaucer 1.0. p. 31 'Senyth'.

[^57]:    1 Line dropped in MS．

[^58]:    Jagmini, Zeits. Deut. Morgen. Gesell. XLVII, p. 204. 2 India I 316.

[^59]:    1 epoch according to Nu p. 153 and Delambre II 575,

[^60]:    1 Cf. Jagmini. Zeit. deut. marg. gesell. XIVII, p. 268. Both A and $P$ Mss have later' instead of 'before' and v. $\nabla$. in this passage. Correct in Nan, 1.c. p. 153.

[^61]:    
    ta'sisat, as has Chron. text p. 340, line 22, translated foundations' p. 342 line 13 and 447 n. as if from assasa. For the same distances from the sun, Wilson has Athazer: this can be explained from Albohazen F\&Iy VIII. 29 Basilea, 1571, where it is stated that the athazir, al-tasyirat (apheses for obtaining forecasts as to rain \&c) must be made at these phases. Also p. 578, atezic.

[^62]:    1 See Nallino. Vol. Orient. Studies, Browne, p. 388. Not to be confused with the real Sablans, randeans, of Southern Mesopotamia, Sabi'a, pl. Subset, Sabi'una; for an excellent description of the present day Subbi see E.S. Stevens, By Tigris and Euphrates, 1923, pp. 204219, and not to be confused wi th the Sabeans, the ancient inhabitants of Saba, Sheba, in Yemen.
    2 PL and PP have naqibat for baqiyat.
    3 It happens once in three years when two lunations occur in one solar month.
    4 Rial is the pellet, fatil, of dirt which is rolled between the palms and thrown away; mas, is month. 5 Ad,hi, super- in composition.

[^63]:    1 P omits Abãn.
    2 Fills laouna in Chron. p. 55.

[^64]:    Chron．p． 268 seq．
    MS has fasin by mistake and $P$ sin for sud．
    Cf．NaIl．I．177．PP has sub，PL suwais．
    As in AO；Kabas AO ${ }^{1}$ ；al－makas，Chron．p． 275 and 432 ； rakes，PP．absent PL．
    5 Cf ．the reahtra of Muharram，301．

[^65]:    l dhawit al－adhen warl－lubdi．
    2 Birds with inflammable material attached to their feet，go that fires should be widely spread．Fullers II 240 also Chron p． 213.
    3 Kay I＇at dropped
    5 IFÏEIL，Shahnamah．
    P．sin．
    The word muzhd giran Chron．p． 216229 or muzdgirain emphasize e the resultant present－giving while maid given of the farhin salad）tatasallatanna．Richardson 1．0． 180 ．
    7 Gahanbars，Fullers \＆Have．o．192．Hyde．Reals．Veter． Persarim Cap． 19 \＆20．Jackson．Iraniache Religion p． 676.

[^66]:    1 As remarked Pers. Cat. B.M. II. 452. PL l has 425 but this is by error due to the preceding bist u panjum ramadan: the words from 1341 - $\overline{a b}$. agree with A.] are omitted; otherwise the calendar is

[^67]:    1 Ne has 50 for 5.

[^68]:    This is also the case in $A O$ and $A O^{1}$, but $A O$ has an inserted leaf pp. 196-7 where it is divided at $45^{\circ}$ (l2 fingers) into umbra rectal $1-12$ and umbra versa l2-1. Usually in Persian Astrolabes the umbra rota is carried to 50 fingers on one quadrant (fig.o.rgs) and 30 feet on the other, umbra versa being only indicated in the central "square of 2 shadows".

[^69]:    1 janūb for juyūb PL.
    2 The altitude of the gun at various places when it passes over the azimuth of the qibla. PL and PP have zilli sim for zill-i sumūt.

[^70]:    1 (chandumP) v. p.l\}\& n:

[^71]:    1 For an alternative method ci. Alfonso, Libras del Saber II, 287. A0 p. 213 leaves out a line between lith and 13 th which requires shifting the ridada to a finger more, before rising to the and position and sighting anew, AOl also. The procedure is the same as in 5346 .

[^72]:    1 Prefece, India, p. 25. "That he believed in the action of the planets on the sublunary world I take for certain; though he nowhere says so. It would handy be intelligible why he should have spent so much time and labour in the study of Greek and Indian Astrology if he had not believed in the truth of the thing." cf . Chron. p. 217. He apparently also shared the general belief in the efficacy of charms and talismans, but his contemporary Avicenna is very contemptuous in his refutation of Astrologers. Risalah $f 1$ rad al-munajjimin. cf. Mehren p. 237, Homenaje b D. Fr. Coder. Bardesanes, a Syrian philosopher in the and half of the and century, condemned astrology in plain and weighty terms.

[^73]:    1 Corrected to posterior in $P$ but not in $A$.

[^74]:    1 I am indebted to Professor Nailing for the interpretation or this word, to the proper pointing of which AL comes nearest. It is the PahlawI vizidhak (N.P. guzIda) 'chosen' = Aveonoyiat (of Vettius Valens) one of the Greek works which reached the Arabs through a Pahlavi translation. See Nallino, Memoirs presented to Prof. E.G. Browne p. 351 and see reference to India $I$, 158. My first Latin book was a 'Delectus', never associated with the name of a compiler. Cf. Grundjiran. phil. p. 303. Valens also appears later as puls 476, 479.
    

[^75]:    $1 \mathrm{PL}, \mathrm{AO}, \mathrm{AO}$.

[^76]:    $1 A^{1}$ and $A B^{I}$ have yabr for $b \bar{I}$ at.
    2 P has ş耳rajhz for gaharij. Tanks were plastered with ṣãrūj, cement.

[^77]:    1 Dexter aspects are those contrary to the order of the signs, so that a planet in $Y$ casts a dexter quartile to one in $K$ and a sinister quartile to one in 0 .

[^78]:    1 The southern signs were formerly called obedient，see

[^79]:    P has burji for badrinE.

[^80]:    1 Habbatu'l-khegrä', the green seed of Pistacia terebinthus according to Al-Baitar, Not.Ext. XXIII, 234, stomachic; good for gums and teeth. In a qitar of Hixilz (608) evidently hashish, perhaps prepared as a confeotion 'pista-i,bang'.

[^81]:    - Na"Im A, shuturmurgh P, but perhaps for naram sheep \&o. and not for ostriches.

[^82]:    1 Zahär, zahra is P. for gall-bladder, as in PP.

[^83]:    I mutarassifun, but here maldūdūn interesting people. 2 l. harailr; hawâmi, the proper plural is hamalah pregnant momen.

[^84]:    1 India II. 225.

[^85]:    1 read ig\#iranah.
    $\%$ in MS.
    3 \% in MS.

[^86]:    1 жupararé入入ovta - cf. Bouché-Leclercq $1 c .125$ and passim. Foll, Sternglaube, 1926, pp. 60, 142...
    2 The lords of the decanates are the lords of the signs in the order of the triplicities 379, Aries, Leo, Sagit tarius \&c.

[^87]:    1 Several MSS have rain for sing.

[^88]:    I MS. has here munir al-fakkah (Alphecca, Corona borealis), present longitude 11010' Scorpius.
    2 one would assume Shaukah to be a spike of capricorn, and not the tail, but the longitude corresponds to Deneb al-jadi.

[^89]:    1 Madkhal KabIr - If. 293-300 are occupied with a detailed description of the various lots and 1.331 seq. With the summary used by Al-BIrunf. 2 The amount subtracted, that from Fhich it is subtracted, the amount added.

[^90]:    I samim, in the middle of the heart, (Lane) of the sun. In astrological works, caziml. The Cent. Dict. suggests a derivation from qaib and shams, but Kasamim, as if the heart, is more probable.
    2 End of lacuna in PL.
    3 They are now west (right) of the sun, rise before it in the east, and become morning stars.

[^91]:    The Mafatin al-Fulom dines the expressions Kanmr-i wiz and Kandr-1 shad incorrectly as respectively

[^92]:    $\frac{1}{2}$ After inferior conjunction.
    2 Superior conjunction.
    $3149,6^{\circ} 22^{\circ}$.

[^93]:    1 destofriyyah. (dastur vazir bud)P position of authority.

[^94]:    1 The "Philosopher of the Arabs" - 9 th Century. For his philosophical Fork of. Hügel, Al-KindI, Leipzig 1857: for his soientifio work Wedemann, XXXVI, XLII, XLIV: for his astrological writings Loth, Al-Kindi ais Astrology, Leipzig 1875. V. note to 250.

[^95]:    l dafara is here used in its sense of giving, not that of repelling.

[^96]:    1 min muģadaqiyyah au muzaiamiyyah.

[^97]:    I An astrological expression for relation of planets by aspect, conjunction, equality of declination (antiscions) \&o.

[^98]:    I The context shows that it is not opposition in the Zodiac (as Dozy incorrectly quotes from Mule) but opposition of natures, 447, or of domiciles which 1 s responsible for the atmospheric phenomena. PL has bEihai ishan; PP khänihai ishān; the definition in Muhit, buybthume. The figure in 440 shows that the domiciles of the pairs in question are opposite.
    2 If you see the moon separate from Venus and apply itself to Mars or $v . v$. this is also opening of the doors, Albohazen paly p. 396.

[^99]:    1 lIne dropped

