



MwYwZK fMvj

fıgKv

mıvıYfıte fMvj ej tZ Ggb kv tK eSıvq hv tZ vıxK I Kıj xK chıq gıby I cıwıte tki gta Avstı m u K cVb cıVb I wıtkıY Kıv nq| fMvj kv tK Pııw cıwb tkYı tZ fıM Kıv hvq:

- K) MwYwZK fMvj
- L) cıKıwZK fMvj
- M) gıbwıK fMvj
- N) c xıwZMZ fMvj

fMvjı th kvLv tmsıRMr, cıwıexı AvKıvı, AvqZb, MwZ, Aııvsk, wıNgısk, FZz cıwıeZı, wıevıwıı nıwıewıx BZıwı wıelqmn Gıı MwYwZK wımwıewıKıvı wıbtq Avtj vPbv Kıı ZıvıK MwYwZK fMvj etj | GB BDıbtU Avgıv cıg wıZbıwı tkYıı wıelqı wıAvtj vPbv Kıe| PZzıKıYıwı gıbwıPııvııb c xıwıZ m u Kııq wıeavıq cııvııfıte Avtj vPbv fıı Kıv nıe|

cW 1.1

tR`wZ` gUj x

Df`k`

GB cW tkfI AvciB

- 1 tR`wZ` K Zv RvbZ cvi teb,
- 1 bxnwi Kv, bqT, Mh, DcMh, agtKZz D`v, tmSi RMZ BZ`w` m`u`K`RvbZ cvi teb,
- 1 M`vj w` , Qvqic_ I bqT gUj i eY`v w` tZ cvi teb|

1.1.1 : tR`wZ` cwi PvZ

Avgiv th cW`extZ evm Kwi Zvi Pvi w` tK w`ti AvtQ AvKvk| AvKvk Avw` AShxb| w`tkfI hveZxq e`zl kiw` th AA`tj tftm AvtQ ZvtKB ejv nq gnvKvk| gnvKvk itqtQ AmsL` tR`wZ`| w` tbi tejvq th mh`Ges ivtZ th Pu Avgiv t`wL G` t`vB tR`wZ` (Luminaries)| Ab` K`vq ejv hvq mh`GKwU bqT, cW`ex m`h`P GKwU Mh Avi Pu cW`exi DcMh| m`w`y`j Zfvte Gifc AmsL` bqT, Mh I DcMh`K w`b`q MvWZ n`qtQ tR`wZ` gUj | w`Avbxi v Pu, mh`Mh, bqT, agtKZz D`v Qvovl Ab`y`j bxnwi Kv, cij mvi, K`evgb, K`Mn`yi c`f`wZ. me w`KQ`KB tR`wZ` etj | w`w`f`b`e ai`tbi tR`wZ``tK mvZwU tkY`tZ f`vM Kiv n`qtQ| GB f`vM, t`j v nj : bxnwi Kv, bqT, Mh, DcMh, agtKZyM`vj w` I Qvqic_ Ges D`v|

1.1.2 : bxnwi Kv

m`y`- AvKvk t`f`vtj w`KZ tg`Ni gZ Av`li`Y`tK etj bxnwi Kv (Nebula)| G` t`j Avmtj nvj Kv M`v`f`mi AwZKvq w`U| tKv`bv tKv`bv w`Avbx etj b- mh` cW`ex I Ab`vb` Zvivi m`w` n`qtQ bxnwi Kv t`tK| Gme bxnwi Kv cW`ex t`tK tKwU tKwU gvBj `fi Ae`vb Ki`tQ| GK GKwU bxnwi Kvi gv`S tKwU tKwU bqT `vK`Z cv`ti | cW`ex t`tK tKwU tKwU Avtj vKel` fi itqtQ ZvB G` i gv`S thme bqT itqtQ Zvt` i`K m`v` Kiv hvq bv| Qvqic_ bxnwi Kvi mgZtj Ae`vb K`ti |

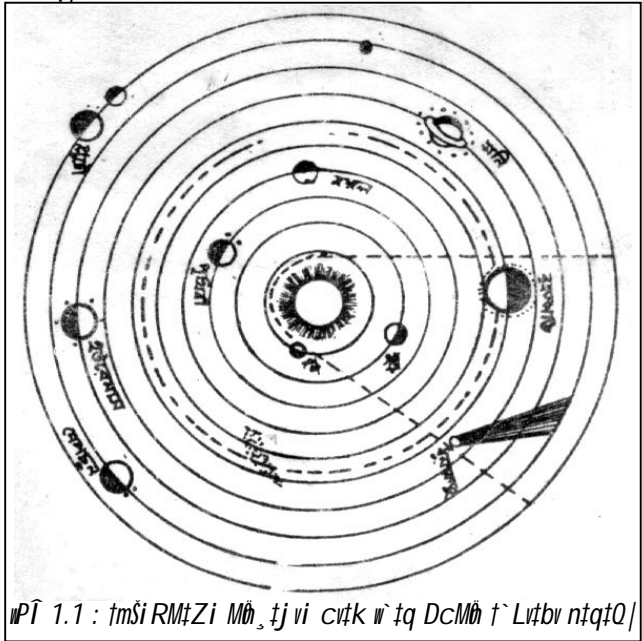
1.1.3 : bqT

tgNg` AvKvk ivtZi tejv AmsL` Avtjvi w`y`Lv hvq| G` t`j`v`K Avgiv bqT (Star) etj `w`K| th me tR`wZ``i w`R`^Avtjv I Zvc AvtQ Zvt` i`K bqT etj | mh`GKwU bqT| GwU cW`exi Z`b`vq c`l`q tZi j`q` Y`eo| cW`ex t`tK Gi `i`Zj 15 tKwU w`K`j`w`gUvi | cW`ex t`tK A`b`K `fi AvtQ etj G`tK AZ eo g`b` nq bv| cW`exi w`b`Ri tKv`bv Avtjv tbB| mh``t`K Avgiv Avtjv I Zvc cvB| cW`ex t`tK

bqT`uj j q tKvU wKtj wqUvi `fi Ae`vb KiTQ| ZvB Gt`iK AwZ qZ`I qY
gtb nq| Gt`i tKvTbv tKvTbvU mthP tPq| j q, Y eo| tKvTbvU Avevi mthP tPq
tQvU| Lwj tPrtL cQq Qq nvrvi Zviv ev bqT` t`Ltz cvl qv hvq| weAvbiv `iextbi
mrvth` GKK tKvU i tenk bqT` t`Ltz tctqtQb| Gme bqT` nvj Kv bxj, nj y ev
jvj i`zi gtb nq| mh`c`exi wBKUZg bqT`| mthP ctiB Ae`vb KiTQ c` gv
tmUivB bvgK bqT`U| c`ex t`K Gi `iZ; 8 j q tKvU wKtj wqUvi | mKj bqT`B
MwZxj | bqT`i thgb Rb` AvTQ tZgwb gZ` AvTQ| c`exi t`K bqT` ev bqT`
t`K bqT`i `iZ;gvctZ th GKK e`euZ nq ZvK AvTj vKel`etj |

1.1.14 : Mh

Avgt`i GB c`ex mthP Pviw`K NjtQ| Gi wBR`^tKvTbv AvTjv tbB, mh`t`K
AvTjv I Zvc cvq| c`ex mthP GKvU Mh (Planet)| mthP G ai`bi bqU Mh AvTQ|
thme tR`wZ` bqT` t`K AvTjv I Zvc cvq Ges bqT`i Pviw`K wv` KqT`_ Nji
Zv`iK Mh etj | bqT`i AvKl`Yi dtj Giv wBR KqT`_ Ae`vb Kti | mthP bqU
Mhni gta` KtqKw`K eo Zviv etj gtb nq| bqT`i Z`bvq Giv A`bK KvTQ Ae`vb
KiTQ etj Gt`iK Gifc gtb nq| mh`Qvov Ab`vb` bqT`i Mh GLbl Awv`vi Kiv
m`e nqub|mthP wBKU
t`K utg `fi w`K
Aew`Z Mh, tjv nj : eg,
iμ, c`ex, g`zj,
ep`uuz, kub, BDtibvm,
tbcPly I c`Uv|



wT 1.1 : tmsi Rm`zi Mh, tjvi cvk w`q Dcmh t`LvTbv ntqtQ|

1.1.5 : Dcmh

Mhni AvKl`Yi dtj
Dcmh (Satellite) Mhni
PZ`K wv` c`_ wv`
mg`q Nji | Dcmhni wBR`^
AvTjv tbB| Givl bqT`
t`K AvTjv I Zvc cvq|
Pu c`exi GKgvT
Dcmh| Ab`vb` Mhni I

Dcmh AvTQ| Gt`i gta` g`zj i 2u, ep`uuz i 12u, kub i 10u, BDtibv`mi 5u,
g`zj i 2u I tbcP`bi 2u Dcmhni big w`kl fiv`e D`j L`thvM`| iμ I eg Mhni
tKvTbv Dcmh tbB|

1.1.6 : agtKZz

agtKZz(Comet) AvKv`k AwZ w`sqKi tR`wZ`| Giv tKvTbv bqT` bq| Givl mthP
Pricv`k Dce`vKv`i NjtQ| n`vjxi agtKZz bvtg wL`vZ agtKZw c`Z 75 eQti

GKevi m#hP Pviw tK Ntj | me#kl 1986 mtj n'vj xi agtKZw cll exevmx t`tLq0 | Avevi 2061 mtj n'vj xi agtKZz`Lv hvte | agtKZz gj- Ask Gt`i gv_v ev tK>`q | Giv Lg nuj Kv Dcr`v#b MmZ | cll ex t`tK t`LqZ gtb nq, D3/4j tK>`te>`y Pviw tK Kqkvvi AveitY XvKv P#j i imk | tKv#v tKv#v agtKZzc ll exi gZ eo, tKv#vU Gi tPtq A#bK tQvU | agtKZz tK>`t`tK tewitq AvtQ D3/4j Sllvi gZ tj R | G tj R nuj Kv M`v#mi `Zmi | agtKZz tj R tKvU tKvU wKtj vngUvi j #n#Z cvti |

1.1.7 : D#v

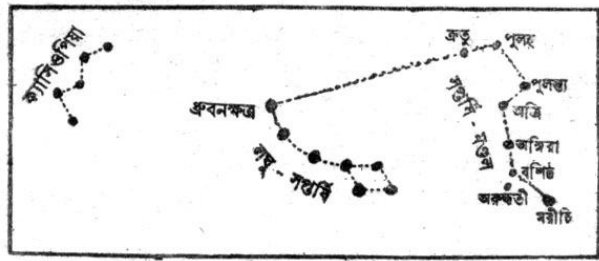
ivtZi AvKv#k gvtS gvtS QvS Av`tbi tMjvi gZ t`Lv hvq | gtb nq thb, GKvU Zviv Qv#Z Qv#Z w#f tMj ev GBgv# GKvU Zviv Ltm coj | G`tj v#k D#v (Meteor) etj | gnvk#b` A#bK RomcU tftm teovq | G`tj v Nj#Z Nj#Z cll exi Kv#Q Gtj cll ex Gt`i#k AvKI# Kti | ZLb c#U tetM D#v cll exi w`tK Qv#Z `v#k | GtK D#v cZb etj | Avevi A#bK D#v GK mt`_ Qv#Z `v#k Zv#k D#v So etj | weMZ 18 b#f#f, 1999-G wek#v# GK c#U D#v So t`tLq0b | c#U tetM cll exi evq#U#j c#ek Kitj D#v evZv#mi NI#Yi dtj m# Zv#c R#j D#v Ges c#o evZv#mB w#:#kl n#q hvq | hLb Rj#Z `v#k ZLbB Avgiv Gt`i#k t`LqZ cvB | b#t#i gZ D#v I Rb# Ges gZ# AvtQ | AwZ A# msL`K eo AvKv#i i D#v c#o QvB nI qvi Av#MB f`c#o Gtm tc#vq Ges VvUv nq | Gt`i#k D#vncU ej v nq | D#vncU I R#b KtqK Ub chS#ntZ cvti |

1.1.8 : M'vj w# I Qv#v`_

k#tZi tgNg# ivtZi AvKv#k D#i-`w#tY we`Z GK `vN#c#_i gZ t`Lv hvq | `w#Bgvb c#_i gZ t`Lvq etj GtK Qv#v`_ (Milky way) etj | c#KZc#t# e#`#i Aew`Z tKvU tKvU b#t#t#K cll ex t`tK G iKg gtb nq | gnvk#b` tKvU tKvU b#t#t#, av# KYv, wekvj ev#úK#mn b#v#v#i Kvi GK GKvU `j#k ej v nq M'vj w# (Galaxy) | tKv#v GKvU M'vj w# i Ask we#kl#k Qv#v`_ etj | ivtZi AvKv#k Avgiv thme b#t#t# Lv#j tP#L I `iextYi m#v#h` t`wL tm`tj v Ges Qv#v`_ GKvU gv# M'vj w# i A#f# | GB M'vj w# i b#v# Qv#v`_ (Milky way) | GKvUgv# M'vj w# #ZB c#q w#k n#v#v#i tKvU b#t#t# i#t#Q etj we#v#v#v# Abgv#b Ki#Qb | Avtj vKel`v#v#v# Kti Qv#v`_i I mKj b#t#t#i `i-Zi g#v#v# nq | Avtj v c#Z tm#k#U c#q wZb j # wKtj vngUvi `i-Zi AwZ#v# Kti | GB tetM P#j Avtj v gv# t`o tm#k#U cll ex t`tK P#t` hvq Ges gv# 8 v#v#t#U m#`#_#k Avtj v cll extZ Gtm tc#vq | A_P m#`c ll ex t`tK c#q 15 tKvU wKtj vngUvi `i-Zi Aew`Z | tm#i RM#Zi w#KUZg b#t#t# c# gv tm#v#v#B t`tK cll extZ Avtj v Avm#Z mgq j v#m c#q m#to Pvi eQi | Avgv#` i GB Qv#v`_ M'vj w# w#i th c#s#c ll exi w#KUZg tm c#s#t`tK cll extZ Avtj v Avm#Z mgq j v#m c#q 2 j # 25 n#v#v#v# eQi | tKvU tKvU b#t#t#i gvtS m#P GB Qv#v`_ Aew`v#b Ki#Q | we#v#v#v# wek#v#v#U KtqK n#v#v#v#i tKvU M'vj w# i Aw`Zi Av#v#v#v# Ki#Z m#q# n#t#Qb | tKv#v#v# tKv#v#v# M'vj w# t`tK cll extZ Avtj v Avm#Z c#q 500 tKvU eQi mgq j v#m | fv#Z AevK j v#m wK wekvj GB wek#v#v#v#U!

1.1.9 : b`qI`gUj

c`PxbKv`tj i tR`wZie`MY AvKv`tki b`qI` ,tj v`tk newfbre` tj fVM Kti Zvi wfbæwfbæ
 bvg w` tq`Qb | ARvbr c` Pj v`P`tj i mgq Gme b`qI`i Ae`vb t`tk w` K w`bY` I w`R
 Ae`vb Rvbr m`æ nZ | thgb, DEi w`tki AvKv`tk th mvZw D`34j b`qI`K Lvwj
 tPv`L KvQvKwQ t`Lv hvq tm` ,tj vi bvg t` lqv n`q`Q mBw`gUj | mij`tiLv w`tq h`y
 ntj mBw`gUj`K GKw` c`kævaK w`P`yi gZ g`tb nq | Gifc b`qI` mgvvi`K
 b`qI`gUj (Corstellation) etj | tR`wZie`iv AvKv`tk G ai`bi 88w` b`qI`gU`tj i
 K`v etj b | mBw`gU`tj i `w` b`qI` c`jn I µZ | G `w` b`qI`K GKw` mij`tiLv Øviv
 h`y Kti tiLw`tK w`b`Pi w`tk evov`tj Zv GKw` D`34j b`qI`i w`bKU hvq | GB
 b`qI`w`i bvg a`yZviv | a`yZviv`K memgt`q DEi AvKv`tk w`i n`q Av`Q etj g`tb nq |
 ZvB GB b`qI`w`i Ae`vb t`tL A`Pbv RvqMvq i`v`Zi tejv w`K w`bY` Kiv nq | Z`æ
 a`yZviv`K t`Kej gv`I DEi tMvj v`taB t`Lv hvq | b`qI`gU`j xi ga` mBw`gU`j , Kij c`jy,
 K`w`ml w`cqv, j NyvBw` BZ`w` bvg D`tj - L`thvM` |



w`P`I 1.2 : a`æZviv, mBw`gU`j I K`w`ml w`cqv

mvisk

gnvKv`tki M`h, DcM`h, b`qI`, ag`KZzD`ev, cvj mvi BZ`w` t`K tR`wZie` etj | gnvæ`tk`
 fvmg`vb thme tR`wZie`i w`R`^ Av`tjv Av`Q Ziv`i b`qI` etj | Av`tjvK`ænv`b
 tR`wZie`K M`h etj | M`h` ,tj vi Pw`i w`tk Nyv`qgvb w`R`^ Av`tjvK` ænv`b tR`wZie`K
 DcM`h etj | gnvKv`tk giv`S giv`S GK c`Kvi tR`wZie` w`KQy` t`bi Rb` t`Lv hvq | Avevi
 A`k` n`q hvq | Gme tR`wZie`K ag`KZze`tj | my`i- AvKv`tk `f`v`tj w`KZ tg`Ni gZ
 Av`i Y`K bxn`vvi Kv etj | A`U`Kvi i`v`Z AvKv`tk D`34j ØvB `xN`c`t`i gZ Zvi Kv i`v`k
 t`Lv hvq Ziv`K Qvqic` etj | i`v`Zi AvKv`tk giv`S giv`S Qv`S`i Av`t`bi tMvj v`tk D`ev
 etj |

c#VvEi gj-vqb- 1.1

m#K DËti i c#k #K (v) #Pý w b|

1.1| ÒAvKv#k mh,®P>`fn AmsL` tQvU-eo Av#j vKucÛ t`Lv hvq, G#` i#K GK K_vq

#K ej v nq?

K. #mSi RMr

L. M#hvbçÄ

L. tR`vwZ®ç

N. bxnvwv Kv

1.2| c#_ex #K?

K. b#j#

L. M#h

M. DçM#h

N. Qvqvc_

1.3| tKv#bv tR`vwZ#ç i tj R Av#Q?

K. Dév

L. ag#KZz

M. bxnvwv Kv

N. Qvqvc_

1.4| c# gv #m>UivB bvgK b#j# t_#K c#_exi `iZ KZ #K#j vqUvi?

K. #Zb j #j tKvwU gvBj

L. Pvi j #j tKvwU gvBj

M. c# j #j tKvwU gvBj

N. AvU j #j tKvwU gvBj

1.5| KvQvKv#Q Ae`vbi Z ARm#bxnvwv Kv I tKvwU tKvwU b#j#i `j #K #K etj?

K. a#Zviv

L. Dév

M. M`vj vw

N. c# gv #m>UivB

DËi : 1.1 L, 1.2 L, 1.4 N, 1.5 M

kb`-ib c#Y Kily

2.1| c#_ex t_#K mh®..... #K: vq: `#i Aew`Z

2.2| ep`úwzi #U DçM#h Av#Q|

2.3| #mSi Rm#zi M#ni msL`v #U|

DËi : 2.1.15 tKvwU #K:vq: 2.2. 12 #U, 2.3. 9#U

ms#j#B c#æ

1| MvwYvZK f#Mj Kv#K etj ?

2| M#h Ges DçM#ni msÁv w b|

3| #mSi RMZ Kv#K etj ?

iPbvj-K c#æ

1| tR`vwZ®ç #K ? vewfbac#Kvi tR`vwZ#ç i veei Y w b|

cW 1.2

tmŠi RMr

Df'ik`

GB cW tkfI Avciob

- 1 tmŠi RMr uK Zv RvbZ cvi teb,
- 1 mh@mútk@eei Y w` tZ cvi teb,
- 1 mfhP bquU Mñni eYv w` tZ cvi teb,
- 1 wefbaMñ Ges DcMñni m@útk@avi Yv cvi teb|

tmŠi RMr

gnvKviki AmsL` tR`wZ@ ubtq th RMtZi mwó ntqtQ ZvK wekRMr ev wekpevU ejv nq| mhK GB wekRMtZi GKwU bqI ejv nq| mh@I Gi PZ@K NY@Z tR`wZ@gUj xK GKfI tmŠi RMr (Solar system) etj | mh@Gi Pvi w` tK NY@Z bquU Mñ, Gme Mñ i Pvi w` tK NY@Z 44wU DcMñ, mfhP Pvi w` tK NY@Z nvRvi nvRvi qZ`MñvYz I j q j q agtKZzb tq MwZ ntqtQ tmŠi RMr| mh@tmŠi RMtZi tKf`^a Ae`vb Ki tQ| wekpevU i wekij Zvi gta` tmŠi RMr wvZvšB tQvU|

1.2.1 : mh@

tmŠi RMtZi tKf`^a i tqtQ mh@(Sun)| GuU GKwU gvSivi AvqZtbi bqI | mfhP e`vm c@q 14,00000 uK.wg. c@exi e`vm c@q 13,000 uK.wg. | mfhP AvqZb c@ex Afcqv c@q 13 j q , Y eo| c@ex t` tK Gi Mo` fZ; c@q 150 wgvj qb wKtj wgvUvi | c@exi AvyK MwZ I ewl R MwZi gZ mfhP I MwZ AvtQ| mh@c@q 25 w` tB GKevi wvR Afcqv Dci AveZ@ Kti (Nti) Ges wvR M'vj wv i PZ@K efvKvi ct_ c@Z 20 tKwU eQti GKevi Nti | mh@c@U i Kg DEB| Gi tKf`^a DEvc 8 wgvj qb t` tK 40 wgvj qb wvM@tmj wvqv Ges c@f` tki DEvc c@q 5,700 wvM@tmj wvqv | wKšbzh@h Zvc wevKiY Kti Zvi gvI 200 tKwU fvM i GK fvM c@ex tZ Gtm tcvq | A_P GB Zvtci dtj B f; c@o me DvM I c@Yx tetP _vK | mfhP Mñni msL`v bquU | G_s t j v nj : ey, i μ, c@ex, g½j, ep`úwZ, kvb, BDti bvm, tbcPly I c@Uvi |

1.2.2 : ey

ey (Mercury) mfhP wvKUZg Mñ | bquU Mñni gta` AvqZtB GuU qZzG Ges e`vm gvI 4,850 uK.wg. | GuU 88 w` tB GKevi mfhP Pvi w` tK tNvi | mh@t` tK Gi Mo` fZ; c@q 58 tKwU wKtj wgvUvi | mfhP AfcqvKZ. Kv tQ etj GLv tB ZvcgvI v Lp tenk | ZvB GLv tB tKv tBv Rxfei Aw`Z; tB etj gtb Kiv nq| m@úwZ weAvbxiv

gnvib`hvb t_K ejai th Qwe wbtqtQb ZvtZ eSv hraq ejai Dcwizj Pti gZ|
ejai tKvrbv DcMh tbB|

1.2.3 : iµ

iµ (Venus) m#hP wZxq wBKUZg Mh| Gi AvqZb cwxexi AvqZtbi cUq mgvb Ges
e`vm cUq 12,000 wK.wg.| mh`t_K Gi Mo `i-Z; cUq 10.8 tKwU wK.wg.| m#hP
Pvi w`K GKevi Nji AvmtZ Gi mgq jvM 225 w`b| mh`l cwxexi KvQvKwQ nI qvq
GtK D3/4j Zvivi gZ t`Lvq| tfvi ivtZ GtK Avgiv ceP tKi AvKvK t`wL| ZLb
GtK ejv nq i`KZviv| Avevi mU`vtejvq GtK cwDg AvKvK t`Lv hraq| ZLb GtK
ejv nq mU`vZviv| iµ Mhni tKvrbv DcMh tbB| GB Mhni DcwifvM mh`t`Lv hraq
bv| i`iµ w`b l ivtZi gta` Avtjvi w`tKl tKvrbv ZviZg` nq bv|

1.2.4 : cwxex

i`iµi ci cwxexB (Earth) m#hP wBKUZg Mh| mh`t_K Gi Mo `i-Z; cUq 15 tKwU
wKtj wglvvi | cwxex PviwU Mh t_K eo Ges Aci PviwU Mh t_K tQvU| Gi tPtq tQvU
PviwU Mh nj : eS, iµ, g1/2 l cUv Ges eo PviwU Mh nj : ep`uuz, kw, b,
BDtibvm l tbcPly| Gi e`vm cUq 13,000 wK.wg.| GKgvI cwxextZB Dw`c l cUxi
emevtmi Dc`hivMx cwi`tek itqtQ| cwxexi evqgU`tj B AvtQ cUqvRbxq Av`tRb l
bvBtU`tRb Ges f`c`o AvtQ ht`o cwb| GRb` G MhwtK Av`k`Mh ejv nq| cwxex
GKevi mh`K cUwY Ki`Z mgq tbq 365 w`b 5 N`v 48 wgvbu 46 tm`K`U| cwxexi
GKwU DcMh AvtQ| Gi bvg Pti |

1.2.4.1 : Pti

cwxexi GKgvI DcMh nj Pti | Pti cwxexi Pviw`K wBR K`ct` 29 w`tb GKevi
NjtQ| Gi fi cwxexi f`ii 18 fivMi 1 fivM| cwxex t_K Gi Mo `i-Z; cUq
3,81,500 wKtj wglvvi | Pti i e`vm 3,475 wKtj wglvvi | 1969 mvtj Gtvtjv-11
bvgK btfvhu`b Pto h`i`v`to`i wZbRb btfvPvix cUg Pti` AeZiY Ktib| tmLv`b
Zviv t`L`Z cvb, Pti` cwb, evqyev tKvrbv MvQcvjv tbB| Pti i wBR`^Avtjv tbB|
m#hP Avtj vtZ Avtj wKZ nq|

1.2.5 : g1/2j

mh`t_K `i-Z; w`f`E`Z g1/2j (Mars) PZz`Mh| tmSi RMtZ cwxexi cti g1/2j Mhni
Ae`vb| mh`t_K Gi Mo `i-Z; 22.8 tKwU wKtj wglvvi | Gi e`vm 6,787 wK.wg|
cwxexi cUq A`aR| m#hP PZz`K GKevi NjtZ Gi mgq jvM cUq 687 w`b| g1/2j
Mhni `w tQvU DcMh AvtQ| Gt`i bvg wlv`gym Ges tdrtevm| KtqK eQi AvtM
h`iv`o`KZ`R t`i`Z GKwU btfvhu`b g1/2j Mhni AeZiY Kti tmLv`b t_K A`bK Z`
cwm`tqtQ| g1/2j Mhni evqgU`tj mvgv` bvBtU`tRb `vKv m`E`l Gi evqgU`j Rieb

ariYi AbKj- bq| g½j Mh cexi Zjbvq AþK tenk WÜv| ZvcgvÎv ingvt¼i
AþK wþP| g½tj i is AþKÜv jvj þP|

1.2.6 : ep`úwZ

tmSiRMþZi epËg Mh ep`úwZ (Jupiter)| Gi e`im c¼q 143,000 wK.wg.| cexi
Zjbvq GiU c¼q 1300 ,Y eo| mh®t_þK Gi Mo `i-Z; 77 tKwU wKtj wvUvi |
ep`úwZ c¼q 12 eQti GKevi mþhP Pviw þK tNvti | Gi 16wU DcMh Awne®Z.nþqþQ|
AvqZþb enr etj GþK MhivR ejv nq|

1.2.7 : kwb

kwb (Saturn) tmSiRMþZi wZxq epËg Mh| Gi e`im c¼q 120,000 wK.wg. mh®t_þK
Gi Mo `i-Z; 143 tKwU wK.wg.| GiU 29 eQti GKevi mþhP PZw þK Nþj | kwbþK
wNvti iþqþQ nvRvi nvRvi mxi ej q| Gi 22wU DcMh iþqþQ| kwb metþqþQ eo
DcMh nj UvBUvb Ges meþKl Awne®Z.DcMhni bvg b`vtUvvm|

1.2.8 : BDþibvm

`iþZi w`K t_þK BDþibvm (Uranus) tmSiRMþZi mBg l ZZxq epËg Mh| mh®t_þK
Gi `i-Z; c¼q 287 tKwU wKtj wvUvi | Gi Mo e`im 49,000 wKtj wvUvi | GiU Lvij
tPvþL t`Lv hvq bv| 84 eQti GiU mþhP PZw þK wR K¶cþ_ Nþj | Gi cþwU Mh
Awne®Z.nþqþQ| G Mhni l kwb gZ ej q iþqþQ| Zte ej q ,tjv D¾aj bq|

1.2.9 : tbcPly

`iþZi w`K w`q tbcPly (Naptune) tmSiRMþZi Aóg Mh| Gi e`im c¼q 48,000
wK.wg| mh®t_þK Gi `i-Z; 450 tKwU wKtj wvUvi | GiU 165 eQti GKevi mþhP
Pviw þK wR K¶cþ_ Nþj | Gi `wU DcMh AvþQ| Gþ`i bvg UvBUvb Ges tbivBW|
m`úwZ G Mhni `wU ej q Awne®Z.nþqþQ|

1.2.10 : cþwv

`iþZi w`K t_þK cþwv (Pluto) tmSiRMþZi beg Mh| mh®t_þK Gi Mo `i-Z; c¼q
590 tKwU wKtj wvUvi | Gi e`im c¼q 6,000 wK.wg| GiU ¶þZg Mh| 284 eQti GiU
GKevi mhþK cÜw¶Y Kþi | Gi GKwU DcMh Awne®Z.nþqþQ| GB MhniU 1930 mþj
weÁvbx KwBW UgevD Awne®vi Kþi b|

1.2.11 : MhivYgþ

g½j l ep`úwZ Mhni ga`eZP cþ_ mþhP Pviw þK `j teta NjþQ tek wKQy¶þ`
tR`wZ®c|Gþ`i e`im 1.6 wKtj wvUvi t_þK 805 wKtj wvUvi Gi gþa`| Gme
tR`wZ®þK MhivYejv nq| weÁvbxiv mnmþwaK MhivYj mÜvb tctþqþQb| `j ex Ae`vq
AvþQ etj Gþ`i þK GKwÎ Zfite MhivYgþ etj | Gþ`i cKZ.Drm ev weKvK m`úþK®
GLbl tKvþbv mwZ Z` Rvbn hvqwb|

mvisk

mh®l Gi Pviw þK NYþbiZ tR`wZ®c gÜj þK GKþÎ tmSiRMr etj | tmSiRMþZi
GhveZ bqÜw Mh Ges Mh ,tjvi Avevi AþK ,tjv DcMh Awne®Z.nþqþQ| mhþK tK`
Kþi Mh, DcMh, MhivYgþ, AmsL` agþKZzl Dév wþq mwó nþqþQ tmSiRMr| mh®Ges

cđ gv tmUivB cᵂ_exi ᵂbKueZPb¶¶ | thme tRᵂᵂZᵂᵂi ᵂbRᵂ^Avᵂj v Ges Zvc tbB
Ges m¶hP Pvi ᵂᵂK tNᵂᵂi Zᵂᵂ`iᵂK ejv nq Mđ | Gijc AvieᵂZ. Mđni msLᵂv 9ᵂU |
Avᵂᵂᵂ`i GB cᵂ_exl GKᵂU Mđ | meᵂPᵂq eo Mđ epᵂᵂᵂZ Avᵂ tQvU Mđ ey | thme
tRᵂᵂZᵂᵂᵂ Mđni PZᵂᵂK tNᵂᵂi Ges ᵂᵂᵂRi Zvc ᵂKsev Avᵂj v tbB Zᵂᵂ`iᵂK DcMđ etj |
Pᵂ cᵂ_exi GKgvᵂ DcMđ | kᵂb Mđni meᵂPᵂq teᵂk msLᵂK DcMđ AvᵂQ |

cᵂVᵂEi gjᵂᵂqb 1.2

mᵂᵂK DĒᵂi cᵂᵂk ᵂK (ᵂ) ᵂPᵂᵂ ᵂ b |

- 1 | tKᵂᵂᵂᵂU cᵂ_exi PZᵂᵂK tNᵂᵂi?
K. Mđ L. DcMđ
M. bᵂᵂᵂᵂi K N. MđᵂYy
 - 2 | tmᵂiRMᵂZi Mđni msLᵂv KqᵂU?
K. 5 L. 6 M. 7. N. 9
 - 3 | epᵂᵂᵂ I ¶ᵂZᵂg Mđ tKᵂᵂᵂᵂ ᵂᵂᵂ?
K. epᵂᵂᵂ I cᵂᵂᵂ L. epᵂᵂᵂ I ey
M. ᵂbcPᵂy N. BDᵂi bᵂm
 - 4 | UᵂBUᵂb tKᵂᵂᵂᵂ Mđni DcMđ?
K. kᵂb L. epᵂᵂᵂ
M. ᵂbcPᵂy N. BDᵂi bᵂm
 - 5 | tKᵂᵂᵂᵂU AvᵂkᵂMđ?
K. ey L. iᵂ M. gᵂᵂj N. cᵂ_ex
- DĒi : 1 | L. 2 | N. 3 | K. 4 | M. 5 | N**

mZᵂᵂᵂᵂ ᵂᵂYᵂ

- 1 | cᵂ_ex m¶hP DcMđ |
 - 2 | ᵂᵂZᵂi ᵂ K ᵂᵂᵂq cᵂᵂᵂ tmᵂiRMᵂZi cᵂᵂg Mđ |
 - 3 | m¶hP Pvi ᵂᵂK NYᵂᵂi Z tRᵂᵂZᵂᵂᵂᵂ gᵂᵂj ᵂK GKᵂᵂᵂ tmᵂiRMZ etj |
 - 4 | cᵂ_exi 5ᵂU DcMđ AvᵂQ |
- DĒi : 1 | 1ᵂg: 2 | ᵂg: 3 | ᵂg: 4 | N 5 | ᵂg:**

GK Kᵂᵂ DĒi

- 1 | cᵂ_ex tᵂᵂK m¶hP ᵂᵂZᵂKZ?
- 2 | eyMđ KZᵂᵂ ᵂb GKeᵂi mᵂᵂK cᵂᵂᵂY Kᵂi?
- 3 | epᵂᵂᵂZi KqᵂU DcMđ AvᵂQ?

iPᵂᵂᵂᵂK cᵂᵂe

- 1 | tmᵂiRMᵂ KᵂᵂK etj ? ᵂPᵂᵂᵂᵂᵂᵂ eYᵂᵂ Kᵂi |
- 2 | tmᵂiRMᵂZi th tKᵂᵂᵂᵂ ᵂZᵂᵂU Mđni eYᵂᵂ ᵂᵂ b |

Gm Gm um tC0Mg

M'vj vw qvm (Galaxious) Gi A_©ntjv 0`gij x^ G Kvi#Y Qirqvc#_i Aci big
wgw#l #q (Milkyway) ev `gij c_/

1.3.4 : agtKZz

mvaviYZ tgNgš ivtZi gnvKvfk grtS grtS GK cKvi tR`wZt`i Aweffe NtU|
Gme tR`wZt`i wKQywtbi Rb` D`q ntq Avevi A`k` ntq hvq| Gme tR`wZt`i K
agtKZzejv nq| agtKZzAvmtj ajv Avi VvUvq RgvU erav M`vpmi GKwU e`lcU|
GB M`vmxq e`lcU bŕŕŕi Pvi w`K` xNŕt`_ cwi agY Kti | mŕhP wKUEZPntj cŕŕŕ
A`úo tŕŕNi AvKvfi t`Lv hvq| mŕhP Zvfc GB RgvU erav M`vmxq wCŕ tŕŕc I Vv
M`vmfK wCŕŕbi w`K tVtj t`q etj B Zv agtKZz mekvj tj R AvtQ etj gtb nq|
tmŕiRMtZi gta`B agtKZz emevm| meÁvbx GwGŕ n`vjx th agtKZz Awme`vi
Ktib Zvi bvg n`vij i agtKZz GwU 75 eQi cici t`Lv hvq| meŕkŕl 1986 mŕtj
n`vij i agtKZz t`Lv wMtqŕŕj | Avevi 2061 mŕtj n`vij i agtKZz t`Lv hvte|

mvivsk : Ašhxb gnvKvfk tKwU tKwU bŕŕŕ, anvj KYv Ges mekvj er`úwCŕ wbtq
tR`wZt`i gŕŕxi th `j mŕŕ ntqŕQ Zvi bvg M`vj wŕ | M`vj wŕ i ŕŕž` AskŕK Qvqvc_
ejv nq| AŬKvi AvKvfk Dŕŕj `xB` xNŕt`_ i gZ th Zvi KviwK t`Lv hvq ZvŕKB
Qvqvc_ etj | ewŕ nevi wK cŕiB mŕh`DVtj A`er AvKvfk , wŕ , wŕ ewŕ nt`Q A`P
AvKvfk mŕh`AvtQ Ggb Ae`vq isabyt`Lv hvq| Gŕŕŕŕ ŕŕž` cwib KYv wCŕŕŕgi gZ
KvR Kti, GŕZ AvtjvK me`QžY ntq AvKvfk i Mŕtq th wewŕŕ etŕP eŕPvc mŕŕ Kti
ZvŕK isabyetj | isaby mvZwU is-Gi mŕwŕŕB bvg nj tebAvmNkvj | agtKZz
AvKvfk i GK me`ŕŕKi tR`wZt`i | agtKZz ajv Avi VvUvq RgvU erav M`vpmi GKwU
e`lcU | Giŕc GKwU agtKZz bvg ōn`vij i agtKZz GwU cŕŕZ cŕŕŕi eQi ci ci
GKevi AvKvfk t`Lv hvq|

cvŕVŕŕi gj`vqY- 1.3

mŕwK Dŕŕi i cvŕk wK (v) wŕŕy w`b|

- M`vj wŕ i ŕŕž` AskŕK wK etj ?
K. agtKZz L. Qvqvc_ M. eYŕŕx N. isaby
- n`vij i agtKZz meŕkŕl 1986 mŕtj t`Lv wMtqŕŕj | Avevi tKvŕbv mŕtj t`Lv
hvte?
K. 2061 L. 2051 M. 2041 N. 2031

Dŕŕi : 1| L. 2| K

mŕwŕŕB cŕŕe

- agtKZz msÁv w`b|
- Qvqvc_ KvŕK etj ?

cW 1.4

cW_{exi} AvKvi

Df'ik

GB cW tkfI Avcb-

- 1 cW_{exi} AvKvi tKgb Zv e'vL'v KiZ cviteb,
- 1 cW_{exi} AvKviti i'c'f' h'v' w'Z cviteb,
- 1 cW_{exi} AvqZb, cwiwa I e'vm KZ Zv Df'k KiZ cviteb/

1.4.1 : cW_{exi} AvKvi

Avgiv Lwjj tPrfL cW_{exi} hZUKz' mL ZvZ gtb nq cW_{ex} mgZj | wKšZcW_{exi} cō mgZj bq| cW_{exi} mWK AvKvi Rvbri Rb" GKwU Kgj vtj eynwZ wbb| fvtjv Kti j'f' Kib, Kgj vtj ej' tMvj Zte Gi Dctii Ges wbfPi w'K mvgvb" Prcv| cW_{exi} AvKvi AtbKuv Kgj vtj ej' gZ tMvj wKšZGi `B' w' tK AwZ mvgvb" Prcv| Zte cW_{ex} Kgj vtj ej' gZ AZ tenk Prcv bq|

GKwU AvUvi i'w' I GKwU dtej wbb| i'w'w' tMvj wKšZ'v'v', dtej wU c'j'v'v' tMvj | dtej i AvKvi w'k' e' t'K tMvj K ej'v nq| cW_{exi} AvKvi cōq tMvj tKi gZ| ZvB GtK AwfMZ tMvj K ej'v hvq| L., c.-250 mtj tR'wZie© BivUvm' wbm cW_{ex} th AwfMZ tMvj K Zv RvbZb| mvari Y R'w'wZK wq'g' wZw Zv wY' KtiZb, hv AvRI Dbz c'w' i' w'w' tL w'f' gtb Kiv nq|

1.4.2 : cW_{exi} cwiwa I e'vm

cW_{ex} 24 NÈvq Avcb Af'f' GK cvK tNvti | dtj GKB RvqMvq 24 NÈv ev 1440 w'w'U ci mh'f' tV| `w' w'v'bi g'f'a" mh'f' Vvi mgq cv_℞" t' t'K cW_{exi} cwiwa (A_℞ w'bi f'f' i' Lvi `N' w'Y' Kiv hvq|

BivUvm' w'w' mi MYbv Ab'v'q-

- cW_{exi} cwiwa cōq 25,000 gvBj |
- cW_{exi} w'bi f'f' q' e'vm 7,927 gvBj |
- cW_{exi} tgi'f' kxq e'vm 7,900 gvBj |

A_℞ cW_{exi} tgi'f' kxq e'vm w'bi f'f' q' e'v'w' mi P'v'Z 27 gvBj Kg| GtZB cōw'YZ nq th cW_{ex} GKwU AwfMZ tMvj K (Oblate spheroid)|

cō'g' w'bi f'f' i' Lvi Dci `w' w'v'bi ga'Kvi mh'f' DVvi cv_℞" Ges `v' w'w' ga'Kvi `i-Z; w'Y' Kiv nq| G t' t'K KZUKz' ieZ'f' w'v'bi ga'Kvi mh'f' DVvi mg'q' i' cv_℞" 1 w'w'U Zv w'Y' Kiv nq| GB `i-Z'K 1,440 (A_℞ 24 NÈvi w'w'U i' msL'v) Øviv , Y KitiB cW_{exi} cwiwa cvl qv hvq| D'PZi Mw'Zi m'f' Ab'v'f' th tK'v'v' tMvj tKi cwiwa tK π ev Gi Mw'YZK gvb 3.14 Øviv f'w' Ki'f' Zvi e'vm cvl qv hvq|

MmYwZK mgm`v : AvdKv gnv`tki Kt½vZ ubi ¶iLvi Dcti `y knii GKUuZ AciuJi tPtq 8 ugubU ci mh`I¶v| kni `y ga`Kvi `iZj 138.5 gvBj ntj cL_exi teo ev cwi na KZ uKtj vugUvi? (1 gvBj = 1.61 uK.ug. ati)

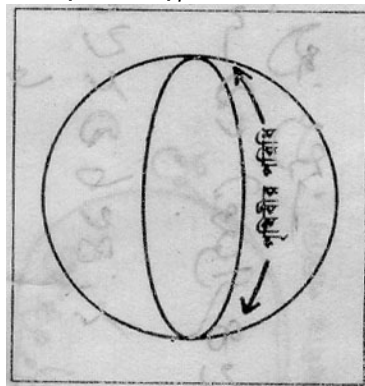
mgvavb : 8 ugubU e`eavtb mh`I¶v 138.5 gvBj `iZj|

$$1 \text{ " " " } 138.5 \times 8 \text{ " " }$$

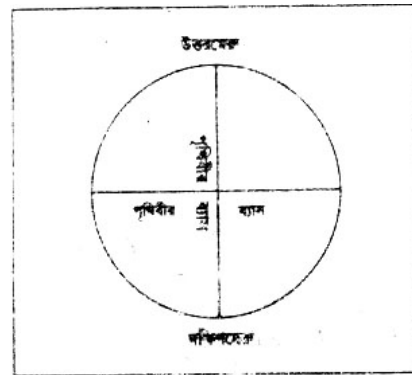
$$\therefore 24 \text{ N} \ddot{\text{E}}\text{v ev } 1440 \text{ " " } (138.5 \times 8) \infty 1440 \\ = 24,940 \text{ " }$$

$$\therefore cL_exi \text{ cwi na } = 24,930 \text{ gvBj ev } 25000 \text{ gvBj c} \ddot{\text{U}}\text{q} \\ = (24,930 \infty 1.61) \text{ uK.ug.} \\ = 40,137 \text{ uK.ug.}$$

cL_exi AvqZb tei KitZ ntj cUtgB Gi cwi na I e`vm ubY¶ Kiv `iKvi| ueAvbxt`i intme gtZ cL_exi cwi na cUq 40,000 uK.ug. cL_exi Mo e`vm cUq 12,800 uK.ug.| e`vm Rvbn vKtj th tKvbn tMj tKi AvqZb D`PZi MmYtZi mfi i mrvvth` ubY¶ Kiv hvq|



¶T 1.3 : cL_exi cwi na



¶T 1.4 : cL_exi e`vm

1.4.3 : cL_exi AvqZb

ueAvbxt`i intme gtZ cL_exi ce`cuotg ubi ¶jxq e`vm 12,757 uK.ug.| DEi - `¶¶tY tgiye`vm 12,714 uK.ug.| cL_exi Mo e`vm 12,735.5 uK.ug.| mij intmte GB e`vm tK 12,800 uK.ug. aiv nq| AZGe cL_exi Mo e`vm va¶j 6400 uK.ug. |

MmYwZK mfi vbnv tKvbn tMj tKi AvqZb = $4 \infty \pi \infty (e`vmva)^2$ hLb [π Gi gvbn 22/7 aiv nq|]

GB intmte cL_exi tMj K Kíbn Kitj ,

$$cL_exi \text{ AvqZb } = 4 \infty \pi \infty (e`vmva)^2 \text{ nte} \\ \text{ev, } cL_exi \text{ AvqZb } = 4 \infty 22/7 \infty (6,400)^2 \text{ eM} \text{ uK.ug.} \\ = 4 \infty 22 \infty 4,09,60,000 \times 7 \text{ eM} \text{ uK.ug.} \\ = 36,044,80,000 \times 7 \\ = 51,49,25,714.3 \text{ eM} \text{ uK.ug.}$$

A_@ cexi ctoi AvqZb 51 tKvU 49 j 9| 25 nvRvi 714.3 eMqK.ig. |

mvisk : Lwj tPvL cexi hZUKzAsk t`Lv hvq ZvtZ gtb nq cex mgZj |
cexK Kgj vtj ey mv_ Zzv Kti Gi AvKvi Kgj vtj ey gZ gtb Kiv nq| cex
dtejt i gZ tMvj l bq| cexi AvKvi cOq tMvj tKi gZ| GtKB AvFMZ tMvj K ej v
nq| AZGe, cexi AvKvi AvFMZ tMvj tKi gZ| cexi Mo eim - 12,800 uK.ig.
aiv nq|

- cexi cwi na - 40,137 uK.ig.
- cexi AvqZb - 51,49,25,714.3 eMqK.ig.

cvtVei gjvqb 1.4

mVK DEti i cvk vK (v) vPy v b |

- 1| cexi AvKvi tKvbmUj gZ Kiv Kiv AvAK tkq?
K. mgZj L. Kgj vtj ey
M. dtej N. AvFMZ tMvj K
- 2| cexi Mo eim KZ?
K. 1280 uK.ig. L. 12800 uK.ig.
M. 128000 uK.ig. N. 1280000 uK.ig.
- 3| cexi cwi na KZ?
K. 40137 uK.ig. L. 50237 uK.ig.
M. 12800 uK.ig. N. 25 tKvU uK.ig. cOq

DEi : 1| N. 2| L 3| K

kbv ib ciY

- 1| cexi AvKvi ----- uK: ig:
- 2| cexi AvqZb ----- uK: ig:
- 3| cexi Mo eim ----- uK: ig:

msvB cke

- 1| cexi AvqZb nmvtei mFuU ij Lj|
- 2| cexi cwi na l eim ej tZ uK tevSb?

iPvj-K cke

- 1| MvYvZK vbqtg cexi cwi na l AvqZb vbYq Ki Y|

cW 1.5

cW_{exi} tMvj KtZj cQvY

Df`k`

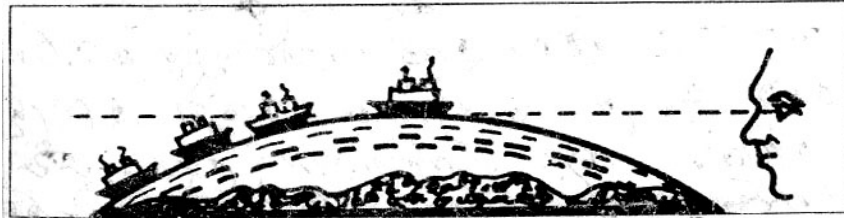
GB cW tk`l Avcib

- 1 cW_{exi} AvKvii mc`q hvy` Dlvcb KtZ cvi`eb,
- 1 cW_{exi} tMvj KZj cQvYi wP` A`b KtZ cvi`eb|

1.5.1 : cW_{exi} tMvj KtZj cQvY

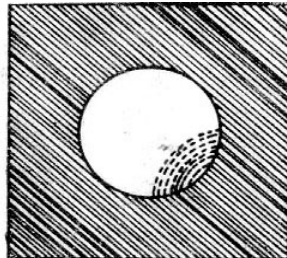
cW_{exi} AvKvi th tMvj tKi gZ Zv weAvbxiv eu ce`_t`K hvy` cQvY w`tq eSv`Z tPtqtQb| cQvY, tj v wbtP t` l qv nj :

- 1| `i mgy`n`Z Zt`i w`tK AvmtZ _vKv tKv`bv Rvrv`Ri gv`z mevi AvtM t`Lv hvq| Zvici mgk tarqv tei`bvi tPvO, Qv` Ges metk`l RvrvRiUi Atc`vKZ. wbtPi w`K t`Lv hvq| cW_{ex} tMvj etj B Gi`c nq| cW_{ex} hv` mgZj nZ Zte RvrvRiUi me AskB GK mv`_ t`Lv thZ|



wP` 1.5.1 : mgy`c`o Rvrv`Ri mrv`th` cW_{exi} tMvj KZj cix`Y

- 2| P` Mh`Yi mgq cW_{ex} mh`q P`i i gvSLv`b Gtm c`o| ZLb cW_{exi} Qvqv P`i i Dci c`o| GtKB P` Mh`Y etj | G mgq cW_{exi} Qvqv tMvj vKvi t`Lvq| cW_{ex} tMvj vKvi bv ntj G Qvqv tMvj vKvi t`LvZ bv|



wP` 1.5.2 : tMvj vKvi e`i Qvqv tMvj nq

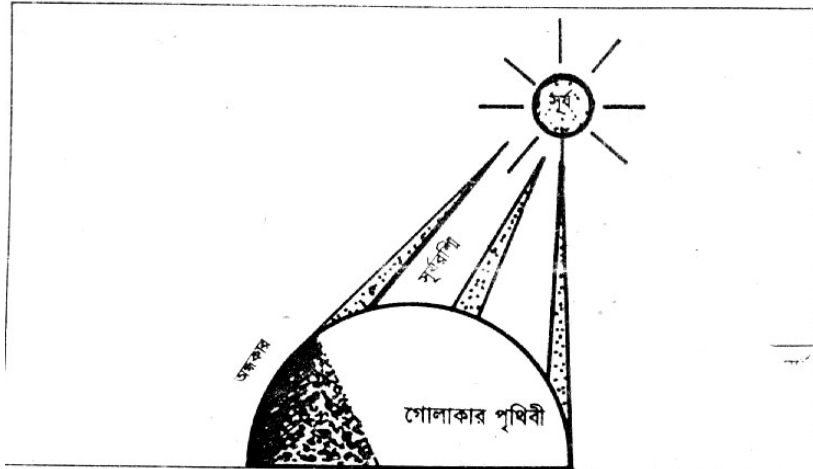
- 3| tKv`bv vekyj tLv v gv`V `wotq Pvi w`tK ZvKv`j gtb nq thb AvKvk f`c`oi mv`_ GKvU e`E`j Lvq wgtk tM`Q (cW_{exi} c`o ev Dcwi f`vM`K f`c`o etj |) G

- eĒti Lvi bvg w MŠti Lv| f;çĀ t_ĤK hZB Dçti DVv hvq, w MŠti Lvi çwi wa ZZB teĀo hvq (wPĪ t`Lçy)| çw_exi AvKvi tMvj ĤKi gZ etj B Gi Kg NĤU|
- 4| çw_ex çĀĀi mKj RvqMvq GKB mgq mĤĤ q wKsev mĤĤ Īnq bv| çw_ex hw` mWZ`B mgZj nZ ZĤe GUv mĀe nZ| wKŠĤtMvj etj Zv nq bv| Ae`vb Abçyqx wbw`Ā mgtqi e`eavĤb wewfbæ`vĤb wewfbæmgĤq mĤĤ q Ī mĤĤ Īnq| G t_ĤK çĀwYZ nq çw_ex tMvj vKvi |



wPĪ 1.5.3 : Dçti DVĤZ w MŠti Lvi çwi wa evotZ`vĤK

- 5| çw_exi tKvĤbv GK`vĤb nĤZ RvrvĤR ev DĤovRvrvĤR KĤi hvĪv KĤi Ges w`K çwi eZĀ bv KĤi GKB w`ĤK AMĤi nĤj t`Lv hvq th`vb nĤZ hvĪv i iytqQj w`K tmB GKB`vĤb çZ`veZĀ mĀe nĤqĤQ| Gifc çixĤv KĤi g`wMj vb, tW`K, Kç çĀy bweKMY w`xvŠĪv ĤqĤQb çw_ex tMvj vKvi |



wPĪ 1.5.4 : çw_ex tMvj vKvi, ZvB wewfbæ`vĤb mĤĤ q Ī mĤĤ Īnq wewfbæmgĤq

- 6| AvavĤKKvĤj i gnvKvKPrxiv gnvkĀ` t_ĤK çw_exi th Qwe wĤqĤQb Zv t_ĤK wbw`Z çĀwYZ nĤqĤQ, çw_ex tMvj vKvi |

mvi sk

cw_exi AvKvi tMvj tKi b`vq| Gi mtefKó.cõvY wmwte ej v hvq- AvawKKKvj
gnvKvkPvixiv gnvkb` t_tK cw_exi th Qne wbtqtOb Zv t_tK wbuÖZ nI qv wMtqtQ th,
cw_ex tMvj vKvi |

cVwEi gj'vqb 1.7

mWK DEti i ctk WK (v) vPy v b |

- 1| cL_xi `B tgi yntZ mgvb `htZ; ce^civd'tg cV'etEi gZ cL_x'K teob Kti th ti Lv Kí br Kiv nq ZvtK WK etj ?
 K. tgi tji Lv L. gj' ga'ti Lv
 M. vbi vti Lv N. AvSRWZK Zvvi L ti Lv
- 2| mteP A vstki gvb KZ vvvv
 K. 360° L. 180°
 M. 90° N. 60°
- 3| vbi vti Lvq atyZvivi DbvZ KZ?
 K. 90° L. 60°
 M. 0° N. 180°
- 4| m'gi ye' tZ atyZvivi DbvZ KZ?
 K. 90° L. 60°
 M. 30° N. 0°
- 5| vbeA vstki ve'vZ KZUK?
 K. 0°-10° L. 0°-20°
 M. 0°-30° N. 0°-40°
- 6| tm- U'vU htšj m'v'v' tKv'v'U cwi gvc Kiv nq?
 K. mgq L. DòZv
 M. Av'vsk N. `vNgvsk

DEi : 1| M 2| M 3| M 4| M 6| M

msv'vB ckae

- 1| Av'vsk Kv'K etj ?
- 2| `vNgvsk Kv'K etj ?
- 3| Av'vsk vby'qi c'vZmgv' WK WK?

iPbvj-K ckae

- 1| Av'vsk I `vNgv' WK? vP'v mn e'vL'v Ki ty|
- 2| Av'vsk vby'qi c'vZ WK WK? Av'tj vPbv Ki ty|

`Nngv#KB ub#`R Kti | A_# 180° ce°`Nngv tiLv Ges 180° c#Dg `Nngv tiLv
 GKB tiLv | GB `Nngv tiLvU#K Av#R#ZK Zvii L tiLv etj |
 c#_ex AbeiZ NjtQ | m#zivs 24 NÈv ci GKB RvqMv Avevi m#h# mvgtb Av#m | uP#
 t`Lv hv#`Q, ubi #tiLv c#_exi tK#`a tgvU 360° tKvY DrcbeKti | m#zivs tKv#bv
 RvqMv 360° NjtZ mgq tbq 24 NÈv ev 24∞60=1,440 ugubU | AZGe 1° NjtZ
 mgq tbq gv# 4 ugubU | GB int#te c#Z 150 `Nngv#ti 1 NÈv mg#qi cv_#` N#U |
 c#_ex ce°t`_tK c#Dg w`_tK NjtQ | m#zivs ce°w`_tKi RvqMv, t#v Av#M m#h# mvgtb
 Av#m |

1.7.3 : `Nngv ubY#

- 1 | c#Z 1° `Nngvi cv_#K`i Rb` `w# `v#bi `vbxq mg#qi cv_#` nq 4 ugubU |
 m#zivs `w# `v#bi mg#qi hZ ugub#U cv_#` nq Zv#K 4 w`_tq f#M Kti Zv#` i
 g#a` `Nngvi cv_#` ubY# Kiv hvq |
- 2 | tKv#bv `v#bi mgq M#b#Pi mgq Atc#v tenk ntj e#tZ n#e `vbuU M#b#Pi ce°
 w`_tK Ae#Z | Kg ntj e#teb `vbuU M#b#Pi c#Dg Ae#Z | M#b#Pi `Nngv#K
 O` w#w#M#ati mg#qi cv_#` t`_tK Ab`vb` `v#bi `Nngv ubY# Kiv hvq |
 #tbwglvi bigK N#o M#b#P mgq Ab#v#ti P#j | G N#o t`_tL tKv#bv `v#bi `vbxq
 mg#q m#t_ M#b#P mg#qi cv_#` ubY# Kiv hvq |
 B#Zv#te°D#j L Kiv nt#tQ th, Av#lv Rwi c`x#Zi t#t# K#l#g DcM#ni Ae`vb
 m#t#t# #R.#c.Gm h#s#j m#v#v#h` c#_exi th tKv#bv `v#bi `Nngv I D`PZv
 ub#v#t#B ubY# Kiv hvq |

M#w#v#ZK m#m`v

`Nngvi Ae`vb t`_tK ev mg#qi e`eavb t`_tK `Nngv ubY#qi KtqKuU D`vniY ub#P
t`_lqv nj :

D`vniY-1 :

XvKv I tev#v#B Gi `Nngv h_v#t#g 90°26' c`-Ges 70°50' c`- | XvKvq hLb ga`v#y,
ZLb tev#v#B Gi `vbxq mgq KZ?

mgvavb :

XvKv I tev#v#B Gi `Nngvi cv_#`
 = 90°26' - 70°50' = 19°36' (`be` : 60 ugub#U 1 w#w#M#tKvY nq | G#K
 Gfv#te tj Lv nq : 60' = 1°)
 = 1936 `Nngvi Rb` mg#qi cv_#`
 = 19 ∞ 4 ug. + 36 ∞ 4 tm. (`be` : 1 ug. `Nngvi cv_#K`i Rb` mg#qi
 e`eavb 4 tm#K#U) |
 = 76 ug. + 144 tm.
 = 78 ug. 24 tm. = 1 NÈv 18 ug. 24 tm:
 tev#v#B XvKvi c#Dg Ae#Z | tmRb` XvKvi t#t#q tev#v#B Gi mgq Kg n#e |
 XvKvi mgq hLb ga`v#y A_# `#j 12Uv ZLb tev#v#B Gi `vbxq mgq
 = 12 N. - 1 NÈv 18 ug. 24 tm.

cVwEi gj`vqb 1.8

mVK DEti i ctk WK (v) wPy w b|

- 1| f_c_tô `B tgi_jK mshy Kti DEi `w_jtY th mKj tiLv Kibv Kiv ntqtQ
tm_jt vtK wK etj?
K. A_jtiLv L. mgv_jtiLv
M. `wNgv_jtiLv N. tgi_jtiLv
- 2| gj- `wNgv tiLv tKv_tbv `vtbi Dci w`tq wMtqtQ?
K. tUwKI L. tewbP
M. MAbP N. c`wim
- 3| gj- `wNgv tiLv ntZ ce`ev cwDtg tKv_tbv `vtbi tKSwYK `i-Z_tK wK etj?
K. A_jvsk L. `wNgv
M. wbi_jtiLv N. ga`tiLv
- 4| MAb_tPi mgq t_tK XvKvi mgq 6 NÈv tewk ntj MAbP t_tK XvKv tKv_tbv w`tK?
K. ce`w_tK L. cwDg w`tK
M. DEi w`tK N. `w_jtY w`tK

DEi : 1| L 2| M 3| K 4| K

msw_jB c_kæ

- 1| `wNgv tiLv Kv_tK etj?
- 2| XvKv I tew`B Gi `wNgv h_v_tg 90° 26 ce`Ges 70-50 ce` XvKvq hLb `v_i
12Uv ZLb tew`B-Gi mgq KZ?

iPbugj-K c_kæ

- 1| wPmn A_jvsk I `wNgvsk eY`v Kiy|

cW 1.9

AvšRŃZK ZwiL tiLv

Df`ik`

GB cW tk`l Avcib

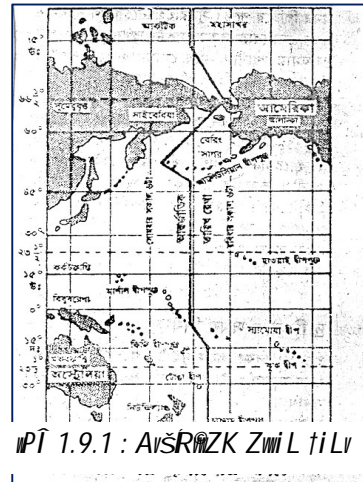
- 1 AvšRŃZK ZwiL tiLvi msAv ej tZ cvi`teb;
- 1 AvšRŃZK ZwiL tiLvi cŃqvRbxqZv ej tZ cvi`teb;
- 1 AvšRŃZK ZwiL tiLv AsKb Ki tZ cvi`teb|

1.9.1 : AvšRŃZK ZwiL tiLv

cW_exi DEi tgiyntZ `wŃY tgiychšl Rj fivMi Dci w`tq AvKv euKvfvte Kw Z 180° `wNgv tiLvU`K AvšRŃZK (International Date Line) ZwiL tiLv etj |

1.9.2 : AvšRŃZK ZwiL tiLvi cŃqvRbxqZv

Avcbriv ce`v`V tR`btQb, cW_exi mKj `vb ev t`tki cŃvY mgq GKikg bq| Avgiv hLb Avgv`i t`k t`K `ieZP`Kv`bv t`k agY Ki tZ hvB ZLb Avgv`i t`tki mgq Abyvqx Nvci mgq tmB t`tki mg`qi mv`_ wgtj bv| dtj mg`qi cv_`K`i Rb` bvbv cKvi Am`eavi m`v` nq| Ggb wK ZwiL vbtq| tMvj`thvM NtU| GB tMvj`thvM Aemv`bi Rb` AvšRŃZK ZwiL tiLvi cŃqvRb Av`Q|



ŃPŃ 1.9.1 : AvšRŃZK ZwiL tiLv

BtZvc`e`Df`j`L Kiv ntqtQ th, cŃZ wv`wMŃ `wNgvi cv_`K`i Rb` mg`qi cv_`R` nq 4 wgvbU| Gfvte wntme Kti wv`fbae`v`bi mgq vby`q Ki tZ Am`eav nq bv| wKšZGKvU gvT `v`b GB Am`eav Pigfvte AbyZ nq| tmB `v`vU nj 180° wv`wMŃce` wNgv wKsev 180° cWŃg `wNgv tiLv| cKZc`Ń| GB tiLv `w` c_`K bq eis GKB tiLv| aiv hvK MŃbP t`K `w` wgvb GKB mgq ce`l cWŃg GB `B w` tK hvT`v Kti| wgvb `w` cŃZ 1° `wNgv AvZµg Kti hv` Nvci mgq 4 wgvbU e`tj t`q, Zte 180° cWŃg `wNgv I 180° ce` wNgv tiLvZ Df`tqi gta` mg`qi e`earb nte 180° ∞ 4 wgvbU + 180° ∞ 4 wgvbU = 1440 wgv. = 24 NĖv = 1 w`b| A_`P Df`tqi K`v`j Ūv`ti Zwi`Li cv_`R` nte 1 w`b| GK R`bi wntme i`µevi ntj Av`iK R`bi wntme nte kuberi |

GLb GKvU cKvAv`m, th`nZzH `v`vU`i Ae`vb GKB ZvB hv`p msMZfvte ZwiL wv`fbae wv`fbaev ntq GKB nI qv DvPZ| GB Am`eav I mgm`v `t` Kivi Rb` AvšRŃZK ZwiL tiLv etj GKvU tiLv K`i`bv Kiv ntqtQ| G tiLvU AvZµtgi mgq ce`P`K MgbKvix

e^{ir3}tk Zvi Nnoi ZwiL GKw`b wciQtq w`tz nq| Avi ciogMigx e^{ir3}tk Zvi Nnoi ZwiL GKw`b emotq w`tz nq|
MabP t_k 180° ce^{er} ciog`j fMtk Gnotq Avkvekv c_t GB tiLnuTk Rj fvtMi Dci w`tq Kibv Kiv ntqtQ| Ab` K_vq ejv nq AvSRZK ZwiL tiLnu Rj fvtMi Dci w`tq Kibv Kiv ntqtQ|

mvisk

cu_xei DEi tgiyntZ `wY tgiychSf th 180° `Ngrv tiLnu Avkvekvfite Rj fvtMi Dci w`tq Kibv Kiv ntqtQ ZvKB AvSRZK ZwiL tiLv ejv nq| gj-Z GuL 180° ce^{er} NgrvLi A_er 180° ciog `Ngrv tiLv| Zte `w tiLv Awfb AvSRZK ZwiL tiLnu AwZptgi mgq ce^{er}tk MgbKvix e^{ir3}tk Zvi Nnoi ZwiL GKw`b wciQtq w`tz nq Ges ciogMigx e^{ir3}tk Zvi Nnoi ZwiL GKw`b emotq w`tz nq| AvSRZK ZwiL tiLvq tKvfv `j fvtMi Aw`Zjtb|

cvVei gj`vqb 1.9

mWK DEti i cvk WK (v) wPy w b|

- 1| cOZ 1° `NgrvLi cv_k`i Rb`mgqi cv`K` KZ?

K. 5 igubU	L. 4 igubU
M. 3 igubU	N. 2 igubU
- 2| AvSRZK ZwiL tiLnu tKvfvMi Dci w`tq Kibv Kiv ntqtQ?

K. fvi Z gnmvMi	L. DEi gnmvMi
M. cvkš'gnmvMi	M. AvUj wUK gnmvMi

DEi : 1| L 2| M

kb`ib ciY

- 1| GK wVwM`Ngrv cv_k`i Rb`mgqi e`earb nq ----- igubU|
- 2| AvSRZK ZwiL tiLv ----- wVwM`Ngrv Aew`Z|
- 3| AvSRZK ZwiL tiLvq tKvfv ----- fvm tb|

mswB cke

- 1| AvSRZK ZwiL tiLv Askb Kily|

iPbij-K cke

- 1| AvSRZK ZwiL tiLv ejtz wK tevSb? G tiLvi cOqvRbxq e`vL`v Kily|

mvisk

AvKvfk m#hP Ae`vb t`tL th mgq MYbv Ki nq Zvfk `vbxq mgq etj | mh`hLb th
`vfb gv_vi wK Dcti Ae`vb Kti tmB mgqK tm `vfb ga`vy ev tejv 12Uv aiv
nq| `gy 12Uv nZ iwl 12Uv chS mgqK Aciv`y ejv nq| iwl 12Uvi ci nZ
cieZP`gy 12Uv chS mgqK ce`y ejv nq|

cutV`Ei gj`vqb 1.10

mWk D`Eti i cutk wK (v) iPy`v b|

- 1| mh`hLb tKvfbv `vfb Dci j`vte Ae`vb Kti ZLb H mgqK wK ejv nq?
 K. ce`y L. ga`vy
 M. Aciv`y N. c`ZtKvj
- 2| ga`vy (Meridies) k`wUi Drcw`E tKvfbv fvlv t`tK Gtm`Q?
 K. M`K L. Rvgt`b
 M. j`vUv N. Av`ex|
- 3| A.M Gi mgq w`vi Kvj KZ N`Ev
 K. 6 N`Uv L. 12 N`Ev
 M. 18 N`Ev N. 24

D`Ei : 1| L 2| M 3| L

msv`B c`kæ

1| AM Ges PM ej tZ wK eSvq?

iPbvj-K c`kæ

1| `vbxq mgq Kvfk etj ? e`vL`v Ki`y|

cW 1.11

cŕvY mgq

Dt`ik`

GB cW tk`I AvciB

- 1 cŕvY mgqti msÁv w`tZ cvi`teb|
- 1 cŕvY mgqti cŕqvRbxqZv ej`tZ cvi`teb|

1.11.1 : cŕvY mgq

Avcbvrv trtbtQb th, GKB `wNgv tiLvq Aew`Z mKj `v`bi mgq GKB nq wKšZGK wWwMŕ`wNgvi cv`K`i Rb` `vbxq mgqti cv`R` nq 4 wgvbU| f,cđoi DEi-`wŕjY we`Z tiLv`K ga`tiLv etj | Avgiv Rvnb th MŕnbP Aew`Z gj-ga`tiLv t`tk ce`ev cwiđtg th tKv`bv `v`bi tKšwYK `iZi ntjv H `v`bi `wNgv| GB ga`tiLv ŐtZ Aew`Z Ges cW`exi cwiwa Őviv Gi mv`_ DrcbretKvY 36Ő | gj- ga`tiLv GB 36Ő tK mgvb `ŕfvM A_ŕ 18Ő ce`I 18Ő cwiđtg fvM Kti`Q| 18Ő MŕnbP gj-ga`tiLv (Ő) Gi mecixZ Ae`vb Ki`Q| Dtj`L` th AvšRŕZK ZwiL tiLv 18Ő `wNgv AvvriY Kti`Q| mgq MYvri Rb` gj-ga`tiLv A_ŕ Ő Ges 18Ő AZie `iZcYŕ GB Rb` tKv`bv t`tki GK cŕšli `vbxq mgq Aci cŕšli `vbxq mgq A`cŕv wfbzi nq| GB Kv`Y cŕZ`K t`tk tKv`bv ga`eZŕ`vb ev kn`ii `vbxq mgq`K H t`tki mKj AĀtji wv`ŕ mgq etj aiv nq Ges tm g`Z tiwvI, tUvj wfkB, WvK, tij I wgvb cŕwZ. wfv`Mi KvRKg`cwi Pij bv Kiv nq| GB mgq`K tmB t`tki cŕvY mgq (Standard Time) etj | Ab` K_vq ejv hvq tKv`bv t`tki ev epr AĀtji ga`eZŕ`wNgv tiLvi wfv`E`Z ga`eZŕ`tKv`bv Dtj`L`thvM` `v`bi `vbxq Kvj ev mgq`K mviv t`tki Rb` ev epr AĀtji Rb` wv`ŕ mgq etj MY` Kiv nq| GB wv`ŕ mgq`K H t`tki cŕvY mgq etj | 9Ő `wNgv`tiLv evsj v`k`K cŕq ga`fv`M j`v`j wfv`te wv`³ Kti`Q| Kv`RB 9Ő `wNgvq th `vbxq mgq i`q`Q G mgq n`Z evsj v`k`i cŕvY mgq MYbv Kiv nq| mZivs evsj v`k`i cŕvY mgq MŕnbP mgq n`Z 6 NĒv GwM`q Av`Q| Kv`Y evsj v`k` MŕnbP`i ce`ŕ`K Aew`Z|

1.11.2 : çÿv mgtqi cÿqvRbxqZv

hw` tKvfbv t`tki cÿZwU kni l Mÿtgi `vbxq mgq _vFK Ges hLb Avgiv GK kni t`tk Ab` knfi ev GK Mÿg t`tk Ab` Mÿtg hvB ZLb hw` Avgv`i nivZ Nwoi mgq cwieZÿ Kivi cÿqvRb cto| Zte Nwoi mgq cwieZÿ KiZ KiZB Avgv`i mvinY e`l_vKtZ nte| Guv GtKevfi Amæe| ZvB cÿZ`Kuv t`tki Rb` GKUv wv`ÿ e`enwvi K çÿvY mgq wbePb Kiv GKvšl cÿqvRb| tmB wv`ÿÿ mgq t`tki mKj Astk cÿqvMthvM` nte| wbgvbyvfi tKvfbv t`tki ga`fvMfi Dvj LthvM` `vbi `vbxq mgqfKB H t`tki Rb` çÿvY mgq wntmte wbaY Kiv nq|

tKvfbv tKvfbv t`tki Rb` GKwaK çÿvY mgq wv`ÿÿ itqQ, thgb- BD.Gm.G Ges KvbWv| BDtivtc wZbUv çÿvY mgq itqQ| thgb- MÿbP mgq, ga` BDtivcix mgq Ges ceBDtivcix mgq| BDtivtci cÿvÁj xq t`k, tjv MÿbP çÿvY mgq Abyvi Y Kfi |

1.11.3 : çÿv mgq wntmte MÿbP mgtqi , iÿi

hÿivR` MÿbP knfi Aew`Z ivRKix gvbv`fi i`wNgv O`| GB wfiE`Z MÿbP çÿvY mgq wbaY Kiv nq| MÿbP çÿvY mgtqi ev MvYwZK wbgg Abyvi Y Kfi wewfbae t`tki çÿvY mgq wbaY Kiv hvq|

mvisk

tKvfbv t`tki ev epr AÁj i ga`eZP`wNgv ti Lvi wfiE`Z ga`eZP`tKvfbv Dvj LthvM` `vbi `vbxq mgqfK tm t`tki Rb` ev tmB epr GjvKvi Rb` wv`ÿÿ mgqfK H t`tki ev GjvKvi çÿvY mgq etj |

Z

cvtVÿi gj`vqb 1.11

mWK Dÿi i cvk WK (v) wPy w b|

1| evsj v`tki ga`fvM tKvfbv `wNgv ti LwU Kíbv Kiv ntqQ?

- | | |
|--------------|--------------|
| K. 23.5° cÿv | L. 66.5° cÿv |
| M. 90° ce° | N. 95° ce° |

2| evsj v`tki çÿvY mgq MÿbPi mgq AvcYv KZ Nÿv AMwvY?

- | | |
|-----------|--------------------|
| K. 6 Nÿv | L. 12 Nÿv |
| M. 18 Nÿv | N. 24 Nÿv ev 1 w b |

Dÿi : 1| M | K

mswYB cÿe

1| çÿvY mgq ej tZ wK eSvq?

iPbvj-K cÿe

- 1/ cōvY mgq KvK e+j ? e`vL`v Ki Y|
- 2/ cōvY mgqji cōqivRbxqZv vK?

cW 1.12

cW_{exi} M_{iZ} : Am_yK M_{iZ}

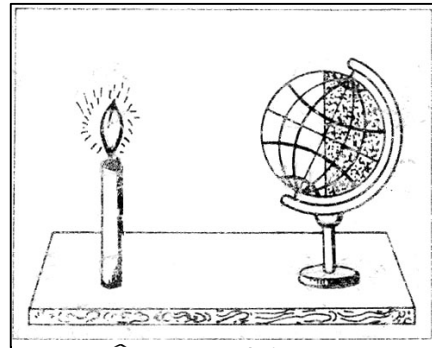
D_ik

GB cW tk_il Av_ib

- 1 Am_yK M_{iZ}i ms_{Av} R_vb_tZ cv_iteb|
- 1 Am_yK M_{iZ}i dj_vdj e_YÖ_r Ki_tZ cv_iteb|

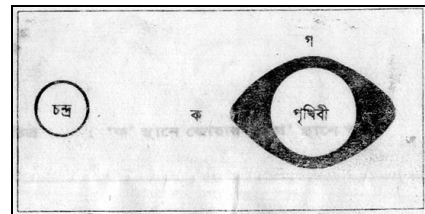
1.12.1 : Am_yK M_{iZ}

cW_{ex} NY_qg_vb j_vU_tgi gZ AbeiZ c_iÖg
 ntZ ce_ptk N_ytQ| w_R A_tŋi P_ricv_tk
 cW_{exi} GB c_kv_i M_{iZ}tK Am_yK M_{iZ} etj |
 Gf_vte w_R A_tŋi G_Kevi N_ytZ cW_{exi} mg_q
 j_vtM c_öq 24 N_Ev| Am_yK kt_äi A_wb|
 GR_b GB M_{iZ}tK cW_{exi} w_bK M_{iZ}i ej_v
 nq| cW_{exi} G_Kevi NY_qK_vj_tK (24 N_Ev)
 t_ms_iw_b ej_v nq| w_el_g tiL_vi D_ci cW_{exi}
 c_wi_wa c_öq 40,250 w_K.w_g.| G w_tm_te
 w_bi_ŋt_iL_vi Am_yK M_{iZ}i teM c_öZ N_Ev_q
 1,610 w_Kt_jw_gU_ti_i te_wk| w_Ks_tz_bi_tŋ_tiL_v t_{tk} D_Ei w_ŋt_y ŋ_gv_bt_q G M_{iZ}teM
 K_gtZ w_tk| 60° A_ŋv_tk Am_yK M_{iZ} ax_ti ax_ti K_tg Av_tm| dtj t_ms_iw_bi N_ö
 c_öZ_w b GK t_mt_kt_öi n_vR_vi f_vt_Mi GK f_vM e_wx cv_tQ|



w_PI 1.12.1 : w_b i_vZ n_l q_v

K. w_bi_wi : i_vt_Zi te_jv G_Ki_U t_gv_ge_wZ_i
 m_gt_b G_Ki_U t_me ev f_tM_vj K i_vL_b|
 f_tM_vj K_iU_i A_ta_R A_st_k Av_tj_v c_öte| ev_K
 A_ta_R A_ÜK_vi v_kte| f_tM_vj K_iU_tK G_KB
 R_vq_Mv_q t_it_L ax_ti ax_ti N_ytZ v_kt_j Gi
 Ab_w Ask Av_tj_vi m_gt_b Av_mtZ v_kte|
 Av_gi_v R_wb cW_{exi} w_bt_Ri t_Kv_tb_v Av_tj_v t_bB|
 m_ht_p Av_tj_vt_KB G_iU Av_tj_vw_KZ nq| w_Ks_tz



w_PI 1.12.1 : w_b i_vZ n_l q_v

cW_{exi} Av_Kv_i t_Mv_j etj G_KB m_gt_q m_ht_p Av_tj_v cW_{exi} me R_vq_Mv_q m_gv_bf_vte c_ö
 b_v| m_ht_p m_gt_b t_it_L cW_{ex} w_R A_tŋi P_ri_wt_K c_iÖg ntZ c_te 24 N_Ev_q ev 1 w_b
 G_Kevi N_yi | Gi dtj cW_{exi} th Ask h_Lb m_ht_p m_gt_b Av_tm t_m Ask Av_tj_vw_KZ nq,
 A_w Z_Lb t_mL_vt_b w_b nq| Av_i Gi w_ec_ixZ A_st_k m_ht_p Av_tj_v h_vq b_v etj t_m w_b
 A_ÜK_vi v_tk ev t_mL_vt_b i_vZ nq| f_tc_töi Av_tj_vw_KZ Ask I A_ÜK_vi_vQ_beA_st_ki
 m_st_hv_M j_tk Q_vq_ve_f etj |
 cW_{exi} t_Kv_tb_v w_b A_ÜK_vi_vQ_beA_sk ntZ Q_vq_ve_f cv_i ntq Av_tj_vw_KZ A_st_k t_cö_vt_j
 t_mL_vt_b nq w_b| A_ci_wt_K cW_{exi} th Ask Av_tj_vk ntZ Q_vq_ve_f cv_i ntq A_ÜK_vi_vQ_be
 A_st_k c_öek K_ti t_mL_vt_b nq i_wi | Gf_vte Am_yK M_{iZ}i dtj w_b l i_wi nq|

L. mgq MYbv : AvyK Muzi dtj mgq MYbvi mæav nq| cexi GKU mæúY[©]
AveZbi mgqi 24 fivMi GK fivMþK GK NËv aiv nq| GK NËvi 60 fivMi 1
fivMþK ugubU Avi 1 ugubtUi 60 fivMi 1 fivMþK tmþKÚ aiv nq|

M. mgýtmîZ, evqçëin I tRiqvi fUv : AvyK Muzi dtj cexi çò evqçëin I
mgýtmîZi w`K cwi evZ nq| G. tju DEi tMj vta[©]Wbwi þK Ges `wY tMj vta[©]evg
w`þK tetK Pþj | AvyK Muzi Rb` cexi th Ask hLb Pþi i w`þK _þK, Pþi i
AvKI[©]Y tmLubKvi Rj fivM ZLb tRiqvi nq|

mvisk

cexi GKU NYqgwb jwUtgi gZ AbeiZ cwög t_þK ceþþK wBR Atþi Pwi þK
NjþQ| cexi GB çkvi MuzþK AvyK Muz etj | wbi þti Lvq AvyK Muzi teM
metþtq tewk | tgiyAAþj AvyK Muzi teM tbB ej tj B Pþj | weAvbþ`i wntme gþZ
AvyK Muzi teM axþi axþi Kþg AvmþQ|

çvWËi gj`vqb 1.12

mþK DEþi i çþk wK (v) wPy w b|

- 1| cexi AvyK Muzi dtj cex tKvþv w`K t_þK tKvþv w`þK NjþQ?
K. ceþþZ cwög L. cwög ntZ çþ[©]
M. DEi ntZ `wY N. `wY ntZ DEþi
- 2| wbi þti Lvq çZ NËvq AvyK Muzi teM KZ?
K. 1,510 wK.wg. L. 1,610 wK.wg.
M. 1,710 wK.wg. N. 1,810 wK.wg.
- 3| AvyK' ej þZ wK eþvq?
K. FZçwievZ[©] L. Muz cwi evZ[©]
M. w`b i wv msNVb N. `wNgvi cwi evZ[©]
- 4| AvyK Muzi teM tKv_vq tbB ej tj B Pþj ?
K. wbi þxq AAþj L. wvþq AAþj
M. Dçwvþq AAþj N. tgiæAAþj
- 5| cexi Avþj wKZ Aaþk I AÜKvi Aaþþki gvSvwmS eþvKvi mvgvþi LvþK wK etj ?
K. Aæeþ L. Dceþ
M. çQvqveþ N. Qvqveþ
- 6| AvyK Muzi Rb` mgýtmîZ I evqçëin DEi tMj vta[©]tKvþv w`þK tetK Pþj ?
K. evgw`þK L. Wbwi þK
M. DEi w`þK N. `wYw`þK

DEi : 1| L 2| L 3| M 4| N 5| N 6| L

mswþB çkæ

1| AvyK Muz wK?

iPbvgj-K çkæ

- 1| AvyK Muz KvþK etj ? Gi djvdj wj Lly|
- 2| wKfvþe w`b i wv msNwUZ nq e`vL`v Kij Ges wPþ GþK eYþv w`b|

cW 1.13

cW_{exi} M_uZ : ewl R M_uZ

D_ti_k

GB cW tk_tl Avc_b

- 1 ewl R M_uZ wK Zv Rvb_tZ cvi_teb|
- 1 ewl R M_uZi eY_öv w_tZ cvi_teb|
- 1 ewl R M_uZi dj ej_tZ cvi_teb|

1.13.1 : ewl R M_uZ

Avgiv ce[©]cvtV tR_tbuQ, cW_{ex} Avc_b A_t¶i Pvi_w tK 24 NÈvq GK cvK N_ti | GKB mv_t cW_{ex} mh_¶K tK_ˆ K_ti GKwU w_bw_ö c_t mh_¶P Pvi_w tK N_ti¶Q| Gfite erm_ti GKevi K¶c_t N_ti Avm_tK cW_{exi} ewl R M_uZ etj | cW_{ex} th c_t mh_¶P Pvi_w tK tN_vi Zv_tK K¶c_t etj |

ewl R M_uZi Mo telM cÜZ NÈvq 1,07,000 wK.wg. hv cÜZ tm_tK_tÜ cÜq 29.72 wK.wg. | 365 w_tb tm_öi eQi MYbv Kiv n_tj l cKZc_t¶ mh_¶K GKevi cwi_{äg}Y Ki_tZ cW_{exi} 365 w_tb 5 NÈv 48 w_gu_bU 46 tm_tK_tÜ mg_tqi cÜqvRb nq| GRb_ˆ Bst_iwR w_mte cÜZ 4 eQ_ti GKw_b ewo_tq 366 w_tb eQi MYbv Kiv nq| tmB eQi tde_gwi gvm 28 w_tbi cwi_etZ[©]29 w_tb aiv nq| Gifc eQi_tK A_wael[©](Leap Year) etj | mvaviYZ th mvj tK 4 w_tq fV_M Ki_tj tKv_tbv fV_Mt_kl _vtK bv tm mvj _tjv A_wael[©] Z_te th mvj _tjv 100 öv_v fV_M Ki_tj w_gt_j wKšz400 öv_v fV_M Ki_tj w_gt_j bv Gifc mvj A_wael[©]nte bv| G_t¶_t¶ th mvj tK 400 w_tq fV_M Ki_tj fV_Mt_kl _vtK bv tm mvj _tjv A_wael[©]nte|

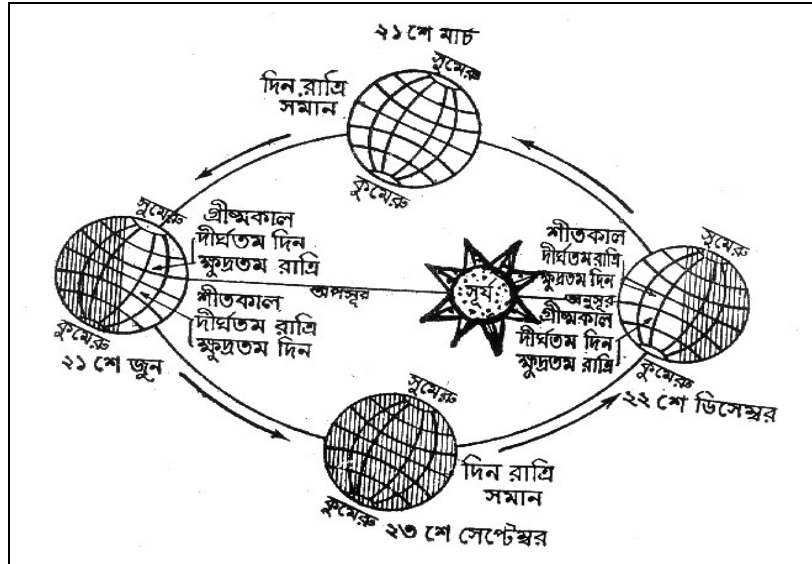
cW_{ex} th c_t mh_¶K cwi_{äg}Y K_ti Zv_tK cW_{exi} K¶ (Orbit) etj | Gi_ˆ N[©]93 tKwU 80 j ¶ wK.wg. | G K¶c_t cwi_{äg}YKv_tj mh_¶t_k cW_{exi} _tZi me[©]v mg_vb _vtK bv|

3 Rvb_gwi_tZ mh[©]cW_{exi} w_bKUZg Ae⁻v_tb (14 tKwU 70 j ¶ wK.wg.) _vtK| G_tK cW_{exi} A_bv_vy (Perihelion) Ae⁻v_tb etj | wKšz4 Rjv_b G mh[©]l cW_{exi} _tZi me[©]c_v¶v tenk (15 tKwU 20 j ¶ wK.wg.) cW_{exi} G Ae⁻v_tb_tK Ac_my (Aphelion) etj |

mh[©]l cW_{exi} _tZi n_wm-e_wx Ges tmB Kvi_tY mh_¶P Av_tc_v¶K Av_qZ_tbi Avc_vZ cwi_eZ_¶ cÜv_vYZ nq th, K¶c_t e_Èv_Kvi bq| GiU Dce_Èv_Kvi (Elliptical)| cW_{ex} th Z_j (Plane) eivei GB Dce_Èv_Kvi K¶c_t cwi_{äg}Y K_ti Zv_tK K¶Z_j (Plane of the Orbit) ej_v nq|

cw_ex KqZtj i mgv`fij A_`r ibi`qtiLv KqZtj Dci j`fvte Ae`vb Kitj cw_exi GK AaBtk w`PiKvj AUkvi ev i`vwi Ges Aci AaBtk w`PiKvj Avtjv ev w`b _vKZ|

Gifc Ae`vq w`ev-i`vwi ev FZzcwi eZB`RwbZ tKv`bv `evP`i t`Lv thZ bv| wKs`zev`e cwi w`wZ j`q` Kti w`Avb`MY Abgyb Kti`Qb th, cw_exi A`q ev tgi`jiLv me`v 23.5° tKv`Y tntj _v`K Ges m`h`P Pvi w``K cwi`gYKv`tj a`y b`q`i w`f`g`y`x n`t`q



w`P`i 1.12.1 : cw_exi cwi`g`f`Yi Rb` w`ev-i`vwi i nwm | FZzc`h`q

tgi`jiLv KqZtj i m`h` 66.5° tKv`Y Ae`vb Kti | G w`v`ea Kvi`t`YB evwl`R MwZi dj`-`f`c w`ev-i`vwi i nwm-e`w`x Ges FZzcwi eZB` N`t`U|

mvi`sk

m`h`K tK`-`a` Kti GKwU w`b`w`` c`f`_ m`h`P Pvi w``K GKevi N`ji Avm`t`Z cw_exi mgq j`v`M 365 w`b ev GK ermi | G`fvte Pvi w``K N`ji Avm`t`K cw_exi evwl`R MwZ etj | 3 Rvbg`vni cw_ex m`h`P L`y Kv`Q Ae`vb Kti | G`t`K cw_exi Abgy`y Ae`vb etj | 4 Rjv`B cw_ex m`h`P`_t`K me`f`P`q te`w`k`-`i`Z; Ae`vb Kti | G`t`K cw_exi Ac`m`j Ae`vb etj | evwl`R MwZi Mo`f`eM c`i`Z N`E`vq 1,07,000 w`K.w`g. | c`i`Z Pvi eQi ci t`d`e`g`vni gym 29 w`b aviv nq | H eQ`ti 366 w`b _v`K | Gifc eQi`t`K j`xc Bqvi ev A`w`ael` etj | evwl`R MwZi dtj FZzcwi eZB` N`t`U|

cVwEi gj-vqb 1.13

mWK DEti i ctk WK (v) wPy w b |

1| mthP Pvi w K Nji AvmtZ m² wntmte cw_exi KZ mgq j vtM |

K. 365 w b 5 NEv 48 wgbU 43 tmKŪ

L. 365 w b 8 NEv 24 wgbU 37 tmKŪ

M. 365 w b 15 NEv 48 wgbU 27 tmKŪ

N. 365 w b 6 NEv 24 wgbU 17 tmKŪ

2| KZw tb GK Arael hq?

K. 356 w tb

L. 365.5 w tb

L. 366 w tb

N. 366.5 w tb

3| cw_exi ewl R Mwzi cwb dj Kqu?

K. GKŪ

L. w

M. wZbŪ

N. Pvi Ū

DEi : 1| K 2| L 3| L

mswB cke

1| ewl R Mwzi wK?

iPbwj-K cke

1| ewl R Mwzi msAv I dj v dj wj Lŷ |

cW 1.14

w`ev-iwîi num-ejx

Dîk`

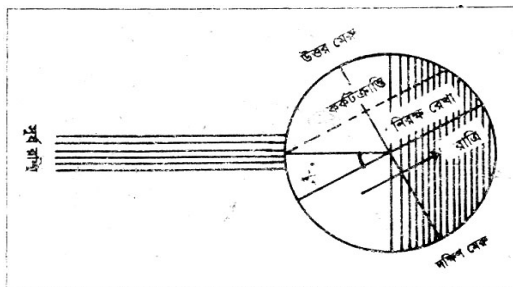
GB cW tkłI Avcb

- 1 cW_ex cłô w`ev-iwîi msNuUZ nI qvi KviY RvbtZ cvi teb|
- 1 cW_ex cłô wKfvte w`eviwîi num-ejx NtU Zv e`vL`v KiłZ cvi teb|

1.14.1 : Avgiv ce`civV AvvYK MvZ m`u`tk`RtbuQ| AvvYK MvZi dtj w`ev-iwîi msNuUZ nq| cW_exi me RvqMvq GK mv`_ w`ev-iwîi msNuUZ nq bv| Avevi w`ev-iwîi cwigvYI me RvqMvq GKB mg`q mgvb nq bv| cW_ex tMj Ges Gi wbtRi tKv`bv Avtj v tb| m`hP Avtj v tMj Kxq GB cW_exi hLb th Astk cWZZ nq ZLb tmLv`b w`b nq| Avcb A`qI Dci NYqgib GB cW_exi th cłô w`b v`K Zvi meciXZ cłô m`hP Avtj v t`Q bv; dtj tmLv`b iwîi v`K| th`nZznh`i cW_exi NY`bi mv`_ mv`_ m`hP Avtj v Av`Av`cW_exi Dci cłôi A`Kvi `i-KiłZ v`K Ges Avtj wKZ Astk AUKvi Kti| Gfvte w`b iwîi msNuUZ nq|

1.14.2 : w`eviwîi numejx

cW_exi A`qIiLv me`v cW_exi K`qZtji m`% 66.5° tKv`Y tntj v`K| m`hP Pviw`K tNvivi mgq cW_exi KK`m`šI I gKi`m`šI ga`eZP A`j mg`n eQti `ovi ga`v`y A`P wK `gy 12Uvq m`K`iY Lvorfite (j`fvte) cłô| Ab`T m`h` i`k` tntj ZxhRfvte cWZZ nq| G Kvi`YB tKv`bv v`b m`h`DVvi Ges W`e hvevi mgq mKj mgq



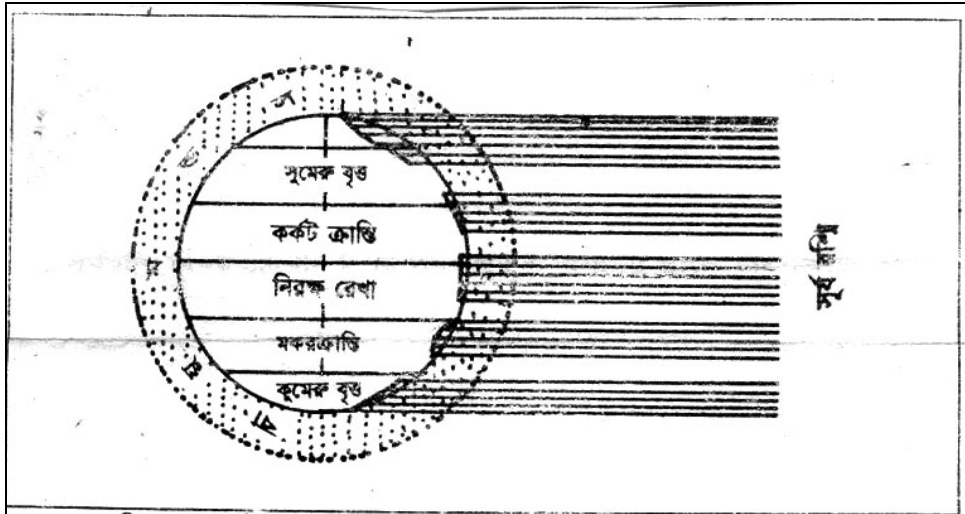
w`P 1.14.1 : m`h`i`K`i KK`m`šI Dci j`fvte cZb

GK iKg v`K bv| Gi dtj w`biwîi numejx NtU Ges Zvcgv`vi cv`R` nq| m`hP Pviw`K `gYKv`j 21 Rb Zvwi`L cW_ex K`q`c`i Ggb GK v`b G`m t`Q, hLb DEi`tgim`hP w`K me`c`q`v teik (23.5) S`K v`K| GB w`b m`h`23.5 DEi A`qIstki Dci A`P KK`m`šI tiLvi Dci j`fvte (Lvorfite) wK`iY t`q|

Acirw#K GB w`b `wY tgiymh`ntZ metPtq tewk `#i _v#K| GB Zwi#L DEi tMjvta`w`b metPtq eo Ges iwi#l metPtq tQvU nq| A_# 21 tk Rly DEi tMjvta`w`b 14 NEv Avi iwi#l 10 NEv ntq _v#K| GB 21 tk Rly Zwi#Lb `wY tMjvta`w`b metPtq tQvU Avi iwi#l metPtq eo nq| Gw`b 66.5` DEi Aq#iLv ntZ DEitgiy ch#l `vb w#Z 24 NEvB w`b _v#K| Avi 66.5` `wY Aq#iLv ntZ `wY tgiych#l `vbw#Z 24 NEvB iwi#l _v#K| Dctii wP#U f#jv K#i j`q` Kily Ges e#tZ tPov Kily th, 21 tk R#bi c#i c#ex Avcb Kq# c#_ AM#i ntZ _vK#j #tg #tg DEitgiymh`ntZ `#i mitZ _v#K Ges `wYtgiymh`ntZ w#KU Avm#Z _v#K| dtj DEi tMjvta`w`b #bi cwigvY ax#i ax#i tQvU Avi iwi#l cwigvY eo ntZ _v#K| 21 tk R#bi c#i m#h#P `wYvqb (A_# `wY tgiy Kv#Q Avm#) i`ynq| Gfvte Pj#Z Pj#Z 23 tk tm#P#f Zwi#L c#ex Kq#c#_i Ggb GK `v#b G#m tc#Q hLb Dfq tgiymh`ntZ mgvb `#i Ae`vb K#i (wP# -f`L#)| dtj G Zwi#L c#exi me# w`b iwi#l mgvb nq| 22 tk w#tm#f Zwi#L c#exi Ggb GK Ae`v#b G#m tc#Q hLb `wY tgiymh`ntZ w`#K metPtq tewk A_# 23.5 S#j c#o| Gw`b `#j#i mh`gKi#v#l Dci j`fvte wKiY t`q| dtj `wY tMjvta`w`b 22 tk w#tm#f Zwi#L w`b metPtq eo Ges iwi#l metPtq tQvU nq| Acic#q DEi tMjvta`w`b Gi w#exZ Ae`v nq| Gw`b 66.5 `wY Aq#isk ntZ `wY tgiych#l 24 NEvB w`b nq Ges 66.5 DEi Aq#isk ntZ m#gi ch#l 24 NEvB iwi#l nq| 22 tk w#tm#f i c#i m#h#P DEivqb (A_# DEi tgiymh`ntZ Kv#Q Avm#) i`ynq| Gici cwim#Yk#j c#ex 21 tk gvP`Zwi#L Ggb GK `v#b G#m tc#Q th w#K 23 tk tm#P#f i Ae`v nq hv GKUz#e#B Av#j vPbv Kiv ntq#Q| 21 tk tm#P#f ntZ 21 tk gvP`ch#l Oq gvm `wY tgi#Z AweiZ w`b Ges DEi tgi#Z AweiZ iwi#l _v#K| Gfvte c#ex m#h#P P#i w`#K w#R Kq#c#_ #gtbi m#% m#% c#ex#Z w`b-iwi#l i nwm-e#x N#UB P#j #Q|

mvisk

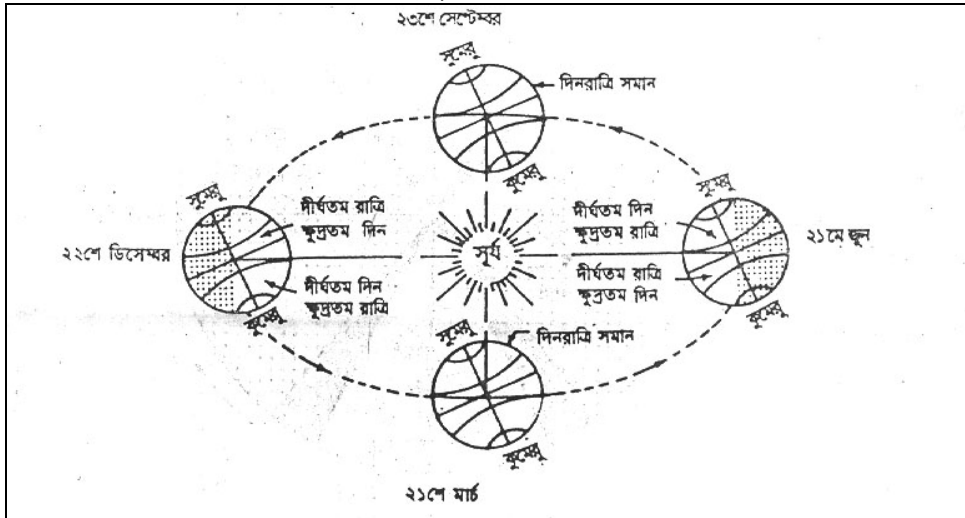
Av#YK MwZi dtj w`ev-iwi#l msNwUZ nq| 23.5` DEi w#sev 23.5` `wY Aq#v#tki D`P tKv#bv Aq#v#tk mh`KLb#l j`fvte wKiY t`q bv| 23 tm#P#f Ges 21 gvP`Dfq tMjvta`w`b Ges iwi#l mgvb nq| 21 Rly DEi tMjvta`w`b metPtq eo Ges iwi#l metPtq tQvU nq| GB Zwi#L `wY tMjvta`w`b Gi w#exZ Ae`v nq| 22 w#tm#f `wY tMjvta`w`b metPtq tQvU Ges iwi#l metPtq tQvU nq GB Zwi#L `wY tMjvta`w`b Gi w#exZ Ae`v nq| metPtq eo w`#bi cwigvY 14 NEv nq| metPtq tQvU w`#bi cwigvY 10 NEv nq|



ৱপি 1.15.1 : ম্হপিকি welg ti Lvi Dci j প্ৰবিতে I Ab'vb'` ব্ৰি Zl Rfite cZb tm` ব্ৰি ম্হপিকি Kg evqy`li t` Kti f-ctô tc`Q Ges f-ctô i Atc`KZ. `f` ব্ৰি tK`ifZ` ব্ৰি (ৱপি-) | dtj Gi fc` ব্ৰি ম্হপিকি Y wZh Rfite cWZZ` ব্ৰি Z`b vq Awak g'lvq Mig nq|

L. w`biwli num-ewx : c`lex ctô w`b-iwli cwi g'vMZ Zvi Ztg'i Kvi tY tKv b'v` ব্ৰি w`bi cwi g'v iwli tPtq` xN`ntj tm` ব্ৰি evqy`Uj AwakZi Dô nq| Aciw`tK tKv b'v` ব্ৰি w`bi cwi g'v ivtZi tPtq` t'vU ntj tm` ব্ৰি evqy`Uj AwakZi kxZj nq|

Avgiv tRt'wQ th, 21 tk Rly Zwi tL m'KKθµwšli Dci Lvovfite w'KiY t`q (ৱপি) Ges tmL'v b' me'tPtq` eo nq| m'z'iv s DEi tMj vta`ZLb M'θ'Kvj Ges` w'vY tMj vta`ZLb kxZKvj | Avevi 22 tk w'v'm'f m'gKi µwšli Dci j প্ৰবিতে w'KiY t`q (ৱপি t`Lb) Ges ZLb` w'vY tMj vta`w`b me'tPtq` eo nq| m'z'iv s tmL'v b' ZLb M'θ'Kvj I DEi tMj vta`ZLb kxZKvj |



ৱপি 1.15.2 : c`lexi cwi µgY w`b iwli num ewx I FZcwi eZθ

Avei 21 tk gvP^oZviiL me^o w`b iwi^l mgvb nq| (wP^l)| DEi tMvjvta^oZLb emšKvj I `w^lY tMvjvta^okirKvj | 23 tk tm^lP^o NtU Gi weciX Ae^lv| mh^ouk^o cZ^lbi tKv^lYi cv^oR Ges w`b iwi^l cwi^ogvYMZ ZviZtg^oi Rb^o f-c^otoi GK c^oš^l th tKv^lbv FZ^lz c^ove j^oY^l Kiv tM^lj weciX c^oš^lwfbwFZ^lz `enk^o t^lLv hvq| G m^oú^lK^ocwi^ovi aviYv cvevi Rb^o w^lb^lPi wP^lU hZ^omnKv^li t^lz e^oš^lZ tP^ov Kib| m^lv^l m^lv^l 2.4, 2.5, I 2.6 b^o w^lP^li m^lv^l w^lb^lPi w^lP^li w^lelq^oz^lgij t^ogij t^ogij wbb|

mvisk

c^oavb FZzPviU| h^ov- kxZ, M^oš kir, I emš^l| 21 tk Rly-DEi tMvjvta^ow`b me^lP^ltq eo Ges iwi^l me^lP^ltq t^oU nq| Acic^lY^l `w^lY tMvjvta^ow`b me^lP^ltq t^oU Ges iwi^l me^lP^ltq eo nq| 23 tk tm^lP^o-c^ow^lex c^oš^o DEi I `w^lY tMvjvta^ow`b iwi^l mgvb nq| 22 tk w^lW^lm^o-DEi tMvjvta^ome^lP^ltq t^oU w`b Ges iwi^l me^lP^ltq eo nq| Acic^lY^l `w^lY tMvjvta^oGB Zvii^lzL w`b me^lP^ltq eo Ges iwi^l me^lP^ltq t^oU nq| 21 tk gvP^oc^ow^lexc^oš^o DEi I `w^lY tMvjvta^ow`b iwi^l mgvb nq|

c^oš^lW^lEi gj^ovqb 1.15

m^lW^lK DE^li i c^oš^l w^lK (v) w^lP^l w`b|

1. c^oavb FZzKqU?

(K) 2wU	(L) 4wU
(L) 6wU	(N) 8wU
2. tKv^lbv Zvii^lzL mh^oKK^oμ^ov^lš^li Dci j^o f^ov^lte w^lKiY^l t^oq?

(K) 21 tk gvP ^o	(L) 21 tk Rly
(M) 23 tk tm ^l P ^o	(N) 22 w ^l W ^l m ^o
3. tKv^lbv Zvii^lzL mh^ogKi^oμ^ov^lš^li Dci j^o f^ov^lte w^lKiY^l t^oq?

(K) 21 tk gvP ^o	(L) 21 tk Rly
(M) 23 tk tm ^l P ^o	(N) 22 tk w ^l W ^l m ^o
4. 23 tk tm^lP^o Zvii^lzL m^oš^o w^lKiY^l tKv^lbv tiLvi Dci j^o f^ov^lte c^o?

(K) KK ^o μ ^o v ^l š ^l	(L) gKi ^o μ ^o v ^l š ^l
(M) w ^l bi ^o Y ^l iLv	(N) Avš ^o R ^o ZK Zvii ^l zL tiLv
5. tKv^lbv tKv^lbv Zvii^lzL mh^ow^lKiY^l w^lbi^oY^liLv Dci j^o f^ov^lte c^o?

(K) 21 tk Rly I 23 tk tm ^l P ^o	(L) 23 tk tm ^l P ^o I 22 tk w ^l W ^l m ^o
(M) 22 tk tm ^l P ^o I 22 tk w ^l W ^l m ^o	(N) 21 tk gvP ^o I 23 tk tm ^l P ^o

DEi : 1| L 2| L 3| N 4| L

ms^oY^lB c^oš^l

1| FZzKv^lK e^ltj?

iPbuj-K cke

1/ wKfiŕe FZzwi eZš msNwZ nq, wPÎ GŕK e`vL`v Ki ky|