

APPOLO STUDY CENTRE

TEST -8

Nature of Universe	6 k; tFgG	myF - 1 Nguz i k; kwWk; #hpa; FLkgk;
	9 k; tFgG	myF-9 - mz i k;
	11 k; tFgG	myF 2 #hpa; FLkgKk; GtAk;

6k; tFgG
myF - 1
Nguz i k; kwWk; #hpa; FLkgk;

- 'ngUntbgG (Big Bang) vdw xU epfo;T Vwgl i jpd; fhuz kha; vz z pyl qfh tiz kb;fS k> thdnghUI fS k; Nj hdwpc. , i t mi dj i j Ak; nghJ thf 'Nguz i k' (Universe) vdW mi oj j dh. , j i d 'mz i k' (Cosmos) vdWk; Fwpggl f;pdwdh; eb;fs; fhz f;pdw tiz kb;fs; kpfTk; nj hi yty; cssj hy; mi t msty; kpfngghpa; hf , UggpDk> rmpaj hf j ; Nj hdWf;pdwd.

mz i j i j gwwpa gbggwF 'mz i tpay' (Consmology) vdW ngah. fh] kh] ; vdgJ xU f;Nuf;fr; nrhyyhFk;

Nguz i k;

- Nguz i k; vdgJ kpfgguej tiz ntsp MFk; Rkhh; 15 gpyyad; Mz i fS fF KdG vwgl i ngU ntbggpd; NghJ Nguz i k; c Uthdj hf gy thdpay; mw;Qh;fs; ekGf;pdwdh; , gNguz i khDJ Nfhbf;fz f;fhd tiz kb; j us; kz i yq;fs> tiz kb;fs> Nfhs;fs> thy; elrj j uq;fs> r;WNfhs;fs> tz f;wfs; kwWk; Ji z f; Nfhs;fs; Mfpatwi w cssl f;f;AssJ.

tiz kb; j us; kz i yk; (Galaxy):

- tiz kb; j us; kz i yk; vdgJ <hgG tpi rahy; xdwhfg; gpi z f;fggLk; , UfFk; elrj j uq;f;sp;dj; nj hFgghFk; thdnstpay; tiz kb; j us; kz i yq;fs; r;ji wpAk> FOthfTk; fhz ggLf;pdwd. ngUntbgG epfo;Tf;Fg; gpwF Rkhh; 5 gpyyad; tUl qfS f;Fg; gpd; 'ghyntsp tiz kb; j us; kz i yk;' (Milky way Galaxy) c UthdJ. ekJ #hpa; FLkgk; ghyntsp tiz kb; j us; kz i yj j py; fhz ggLf;pwJ. Mz i Nuhnkl h (Andromeda) tiz kb; j us; kz i yk; kwWk; nkfy;yd;f; fsTI] ;

tɪz kɪd; j μs; k z l yk; Mfɪəd GtɪfɪF mUfɪy; fhz ggLk; (Magellanic clouds) tɪz kɪd; j μs; k z l yqfs; MFk;

xh; xspahz L vdgJ xsp Xh; Mz by; gaz pɪffɪ\$ba nj hi yT MFk; xspɪəd; jɪ rNtfk; tɪdɪbfɪF 300000 fɪkɪ MFk; Mdhy> xypahdJ tɪdɪbfɪF 330 klɪh; vdW Ntfɪjɪy; gaz pɪfɪk;

#hɪaf; FLkgk; (Solar system):

- Nrhyhh; vdW gj khdJ ‘#hɪaf; fɪTs’ vdg; nghUsgLk; sol vdW , yjjɪd; thhj j j aɪpUeJ ngwggɪJ. #hɪaf; FLkgf; Rkhh; 4.5 gɪyɪəd; tUl qfS fɪF KdG c Uthdj hf ekggɪLɪwJ. #hɪəd> vl L Nfhs;fs> fWɪ sf; Nfhs;fs> Ji z Nfhs;fs> thy; el rj j μqfs> rɪw Nfhs;fs; kwWk; tɪz fwfs; Mfɪatwi w c s s l fɪpɪJ #hɪaf;FLkgk; MFk; , /J <hgG tɪ rahy; gɪ z fɪfgɪL s s Xh; mi kgghFk;

#hɪəd;

- #hɪaf; FLkgj jɪd; i kaj jɪy; #hɪəd; mi keJ s s J. #hɪaf; FLkgj jɪy; c s s mi dj J thdnghUl fS k; #hɪaɪ dr; Rwwɪ tUfɪdwd. #hɪəd; #hɪaf; FLkgj jɪd; nkhhj epi way; 99.8 rj tɪfɪj k; c s s J. #hɪəd; i ` l u [d; kwWk; ` ɪpɪk; Nghdw ntggkhd thAffshy; MdJ. #hɪəd; j hNd xspɪ a c kɪpɪ\$ba j di k ngwwJ. #hɪəd; xU tɪz kɪd; MFk; #hɪədɪd; NkwgugG ntggei y 6000°C MFk; #hɪaf; FLkgj jɪd; mi dj J Nfhs;fs fɪFk; ntggj j j Ak> xspɪ aAk; #hɪəd; mspɪfɪwJ. mj d; ntggeɪ y Gtɪəd; Nkwgugi g tej i la Rkhh; 8.3 epkɪ qfs; MfɪdɪwJ.

#hɪəd; 1.3 kɪyɪəd; Gtɪfɪ s j d fɪsNs mi fɪfɪ\$ba ti faɪy; kɪfɪgnghɪj hFk;

Nfhs;fs;

- ‘Nfhs’ vdwhy; ‘rwwɪtUgth’ vdW nghUs; #hɪaf; FLkgj jɪy; vl LNfhs;fs; c s s d. mi t Gj d> ntssɪp Gtɪ nrt;tha> tɪahod> rdɪ ANud] ; kwWk; negbAɪd; MFk; ntssɪp kwWk; ANud] ; Nfhs;fi sj; j tɪu gw Nfhs;fs; mi dj Jk; #hɪaɪ d vj ɪ; fbɪhurRwwɪy> mj htJ NkwɪpɪUeJ fɪpɪfɪfr; Rwwɪ tUfɪdwd. , t;thW Nfhs;fs; #hɪaɪ dr; Rwwɪ tuf;\$ba ghi j Rwwɪgghi j vdgɪLɪwJ. Nfhs;fs; mi dj Jk; j j j k J ghi j i a tɪl tɪyfhky; #hɪaɪ dr; Rwwɪ tUtj wFR; #hɪəd; <hgG tɪ rNa fhuz khFk;

gz i l j; j kɪpɪhfs; #hɪəd; kwWk; gw Nfhs;fi sg; gwwɪ mwɪej ɪUeJ dh; vdgJ rɪqf , yffɪaqfs; thɪɪyhf ekfɪG; GydhɪwJ. c j huz khf> rɪwghz hwWggi l aɪy; fhz ggLk; ‘ths; epw tɪRkgɪd; Nfhs; kɪd; #oej , sqfj ɪ; Ohɪw’ vdW ghɪ y; thɪfSɪpɪUeJ ehk; nj hɪeJ fɪnfs;Nthk;

- #hɪaDfɪF mUfɪy; c s s ehd;F Nfhs;fshd Gj d> ntssɪp Gtɪ kwWk; nrt;tha; ‘c l Gwf; Nfhs;fs’ myyJ ‘Gtɪpɪfh; Nfhs;fs’ vdW mi ofɪfgɪLɪpɪdwd. ghi wfshy; md , fNfhs;fs; mstɪy; rɪwɪd. , fNfhs;fsɪd; Nkwguggɪy; ki yfs> vɪkɪ yfs; kwWk; j i uf;FopTg; gssqfs; (Craters) fhz ggLɪpɪdwd.
- #hɪaf;FLkgj jɪy; c s s fi l rɪ ehd;F Nfhs;fshd tɪahod> rdɪ ANud] ; kwWk; negbAɪd; Mfɪəd ‘ntsgGwfNfhs;fs’ myyJ ‘tɪahod; epɪu Nfhs;fs’ vdW mi ofɪfgɪLɪpɪdwd. , fNfhs;fs; thAffshy; epukɪfɪ; fhz ggL tɪj hy; ‘tspkɪ; Nfhs;fs’ (Gaseous Planets) vdTk; mi ofɪfgɪLɪpɪdwd. nrt;tha> tɪahod; Nfhs;fS fɪfɪ l Na ‘rɪw Nfhs; k z l yk’ fhz ggLɪwJ.

Nfhs;fspd; thpi ri a epi dtwfnfhs (Mnemonics):

GJ ntssk; Gtpay; nrYjj pdhy; tpthj k> rz i l> Aj j k; neUqfhJ

Gj d; (kpf mUfpyss Nfhs) :

- #hpaDfF mUfpy; , UfFk; Gj d; mstpy; kww Nfhsfi stpl kpfTk; rpwpaJ. , fNfshdJ Nuhkhdpa; flTsfspd; J}J tuhd 'nkhFhp'apd; ngauhy; mi offggLfwpJ. , fNfhs; eNuh> thAf;FNsh fpi lahJ. , fNfhs; tszklyk; , yyhj jhy; gfy; nghOj py; mj pf ntggepi yAk> , uT Neuj j py; fLqFspUk; fhz ggLk; NkYk; Gj d; Nfhs fFj; Ji z fNfhsfs; vJTkpyi y. mj pfhi yg; nghOj pYk> mej pg; nghOj pYk; Gj d; Nfhi s ehk; ntwWf; fz fshy; fhz KbAk;

ntssp (ntggkhd Nfhs):

- ntssp #hpadpl kpUe;Jk; , uz ihtj hf mi keJssJ. Gtpi ag; NghdNw xjj mstssjhy; ntsspAk; GtpAk; 'ul;lf; Nfhsfs' vd mi offggLfwd. mj d; RoYj y; fhyk; kww Nfhsfi sf; fhlpYk; mj pfkhf cssJ. ntssp j di dj; jhNd Rwwpf; nfhs 243 ehsfs; vLjJf; nfhs;fwJ. ANudi] g; NghdNw , fNfhs k; fpf;fpyUe;J Nkw;fhfr; RwwfwpJ (fbfur; Rww). , J kww Nfhsfi sf; fhlpYk; kpfTk; nkJthfr; RwwfwpJ. Gj d; Nfhi sg; NghdNw ntsspfFk; Ji z fNfhsfs; , yi y. mdG kwWk; moi ff; FwppFk; Nuhkhdpa flTshd 'td]' vdW ngauhy; , fNfhs; mi offggLfwpJ. fhi yapYk> khi yapYk; tiz z py; fhz ggLthj; , fNfhi s 'tpntssp' kwWk; 'mejntssp' vdW mi offpdNwhk; epyt;wF mLjj ggbahf , utpy; gpfhrkhfj; nj hpAk; tiz nghUs; ntsspahFk;

Gtp (c ahp;Nfhs):

- #hpadpl kpUe;J %dwhthf mi keJss Gtp l ejhtJ nghpa NfshFk; Gtpapd; NkwgugghdJ ehd;fpy; %dW gFj p elhy; #ogglLssjhy; 'e;fNfhs' vdWk; 'eh;fNfhs' vdWk; mi offggLfwpJ. Nuhkhdpa kwWk; f;Nuff; flTsfspd; ngauhy; mi offggLhj xNu Nfhs; GtpahFk; Gtpapd; JUt t;lik; 12>14 f;Nyhkl;lh; kwWk; epyeLfNfhlL t;lik; 12>56 f;Nyhkl;lh; MFk; Gtp #hpa; d t;pdhbf;F 30 f;Nyhkl;lh; Ntfj j py; Rwwp tUfwpJ. , fNfhs; e;yk> eh; kwWk; tszklyk; fhz ggLthj; c ahp;dqfs; thoj; j Fj pahd #oy; epyTfwpJ. Gtpapd; XNu Ji z fNfhs; epythFk;

#hpaDfFk; GtpfFk; , i lNa css njhi yT 150 kpyypad; f;Nyh kl;lh;uhFk; kz pf;F 800 f;kp Ntfj j py; nry;Yk; thD}hj p #hpa; d nrdwi la 21 tUl qfs; MFk;

nrt;tha; (nreepwf; Nfhs):

- #hpadpl kpUe;J ehd;fhtjhff; fhz ggLk; nrt;tha; NfshdJ mstpy; Gj DfF mLjj gbahf , uz ihtJ rpwpa NfshFk; , fNfhs; Nuhkhdpa; Nghh;f;flTs; 'khh]' ? (Mars) ngauhy; mi offggLfwpJ. , j d; Nkwguggpy; , UKG Mfi] L cssjhy; nreepwkhfj; Nj hwwks;pf;fwJ. Mfnt> nrt;tha; [rptej Nfhs' vdWk; mi offggLfwpJ. , fNfhs;pd; tszklyk; kpfTk; nkyypaj hFk; , j d; JUt; gFj p;f;py; Gtpi ag; NghdNw gz pAi wfs; (Ice caps) fhz ggLfwd. , fNfshdJ /Nghg] ; (Phobos) kwWk; Bk] ; (Deimos) vdW , U Ji z fNfhs;fi sf; nfhs LssJ. nrt;thaf; Nfhi s Muhatj wfhf> RwwptUk; fyqfSk; (Orbiters), j i u Chj p;f;Sk; (Rovers) mDggglLssd.

, ej pa tiz ntsp Muharrp e;Wtdk; (ISRO) nrt;thaf; Nfhs;pd; tszklyk;

kwWk; ji uggFj pi a Muhartj wfhf 24.09.2014 mdW kqfsahd; (Mars Orbiter Mission) vdggLk; t pz fyji j mDggpaJ. , j dhy; , ej pah nrt;thaf; Nfhs pi d MuhAk; ehLfspd; gl baypy; u~ah t pz ntsp Muharrp epWtdk> eh] h (USA), l Nuhggpa t pz ntsp Muharrp epWtdjj wF mLjjjh hf ehd,fhk; , ljjjy; cssJ.

t pahod; (ngUqNfhs)

- #hpaf; FLkgj j pd; kpf; ng hpaf; Nfhs hd t pahod; #hp adpl kpUeJ l ej htj hf mi keJssJ. , J Nuhkhd pahfspd; Kj di kf; flTs; (Jupiter) ngauhy; mi of;fggLf wJ. epyh kwWk; ntssp Nfhs fF mLjjjh hf gpfhrkhf t pz z py; nj htJ t pahod; MFk; , fNfhs; j d; mrrpy; kpfTk; Ntfkhfr; Royf;\$baj hFk; #hpa dg; NghdNw , j d; tszk;lyj jYk; i` lu[dd; kwWk; `lyak; thAffs; fhz ggLf pdwd. kpf mj pfkhd Ji z fNfhsfi s , fNfhs; nfz LssJ. mtwWs; mNah (IO), ANuhggh (Europa), fdpkl (Ganymede) kwWk; Nfyp] NI h (Callisto) Mf pad rpy kpf gng hpa Ji z fNfhs;fshFk;

rdp (ti saqfs; nfz l Nfhs):

- #hpaf; FLkgj j pd; , uz;htJ ng hpa Nfhs hd rdp #hp adpl kpUeJ Mwhtj hf mi keJssJ. Nuhkhdpa Ntshz j k flTspd; ngauhy; (Saturn) , J mi of;fggLf wJ. ghi wj;Jfsfs> gdj;Jfsfs; kwWk; J}Rf;fshy; Md gy ng hpa ti saqfs; , fNfhi sr; Rwwpf; fhz ggLf pdwd.
- rdp 62 Ji z f; Nfhsfi sf; nfz LssJ. t pahod; Nfhi sg; NghdNw mj pf Ji z fNfhs;fi sf; nfz l , fNfhs pd; kpf gng hpa Ji z fNfhs; 'i l l d' (Titan) MFk; #hpaf; FLkgj j py; fhz ggLk; Ji z fNfhs;fspy; i elu[d; kwWk; k] Nj d; Mfpa thAffi sf; nfz l tszk;lyk; kwWk; Nkf qfs; #oeJ fhz ggLf pdw xNu Ji z fNfhs; i l l d; MFk; rdpf; Nfhs pd; j d; <hgGj; j pd; (Specific Gravity) el u t pl f; Fi wthFk;

ANud] ; (c US k; Nfhs):

- tpyy;ak; n` h~y; vdw thd;pay; mwQuhy; 1781 Mk; Mz l ANud] ; fz Lg;bf;fggl;J. nj hi y Nehf;fahy; fz Lg;bf;fggl; Kj y; Nfhs; , J thFk; , J #hp adpl kpUeJ Vohtj hf mi keJssJ.
- k] Nj d; thA , fNfhs py; cssj hy; , J gri r epwk hf j; Nj hdWf wJ. , J fNuff t pz; flTshd 'ANud]' ngauhy; mi of;fggLf wJ. ntssp; Nfhi sg; NghdNw , fNfhs k; j d; mrrpy; fbfhur; Rwwpy; Rwwf wJ. , j d; mrR kpfTk; rhaeJ fhz ggL t j hy; j d; Rwwggh j ay; c Uz NI hL t J NghdW #hpa dr; Rwwp tUf wJ. ANud] pd; 27 Ji z fNfhs;fspy; 'i l l d; hdpah' (Titania) kpf; ng hraj hFk;

negbAd; (Fs;hej Nfhs):

- #hpaf; FLkgj j py; vl;htJ kwWk; kpf; nj hi yty; mi keJss Nfhs; , J thFk; Nuhkhd;faf; fl y; flTspd; ngai uf; nfz l , fNfhs py; gyj j fhwW tRk; 14 Ji z fNfhs;fi sf; nfz l negbAd;pd; kpf; ng hpa Ji z fNfhs; 'bi ul d' (Triton) MFk; negbAd; #hpaf; FLkgj j py; kpf; nj hi yty; cssj hy; kpfTk; Fs;heJ fhz ggLf wJ. , fNfhs py; fhz ggLk; eYk; kwWk; ntsi s epwkhdJ ANud] ; Nfhs pyUeJ , i j NtWgLj j pf; fh l f wJ.

FWqNfhs;fs; (Dwarf plants):

- negbA;d; Nfhs f;F mgghy; nj hi ytiy; fhz ggLk; rmpa tiz nghUI;fs; FWfNfhs;fs; MFk; mi t kpfTk; Fsthe;Jk; xspaiyyhkYk; fhz ggLfjpdwd. Nfhs tbtty; fhz ggLk; , i t Nfhs;fi sg; Nghy , yyhky; jkJ RwwGgghi ji ag; gw FWi sf; Nfhs;fS l d; gfthe;Jnfhs;S k; GS l Nl h> nru] > <hp] > NkfNkf; kwWk; n` skpah Nghdwi t #hpaf; FLkgjj iy; fhz ggLk; l eJ FWqNfhs;fshFk;

epyT (Gtjapd; Ji z fNfhs):

- Nfhs;fi sr; RwwptUk; tiz nghUI;fs; Ji z fNfhs;fshFk; Gtjapd; xNu Ji z fNfhs; epythFk; epyT j di djjhNd Rwwpfnfhs; vLj;Jfnfhs;S k; NeuKk; Gtpi ar; Rwwptu vLj;Jfnfhs;S k; NeuKk; Vwf;Fi wa xdwhFk; mj thJ 27 ehs;fs; 8 kz p NeukhFk; epytwF ts;kz;lyk; fpi lahJ. , j d; fhuz khf tiz fwf;f;pd; j hf;f;jj hy; , j d; NkwgFj japy; mj pfstiy; ji uf;Fog; gssqfs; fhz ggLfjpdwd. epyT GtpajpUeJ 3:84:400 f;kp nj hi ytiy; mi ke;JssJ. , J Gtpajy; ehd;f;iy; xU ggNF mSTi laJ. kdj d; ji uapwqfpa xNu tiz nghUs; epythFk;

epyi tg; gwwp Muha;tj wfhf , ej pahthy; mDggggll J Kj y; tiz fyk; rej puhad; - l MFk; , J 2008 Mk; Mz l tiz z iy; nrYjj ggl l J.

rjW Nfhs;fs; (Asteroids):

- #hpai dr; Rwwp tUk; rmpa jpl g; nghUI;fNs rjWNfhs;fs; vdggLk; nrt;tha; kwWk; t;ahod; Mfpa Nfhs;fS f;fpi l Na rjWNfhs;fs; kz;lyk; fhz ggLfjpwJ. mi t mstiy; kpfTk; rmpaj hf , Uggj hy; Nfhs;fs; vd mi offggLti jiyi y.

thy; tiz kb;fs; (Comets):

- thy; tiz kb;fs; jiy kwWk; thy; gFj pfi sf; nfhz ;j hff; fhz ggLk; jpl g; nghUI;fshy; Md ji yg; gFj pi a gdpffl bahy; gpi z f;fggl LssJ. mj d; thygFj p thAffshy; MdJ Gtpf;F mUf;iy; 76 tUl qfS f;F xUKi w tuf;\$ba 'N` yp' thy;tiz kb; fi l r;ahf 1986 k; Mz l thd;iy; nj dgl l J. , J kb; Lk; 2061 Mk; Mz l tiz z iy; Nj hdWk; vd fz f;fpl ggl LssJ.

tiz fwf;fs; (Meteors) kwWk; tiz ;tb;fwfs; (Meteorites):

- #hpaf; FLkgjj iy; fhz ggLk; rjW fwf;fs; kwWk; cNyhfg; ghi wfshy; Md tiz nghUI;fs; tiz fwf;fs; vdW mi offpNwhk; , ej tiz fwf;fs; Gtjapd; ts;kz;lyjij mi l Ak; NghJ cuha;t;pd; fhuz khf vhp;J xsh;tj hy; vhpel rjj juk; vdWk; mi offggLfjpwJ. Mdhy> ts;kz;lyjijj; jhz b Gtjapd; Nkwgugi gj; j hf;Fk; tiz fwf;fs; 'tiz ;tb;fwfs;' (Meteorites) vdW mi offggLfjpdwd.

Gtjapd; Rowr;

- #hpai df; fhi yapNyh> kj j;aNkh myyJ khi yapNyh ftdj j Jz ;lh? ehs; KOtJk; m/J xhpl j j pNyNa fhz ggLfjpwj h? myyJ khWgLfjpwj h? #hpad; fhi yapy; f;f;f;f;Yk> kj pak; c;r;rp;Yk; khi yapy; Nkw;f;Yk; fhz ggLfjpwJ. Gtp #hpai d , i l tpl hky; Rwwp tUtNj , j wFf; fhuz k; MFk; ekJ fz f;S f;Fr; #hpad; efhtij g; NghdW Nj hdw;pdhYk; mJ cz i kayy. vt;thnwd;iy> ehk; NgUej Nyh myyJ Gi f tz baiNyh nry;Yk; NghJ kuq;fs> t;sf;Ff; fkgq;fs; kwWk; fl;l l q;fs; Ntfkhf ehk; nry;Yk; jpi r;f;F vj thj; jpi rapy; efhtij g; ghj j pUf;f;Nwhk; mNj NghdW Gtp #hpai d Nkw;f;f;f;f;UeJ f;f;f;f;f;fr; Rwwp tUtj hy; #hpad; f;f;f;f;f;f;UeJ Nkw;f;f;fr;

nry;tj hfj ; Nj hdWfjwJ Gtjpd; Rowrpi aggwmp GhpeJ nfhss mj d; tbtjijg; gwwpAk> rhai tg; gwwpAk; mwpej pUff Ntz Lk;

Gtjpd; tbtKk; rhaTk;

- Gtp Nfhs tbtkhdJ. , J j d; mrrpy; RoYfjwJ. Gtjpd; tl JUtjjjpyUeJ> Gtp i kajjpd; tophf nj d; JUtK; ti u nryyf;\$Ba xU fwi df; NfhL Gtjpd; mrR vdgLk; Gtp j d; mrrpy; 23½° rhaeJ j di djjhNd Rwwpf; nfhz L #hpa dak; Rwwp tUfjwJ. j d; Rwwtllg; ghi j fF 66½° Nfhz j i j , ej rha;T vwglj;JfjwJ.

Gtjpd; RoYk; Ntfk; eyelNfhllg; gFj jpy; 1670 fkp / kz p MFTk> 60 tlfF ml rNui fapy; 845 fkp / kz p MFTk> JUtj; gFj jpy; RoYk; Ntfk; RopakhfTk; UfFk;

RoYj y; (Rotation):

- Gtp j d; mrrpy; j di dj; j hNd Rwwtllg; RoYj y; vdW \$WfjNwhk; NkwfjpyUeJ fpfhfr; RoYk; GtjhdJ> xUKi w RoYtjwF 23 kz p NeuK> 56 epkl qfs> 4.09 tpdhbf; vLj;Jf; nfhf;fwJ. Gtp xUKi w RoYtjwF vLj;Jf; nfhf;S k; Neuj j j xU ehs; vdW mi off;Nwhk; Gtp RoYtj d; fhuz khf , uT> gfy; VwglfjwJ. Gtp Nfhs tbtkhf cssjhy; xU Fwggpl; Neuj j py; #hpa ntsrrk; Gtjpd; xU gFj jpy; klLNk glfjwJ. mggFj jpy; mJ gfyngH OJ MfK; Gtjpd; xsgl hj gFj j , uthf , UfFk;

esspT #hpad; vdgJ , U mi ufNfhssqfs;Yk Nfhi lffhyj j py; Mh;fbf; tlljjjpwF tlf;fpyk> mz lhhbf; tlljjjpwF nj wfpYk; 24 kz p NeuKk; #hpad; j i yf;FNky; nj hpAk; epfo;thFk;

, t;thW Gtjpd; xsglLk; gFj j aAk> xsgl hj gFj j aAk; ghp;fFk; NfhL bwF ‘xsp;T tllk’ (Terminator Line) vdW ngah;

RwWj y; (Revolution):

- Gtp j d; eS;tllg; ghi j jpy; (Elliptical Orbit) #hpa dr; Rwwp tUk; efhi tNa RwWj y; vdW \$WfjNwhk; Gtp tpdhbf;F 30 fpyhkl;lh; Ntfj j py; #hpa dr; Rwwp tUfjwJ. Gtp xU Ki w #hpa dr; Rwwp tu 365¼ ehs;fs; MfjwJ. , J Nj hukhf 365 ehs;fshf vLj;Jfnfhssggll xU tUl k; vdW mi off;ggLfwJ. kJ Kss ¼ ehl;fs; ehd;F Mz l;fS fF xU Ki w xU ehshff; fz fpl ggl;L g;guthp khj j j py; \$Lj yhf xU ehs; Nrh;f;ggLfwJ. mj htJ ehd;F tUl qfS fF xU Ki w g;guthp khj j j pwF 29 ehs;fshf , UfFk; mej tUl k; ‘y;g; tUl k’ (Leap year) vdW mi off;ggLfwJ. Gtp #hpa dr; rwwp tUtj hy; gUt;fhyqfs; Nj hdWfjpdwd.
- Gtp #hpa dr; Rwwp tUtj hy; khhr; 21 k; Nj j p Kj y; nrgl kgh; 23k; Nj j p ti u MWkhj qfs; Gtjpd; tl mi ufNfhsk; #hpa d Neh;f;f rhaeJ fhz ggLk;

‘#hpa mz i k’ (Perihelion) vdgJ Gtp j d; RwWgghi j jpy; #hpaDf;F kpf mUfjpy; tUk; epfo;thFk; #hpa; Nrai k (Aphelion) vdgJ Gtp j d; RwWgghi j jpy; #hpaDf;Fj; nj hi ytjpy; fhz ggLk; epfo;thFk;

- mrrkaj j py; nj d; mi ufNfhsk; #hpadpl kUeJ tpyf; fhz ggLfwJ. mLj j MWkhj qfs; mj htJ nrgl kgh; 23k; Nj j p Kj y; khhr; 21 k; Nj j p ti u Gtjpd; nj d; mi ufNfhsk; #hpa d Neh;f;f rhae;Jk> tl mi ufNfhsk; #hpadpl kUe;Jk; tpyf;Ak; fhz ggLk;

- , t;thW Gtp j d; Rwwgghi j apy; #hpa; dr; Rwwp tUtj hy; #hpad; epyeLfNfhl bwF tI f;fhfTk> nj wfhfTk; efhti j g; Nghdw Nj hwwj i j vwgLj j fpwJ. , j d; fhuz khf khhr; 21 kwWk; nrgl kgh; 23 Mfja ehs;fs; epyeLfNfhl Lg; gFj papy; #hpad;pd; fj phfs; nrgFj j hf t;Ok; mj dhy; Gtpad; mi dj j g; gFj p;Yk; gfy; kwWk; , uTgnghOJ rkkhff; fhz ggLk; vdNt> , eehL fs; 'rkggfypuT' ehl fs; vd mi of;fggLfdwd.
- , Nj NghdW [{d; 21k; ehs; fl fNui f kU #hpad;pd; nrgFj j f; fj phfs; t;Otj hy; tI mi uFNfhsj j py; meehs; kpf eL j gfyngghOj j f; nfhz bUfFk; nj d; mi uf; Nfhs; eL j , ui tf; nfhz bUfFk;
- , eepfo;T 'Nfhi l f;fhyf; fj phj pUggk;" vdW mi of;fggLfdwd. brkgh; 22k; Nj j p kfuNui fap; kU #hpad;pd; nraFj j f; fj phfs; t;Ofpdwd. , eepfo;tpwF 'Fsh;fhyf; fj phj pUggk;' (Winter Solstice) vdW ngah; , rrkaj j py; nj d; mi uFNfhsj j py; gfyngghOJ mj p;fkhff; fhz ggLk; tI mi uFNfhs; eL j , ui tf; nfhz bUfFk;



Gt;pf; Nfhsq;fs:

- c a;h;pdq;fs; thoj; j Fj ;ahd Nfhs; Gt;ahFk; Gt;ary; fhz ggLk; %dW nj hFj ;pf;S;d; j Fj ;ahd Nfhs; gh; wfNfhs; eh;fNfhs; kwWk; nts;pkz ;lyk; MFk; , j nj hFj ;pf;S;d; j Fj ;ahd Nfhs; fhyepi yAk; epyTtjhy; c a;h;pdq;fs; thoj; j Fj ;ahd Nfhs; , l khf Gt; khw;wpAssJ. c a;h;pdq;fs; thof;\$ba FwF;pa kz ;lyk; 'c a;h;fNfhs;' vdW mi of;fggL;f;pdw.

gh; wfNfhs;

- gh; w vdW nghUsgLk; 'y;ij Nj h] ; (Lithos) vdW f;Nuff;g; g;jj;j;py; , Ue;J gh; wfNfhs; (Lithosphere) vdW nrhy; ngwgg;l;J. Gt;ap;d; Nkwgugg;py; fhz ggLk; gh; wfs; kwWk; kz ; mLf;f;g; gh; wfNfhs; vdW \$Wf;Nwhk; , ej epyggugg;py; c a;h;pdq;fs; fhz ggL;f;pdw.

eh;fNfhs;

- 'i ` l Nuh" (Hydro) vdW f;Nuff;r; nrhy;py;Ue;J ngwgg;l; nrhy;Ny i ` l Nuh] g;rah; (Hydrosphere) MFk; , j wF eh;fNfhs; vdW ngah; , J ngUq;f;ly;f;S; > fl;y;f;S; > MWf;S; > Vh;pf;S; > ki yArr;pf;S;py; fhz ggLk; g;d;Ai wfs; > t;spkz ;ly;j;j;py; fhz ggLk; e;h;tp Mf;pa mi d;ji j Ak; c s;S;l;f;f;pa;j hFk;

t;spkz ;lyk;

- 'm;Nkh' (Atmo) vdW f;Nuff;g; g;jj;j;w;F t;sp;my;J fhwW vdW nghUs; Gt;pi ar; Rww; fhz ggLk; gyNtW fhwWj; nj hFj ; t;spkz ;lyk; vdggL;f;pdw. t;spkz ;ly;j;j;py; fhz ggLk; thA;f;f;S;py; i elu[d; (78%) kwWk; Mf;] p[d; (1%) K;di kahd thA;f;f;shFk; fh;gd;i l-Mfi] L > Mh;fhd > i ` lu[d; ` ;p;ak; kwWk; XNrhd; thA;f;f;S; Fi wej m;st;py; fhz ggL;f;pdw.

c a;h;Nfhs;

- gh; wfNfhs; > eh;fNfhs; kwWk; t;spkz ;lyk; Mf;atwNwhL nj hl hGi l a c a;h;pdq;fs; thof;\$ba xU gFj ;p 'c a;h;fNfhs;' vdggL;f;pdw. 'gNah' vdW f;Nuff;r; nrhy;py;wF 'c a;h;' vdW nghUs; c a;h;fNfhs; gyNtW kz ;ly;q;f;shf;g; gh;f;f;gg;l;S;S;J. xtntH U kz ;ly;Kk; xggw fhyepi y > jhtuq;fs; kwWk; t;pyq;f;pdq;fi sf; nfhz ; gFj ;ahf c s;S;J. , kkz ;ly;q;fs; '#oy; kz ;ly;q;fs;' vdW mi of;fggL;f;pdw.

k;d;dh; c a;h;fNfhs; ng;l;l;fk; , ej ;pa ngUq;f;ly;py; 10-500 r;Ju f;pk; gugg;st;py; mi ke;J;S;S;J.

9. m;z ;k;

m;w;K;fk;

- thd;pay; fUtp;fs; fz L;g;pb;f;fgg;Lt;j;wF Kd; ek; Kd;Nd;hh;fs; m;z ;l;j;j;py;S;S; nghUs;f;S; mi d;ji j ;w;Fk; G;k;Na i kakhf c s;S;J vdW fUj;pdh; , j wF Gt;pi ka khj ;hp vdW ngah; f;Nuff; thd;pay;sh; jhyk; (2Mk; E;w;whz L) kwWk; , ej ;pa thd;pay;sh; Mh;pa;g;l;h; (2 Mk; E;w;whz L) c s;S;l;l; m;f;f;hy;j;j;py;Ue;J gy thd;pay;sh;f;S;k; , ej khj ;h;pi a ek;g;pdh; g;d;d;h; Nghye;J eh;l;i l r; Nrhe;j thd;pay;sh; e;Nfhy] ; Nfhghe;pf] ; vdgh; t;iz nts;pi af; \$he;J Neh;f;f; #h;pai ka khj ;h;pi a nts;pa;l;l;hh; , j dg; > #h;pa kz ;ly;j;j;pd; i kaj;j;py; #h;pad; mi ke;J;S;S;J. 1608-

nej hyhej py; nj hi yNehffpahdJ fz Lgibf;fggl l gpd; thdpaypy; xU Gul rp Vwgl l J. , gghl j j py> mz l j j pd; fl LWgGfs> nfgshpd; , aff t j j fs> nrawi ff; Nfhs;fspd; Rwwffhyk; kwWk; gddhl l t p z ntsp i kak; Mfpatwi wg; gwwp fhz Nghk;

mz l j j pd; fl LWgGfs;

- Nfhbffz fhd t p z kbdfi s c s s l f f a > x s p t f ; \$ b a t p z k b d ; j u s f N s m z l j j p d ; m b g g i l f ; \$ W f s h F k ; G t p N f h s f s > t p z k b d f s > t h d n t s p k w W k ; t p z k b d ; j u s f s ; M f a m i d j i j A k ; c s s l f f a m i k g N g m z l k ; M F k ; , j j y ; g U g n g h U s f s > M w w y ; k w W k ; f h y k ; c s s l l m i d j j k ; m l q F k l . , e j m z l k ; v t t s T n g h a J v d W v t U f F N k n j h a h J . m J v y i y a w w j h f , U f f y h k ;
- g U g n g h U s f s > M w w y ; k w W k ; f h y k ; c s s l l m i d j j k ; m l q F k ; , e j m z l k ; v t t s T n g u a J v d W v t U f F N k n j u a h J . m J v y i y a w w j h f , U f f y h k ; j q f s h y ; g h u f f K b e j i j i t j J m z l j j p d ; m s i t m w p t p a y h s h f s ; f z p f f d w d h ; , j w F g h u f f \$ b a m z l k ; 9 3 g p y p a d ; x s p M z L f s ; m s T n f h z l J (1 x s p M z l © 9 . 4 6 0 7 u 1 0 ¹² f p k x U M z l f h y j j p y ; x s p n r y ; Y k ; n j h i y T) .
- m z l j j j g ; g w w p M u t j i j j ; J } z l f ; \$ b a J v d d n t d w h y > m J j w N g h J t p u t i l e J n f h z b U f f p w J v d g N j m z l k h d J N k Y k ; N k Y k ; n g u j h f p f ; n f h z N l t U f p d w J . m J k l l k y y > m z l j j p d ; v y i y k p f N t f k h f t p u t i l e J n f h z N l , U f f p w J . , U g g p D k > m z l j j p d ; n g U k g F j p n t w w p l k h f N t c s s J . m z l j j p Y s s m i d j j m Z f f i s A k ; x d W N r u j j h y ; j w N g h J s s m z l j j p y ; n t W k ; e h d F r j t j k ; k l l N k t U k ; m z l j j p d ; n g U k g F j p , U z l n g h U s ; (d a r k m a t t e r) k w W k ; , U z l M w w y h f N t (d a r k e n e r g y) c s s J .

mz l j j pd; taJ (thoehs)

- x U k h n g U k ; n t b g g r p U e J j h d ; m z l k ; N j h d w p a J v d W m w p t p a y h u f s ; f U J f p d w d u ; , f n f h s i f a p d g b > m z l j j p Y s s m i d j j g ; n g h U s f S k ; m j p f m l u j j p n f h z l x u ; g U g n g h U s p y ; n r w e j p U e j d . V w j j h o 1 3 . 7 g p y p a d ; M z L f s f F K d d h y ; x U n g U n t b g G V w g l l t p z k b d ; j u s f s p d ; t b t p y ; m i d j j g ; n g h U s f S k ; m i d j j j ; j p i r f s p Y k ; n t b j j r ; r j w p d . m z l j j p Y s s m i d j j g ; n g h U s f S k ; n g U n t b g g p d ; N g h J N j h d w p a m b g g i l r ; j d p k q f s h d i ` l u [d ; k w W k ; ` l y a k ; M f p a t w w h y ; M d i t e h k ; R t h r p f F k ; M f r p [d > e k ; c l y p y ; c s s f h u g d > f h y r p a k ; k w W k ; , U k G > f z p d r ; r p y Y f s p y ; (c h i p s) g a d g L k ; r p y p f f h d ; c s s l l V i d a j d p k q f s ; m i d j j N k t p z k b d f s p d ; c s s l f f j j p y ; c s s d . t p z k b d f s ; m i d j i j A k ; x d w h f , i z f F k ; < h g G t p i r j h d ; , j j d p k q f s ; m i d j j A k ; m t w w p D s N s < u j j i t j j s s J . , e j t p z k b d f s ; n t b j j r ; r j W k ; N g h J > m t w w p D s N s , U f F k ; j d p k q f s ; n t s p a p l g g L f p d w d .

t p z k b d ; j u s f s ;

- n g U n t b g G e p f o e j c l N d N a < u g G t p i r a p d h y ; t h A N K f q f s ; a h T k ; < u f f g g l l t p z k b d ; j u s f s p d ; f l L W g G f i s c U t h f f p d . t p z k b d ; j u s f s ; f l L W g G f i s c U t h f f p d . t p z k b d ; j u s ; v d g J t h A > J } R > N f h b f f z f f h d t p z k b d f s ; k w W k ; # u p a k z l y q f s ; M f p a t w i w c s s l f f a j u z l n j h U m i k g G M F k ; , e j g h u f f f ; \$ b a m z l j j p y ; R k h u ; E } W g p y p a d ; (1 0 ¹¹) t p z k b d ; j u s f s ; c s s d v d W m w p t p a y h s u f s ; f U J f p d w d u . t p z k b d ; j u s f s ; m i d j j k ; g y t b t q f s p y ; c s s d . m t w w p d ; t b t j i j g ; n g h W j j m i t R U s ; j u s > e s t l i j ; j u s ; k w W k ; t b t k w w j u s ; v d t i f g g l j j g g L f p d w d . t p z k b d j u s f s ; j d p a h f N t h > , u l i l a h f N t > n j h f j p a h f N t h (c l u s t e r) n g U e n j h f j p a h f N t h (s u p e r c l u s t e r) f h z g g L f p d w d . n j h f j p a h f T s s j u s f s ; x d N w h n l h d W n r a y t p i d G u p t J l d ; r p y N t i s f s p y ; , i z a T k ; n r a f p d w d .

- #upad; kwWk; #upa kzlyjYss Nfhsfs; mi djJk; ghyntsp tjp tiz kbd; jpusy; cssd. ghyntsp tjp i aj; jtu gy tiz kbd; jpusfs; cssd. ekfF mUfpy; css mLjj tiz kbd; jpusd; ngau; mz bNuhkl h tiz kbd; jpus; ghyntsp tjp tiz kbd; jpus; Rus; tbi tf; nfhz iJ. Thdpy; xU ghytz z g; gli l NghdW fhz ggLjtjhy; mJ ghyntsp tjp vdg; ngau; ngwwJ. mjpy; Rkhu; 1:00 gpyypad; tiz kbdfs; cssd. NkYk; mj d; tpi k; 1:00:00 xsp Mz Lfs; MFk; Mj d; i kaj jpyUeJ Rkhu; 25:000 xsp Mz Lfs; njhi ytpy; ek; #upa kzlyk; cssJ. Gkp #upai dr; Rwwp tUti jg; Nghy> ekJ tiz kbd; jpusd; i kaj i jr; Rwwp tu #upad; 250 kpyypad; Mz Lfs; vLj Jf; nfhsfwwJ.

ekfF mUfhi kapy; css mz bNuhkl h tiz ntsj; jpusd; njhi yT 2.5 kpyypad; xsp Mz Lfs; MFk; Gkp , aqFk; Ntfj jpy; (mjhtJ 30 fkp / tp) ehk; nrdwhy;\$l mi jr; nrdwi la 25 gpyypad; Mz Lfs; Nj i tggLk;

tiz kbdfs;

- tiz kbd; jpusfsd; mbggi l ffl i LWgGfs; tiz kbdfs hFk; ngUntbggpy; tiz kbd; jpusfs; cUthd NghNj mi tAk; Nj hdw pd. ntggk> xsp Gw Cj hf; fj pfs> X-fj pfs; csspl i gy fj pti Rfi s tiz kbdfs; cUthfFpdwd. mi t thA kwWk; gish] kh (mj pf #Ni wggli gUgnghUs; epi y) Mfpatwi w mj pfkhf cssl fpai t MFk; tiz kbdfs; mi djJk; i` lu[d; thAthY; epukgAssd. , ej i` lu[d; mZ ffs; ahTk; , i z eJ ` lypak; mZ ffs; cUthFk; NghJ kpf mj pf mstpy; ntggk; ntsahf pdwJ. xU , Uz l , utpy; Rkhu; 3:000 tiz kbdfs ekJ fz fs; %yk; ekkhy; fhz KbAk; nkj jkhf vtst tiz kbdfs; tiz ntsapy; cssd vdgJ ekfFj; nj upahJ. ekJ mz l jpy; 100 gpyypad; tiz kbd; jpusfs; cssd: xtnthdwpyk; 100 gpyypad; tiz kbdfs fFk; mj pfkhd tiz kbdfs; , Uffyhk;
- tiz kbdfs; j drahf , UggJ Nghy; Nj hdw pdhYk> ngUkghYk; mi t , i z eNj fhz ggLfpdwd. xU tiz kbd; vej stpwF ntsprfkhfj; nj upfwJ vdgJ fhz ggLfpdwd. xU tiz kbd; vej stpwF ntsprkhfj; nj upfwJ vdgJ mtwwpd; nrwi tAk> GkpyUeJ mtwwpd; njhi yi tAk; nghWj Nj cssJ. ntgg epi yi ag; nghWj Jk> tiz kbdfs; nttntW tz z qfsy; Nj hdwyhk; ntggkhd tiz kbdfs; ntz i kahfNth myyJ eYkhfNth Nj hdWk; mstpyk; tiz kbdfs; NtWgLfpdwd.
- xU rpy tiz kbdfs; FOffshf , i z eJ xU mi kggpi d tiz ntsapy; VwgLj Jfpdwd. mi t> xU tpyqfpi dNah> flTi sNah myyJ vjhtJ xU nghUi sNah Fwfffyhk; , gbggll tiz kbdfs d; FOffs; el rj juf; \$l i qfs; (Constellations) vdgLfpdwd. gyNtW ehLfsYss kffs; gyNtW tbtKss el rj juf; \$l i qfi s mi lahsK; fz l wpeJssdh; mtthW Vwwf; nfhs; ggl i el rj juf; \$l i qfs; 88 cssd. Ml Lf fl h> kpJdk> rpfk> #hpad> Nj s; kwWk; NfrpNahgah Nghdwi t xU rpy el rj juf;\$l i tbtqfshFk;

#hpa kzlyk;

- #hpad; kwWk; mi jr; Rwwp tUK; thd; nghUsfs; mi djJk; Nrhej Nj #hpa kzlykhFk; mjpy; Nfhsfs> thy; tiz kbdfs> rjWNfhsfs; kwWk; tiz fwfs; csspl i gy nghUsfs; ml qFk; #hpaDfFk; mgngghUsfS fFk; , i l Na css <hgG tpi rapdhy; mi t #hpa i dr; Rwwp tUfpdwd.

#hpad;

- #hpad; xU eljju msTila tiz kbd; mJ kpf mj pf ntggKss> RodW nfhz bUffff; \$ba thAg; geJ MFk; mj d; Kffhy; gFj p i` bu[d; thAthYk> fhy; gFj p ` lypak; thAthYk; epukgAssJ. mJ Gkpi a tpi kpyypad; kl qF

ngnpaJ. mj pf mOj j j j j y; i ` bu[d; mZ ffs; , i z eJ ` byak; mZ ffs hf khWf pdwd. mZ f f U , i z T vd mi offggLk; , ej epfo: t pdhy> ngUk s T Mwwy; xsp kwWk; ntgg tbt y; c Uthf pdwJ. , ej Mwwy pdhy; #hpad; xshf pdwJ NkYk; ntggj j ms pf pdwJ. #hpa kz l y j j pd; i kaj j y; #hpad; mi keJ ssJ. mj d; t y pi kahd <hgGg; Gyj j pdhy; gw #hpa nghUsfs> Nfhsfs> r p W N f h s f s > t h y; t p z k b f s > t p z f w f s; kwWk; gw r p i j T w w nghUsfs; ahTk; #hpa i dr; Rwwp t U f p d w d. Vw j j h o 4.6 g r y y p a d; Mz l f S f f N k y h f , J , U e J t U f p d w J.

#hpad; Nj hdwpa t j k;

- ngUntbggpd; NghJ> ntggkhd i ` lu[d; thAffs; FshtileJ kpfngnpa Nkf q f i s c Uthf f p d. g p d h; mi t NkYk; mlh; T k p F e J t p z k b d; j u s f i s c Uthf f p d. m j y; k j k p U e j i ` l u [d; t h A f f s; m g F k p q F k h f k j e J n f h z b U e j e p i y a y > f h y g N g h f f y; i ` b u [d; t h A f f s p d; m l h; T k p F e J # h p a d; k w W k; # h p a k z l y k h d J c Uthf f; f h u z k h d J. e h s i l t y > mi t n k J t h f r; R w w f \$ b a j d i k i a m i l e j d. i ` l u [d > ` b y a k; t h A f f s; k w W k; J J R f s; n f h z l j j u l r p i a m i t c s s l f f p , U e j d. < h g g p d; f h u z k h f > mi t m O j j k i l e J , U f p d. # h p a d p d; N t f k; m j p f h j j NghJ mj d; N k w g u g j l i l a h f p t l l g; N g h d W k h w p a J.

Nfhsfs;

- ehz apf f g g l t i s t h d R w W g; g h i j a r y; N f h s f s; # h p a i d r; R w w p t U f p d w d. , J e s; t l l t b t y; c s s J. # h p a i d x U K i w R w w p t U t j w F N f h s f s; v L j J f; n f h s S k; f h y k; R w W f f h y k; v d g g L k; # h p a i d r; R w w p t U k; m N j N t i s a r y; g k g u j i j g; N g h y; N f h s h d J j d i d j; j h N d A k; R w w p t U f w J. j d i d j; j h N d x U K i w R o y t j w F x U N f h s; v L j J f n f h s S k; f h y k; R o w r p f f h y k; v d g g L k; G k p a d; R o w r p f f h y k; 23 k z p 56 e k p l q f s; M F k; v d N t > G k p a r y; x U e h s; v d g J 24 k z p M F k; m l i t i z x t n t h U N f h s p d; R o w r p f f h y K k; n f h l f f g g l L s s J.

Nfhs;	xU ehspd; mST
Gj d;	58.65. eh s f s;
ntssp	243 eh s f s;
Gkp	23.93 k z p
nrttha;	24.62 k z p
tpahod;	9.92 k z p
rdp	10.23 k z p
ANud] ;	17 k z p
negbAd;	18 k z p

- #hpa kz l y j j p Y s s N f h s f s; a h T k; n t t N t W , i l n t s p f s y; f h z g g L f p d w d. K j y; e h d F N f h s f s; x d W f n f h d W n e U f f k h f T k; # h p a D f F m U f h i k a p Y k; c s s d. mi t c l G w # h p a k z l y j j mi k f f p d w d. n t s p g G w # h p a k z l j j p Y s s N f h s f s; # h p a D f F n t F n j h i y t y; , i l n t s p t p l l f h z g g L f p d w d. v d N t r d p N f h s p w F k > A N u d] ; N f h s p w F k; , i l N a c s s n j h i y T G k p f F k; n r t t h a; N f h s p w F k; , i l N a c s s n j h i y i t t p l g y k l q F (20 k l q F) m j p f k h f c s s J.
- c l G w # h p a k z l y j j y; f h z g g L k; e h d F N f h s f s h d G j d > n t s s p G k p k w W k; n r t t h a; M f p a i t c l G w N f h s f s; v d W mi o f f g g L f p d w d. m t w w p d; G w g g u g G j j z k g g h i w N k N y h l b d h y; mi k e J s s j h y > mi t e p y k r h; N f h s f s; m y y J g h i w f N f h s f s; v d mi o f f g g L f p d w d. m t w w p d; c l g F j p G w g g u g G k w W k; t s j k z l y k; M f p a i t x N u K i w a y; x N u t b t y; c U t h d i t. N k Y k > mi t x j j mi k g g y; c s s d. e k; G k p i a , t w w p w f h d k h j p h a h f f; n f h s s y h k;
- ntspgGw #hpa kz l y j j y; xgg l i s t y; #hpa i d n k J t h f R w w p t U k; N f h s f s h d t p a h o d > r d p A N u d] ; k w W k; n e g b A d; M f p a i t n t s p g G w f; N f h s f s; v d mi o f f g g L f p d w d. mi t i ` l u [d > ` b y a k; c s s p l l g w t h A f f s h y; e p u k g r a

mlhT kpf tszkzlyjijf; nfhz Lssd. mi t thAg; ngUqNfhsfs; vdWk> thAf; Nfhsfs; vdWk; mi offggLfpdwd. , ej ehdF ntspgGwf; NfhsfS fFk; ti saqfs; cssd. Mdhy; ehdF clGwf; NfhsfS fF ti saqfs; , yi y. , ej ti saqfs; gdpahy; %l ggl ghi wj; Jfsfisi; nfhz Lssd. ehk; , gNghJ xtntthU Nfhi sg; gwwpAk; ghfffyhk;

- **Gj d;** #hpaDfF kpf mUfpy; mi keJss ghi wNfhsjhd; Gj d; MFk; , J gfy; kpf mjpf ntggjJlDk; , utiy; mjpf; FspUlDk; fhz ggLk; Gj d; kpfTk; kqfyhfTk> rmpajhfTk; fhz ggLthjhy> ntWk; fz zhy; ghggi jtpl xU njhi yNehffpahy; mij edF fhz KbAk; mij vgNghJk; fpoF myyJ NkwFj; jpi rapd; fbthdj jpy; klLNk , aYk;
- **ntssp;** fplljll Gkpad; msitnahjj xU rpwgGFNfhs; ntssp ek; #hpaKzlyj jpy; fhz ggLk; NfhsfSpNyNa mjpf ntggepi y nfhzlj ntssp MFk; epytwFg; gwF> thdj jpy; njhpAk; kpfggufhrkhd thdnghUs; , Jnt> kww Nfhsfisi; Nghy; myyhy> , J vjhj; jpi rapy; Roytjhy> , qF #hpad; NkwNF Njhdwp fpoNF ki wfwJ. ntsspi a ehkntWk; fz zhy; vsj jpy; fhz yhk; mj fpoF myyJ NkwFj; jpi rapy; fbthdj jpy; njhpAk;
- **Gkp;** #hpa kzlyj jpyss NfhsfSpNyNa ehk; thOk; Gkpar; klLkjhd; caphthoj; jFj pahd #oy; cssJ. #hpadpyUeJ rhahd njhi yty; mj cssjhy> rhahd ntggepi y> eh; Mjhuk> rhahd tszkzlyk; kwWk; XNrhd; glyk; Mfpatwi w Gkp nfhz LssJ. , i tai djJk; cssjhyjhd> Gkpar; caphs; njhlheJ thotnjdgJ rhjjakhfpdwJ. Gkpad; kUss eH; kwWk; epyg; gFj pfsPd; kU xsp vjruhs;ggj dhy> tiz zpyUeJ ghffFk; NghJ Gkp eYk; fyej gri r epwJlD; fhz ggLk;
- **nrttha;** Gtpad; RwWgghi jfF ntspar; mi keJss Kjy; Nfhs; nrttha; MFk; , J rwnw rptgG epw jpy; fhz ggLthjhy> , J rptgGFNfhs; vd mi offggLfpwJ. , jwF BNkh] ; kwWk; NghNgh] ; vdggLk; , U , awi fj; Jiz fNfhsfs; cssd.
- **tpahod;** tpahod; NfhsjdJ> ngUqNfhs; vd mi offggLfpdwJ. NfhsfSpNyNa kpfngghpaJ , Jnt (Gtpi a tpl 11 klqF nghpaJ> 318 klqF vi l nfhz lJ) , jwF 3 ti saqfSk; 65 epyTfSk; cssd. , jd; epythd fhdpl vdW epyTjhd; #hpa kzlyj jpyNyNa kpfngghpa epythFk;
- **rdp;** ti saqfS fFg; ngahNghd rdp Nfhs> kQrs; epw jpy; fhz ggLfpdwJ. ntspgGw \$pakzlyj jpy; fhz ggLk; , fNfhsjdJ tpahodfF mljJ , uz lhtJ ngUk; thAfNfshFk; Fi wej glrk; rdpar; 60 epyTfs; cssd. illld; vdW epyNt mjpy; ngupaJ. MFk; ek; #upa kzlyj jpy; NkfqfSlD; \$ba xNu epyT , JthFk; rdpar; mluj j p kpfTk; Fi wthf cssjhy; (Gtpi a tpl 30 klqF Fi wT) , ej Nfhs; fdkwwJ.
- **ANud];** ANud]; xU Fspkpf thAg; ngUqNfshFk; ngupa njhi yNehffpahd; %ykhfnt , ijf; fhz , aYk; , J kpfTk; rhaej Roy; mri rf; nfhz LssJ. mj dhy; , J c Uz NI hLth Nghy; nj upf pdwJ. , jd; mrhj huz rhatpd; fhuz khf , qF Nfhi l fhyKk> Fsp; fhyKk; kpf eZ L , UfFk; xtntthdWk; 42 Mz Lfshf cssd.
- **negbAd;** , fNfhsjdJ gri r epw tiz; kb; NghdW fhlpasrfFk; #hpadpyUeJ vlhtjh fcss , ejf; Nfhs; kpfTk; fhwW tlrF;\$ba NfshFk; 248 Mz LfS fF xUKi w GSINI h , jd; RwWgghi jiaf; flffpwJ. , ej epi y 20 Mz LfS fFj; njhl upfwJ. , jwF 13 epyTfs; cssd. mjpy; bi ul lhd; vdW epyNt ngupaj hfK; #upa kzlyj jpy; NfhsPd; RowrpfF vj j jpi rapy; RwWk; xNu epyT bi ul lhd; MFk;

#upa kzlyj jpyss gpw nghUsfs;

- vL Nfhs;fi sjjj tpu NtW rpy nghUs;fS k; #upai dr; Rwwp tUf;pdwd. mi tAk; #upakz l yj j r; Nruej i tfNs MFk;

rjWNfhs;fs; (Asteroids): nrt;thapd; RwWgghi j f;Fk; t;ahod;pd; RwWgghi j f;Fk; , i l Na xU ngupa , i l nts; c ssJ. , ej , i l nts;par; Nfhs;fs; Nj hdwpa NghJ c Uthd yl r;f;fz f;fhd ghi wj ;Jz Lfs; (xU gli l NghdW fh l r;pas;f;Fk) Rwwp tUf;pdwd.

- , i tNa rjWNfhs;fs; vdggl;f;pdwd. m; j i j fa Nfhs;fs;Ny nru] ; vdgNj k;pf;ngupa rjWNfhs;f;Fk; , j d; t;pl;k; 346 f;pk; MFk; Rkhu; 50 k;py;pad; Mz LfS f;F;nf;hU Ki w ek; Gk;pad; k;U rjWNfhs; t;bt;Jz L; m;J 10f;pk; m;fyk; nf;hz;l;jhf , Uf;Fk; , twi wAk; ngupa nj hi yNeh;f;f;ahy; k;LNk fhz KbAk;

thy; t;tz k;bf;S; (comets):

- m; j p e;S;t;l;l;gghi j a;py; ek; #upai dr; Rwwp tUk; J}R kwWk; gdp epi wej nghUs;fNs thy;t;tz k;bf;S; vdggl;k; , twwpd; RwWf;f;hyk; m; j p;fk; MFk; , i t #upai d neUq;Fk; NghJ> M;trah;f; j i y kwWk; thy; M;f;pai t c Uthf;pdwd. xU rpy ngupa thy; t;tz k;bf;S; f;F 160 k;py;pad; (16 Nf;hb) f;pk; e;S;Kss thy; c ssJ. , J Gt;f;Fk; \$upaD;f;Fk; , i l ggl; nj hi y t;py; t;pl m; j p;fk;h;Fk; gy thy;t;tz k;bf;S; Fw;gg;l; f;hy , i l nts;par; k;l;Lk; Nj hdWgi t MFk; m; j py; XdWj hd; ` hyp thy;t;tz k;bf;S; , J 76 Mz LfS f;F xU Ki w k;l;Lk; nj upAk; fi l r;pahf 1986-y; , J ghuf;f;gg;l;J. vdNt , J k;l;Lk; 2062-y; nj upAk;

- t;tz f;w;f;S; kwWk; t;tz ; t;bf;w;f;S; (meteors and Meteorites): #upakz l yk; KOTJk; gutyhf nj w;f;f;pl f;Fk; r;W ghi wj ;Jz LfNs t;tz f;w;f;S; vdggl;f;pdwd. k;pf m; j p;f; Nt;f;J;l;d; gaz p;f;Fk; , i t Gt;pad; t;sp;zk;l;y;j;j neUq;Fk; NghJ> m; j d; <ugG t;pi rahy; ftuggL;f;pdwd. tUk; t;op;py> t;sp;zk;l;y; cuha;t;id;hy; c UthFk; ntgg;j;pd; fhuz khf , i t ngUkghYk; vup;J;t;L;f;pdwd. mi t t;tz f;w;f;S; vdggl;k; Mdh; xU rpy ngupa m;st;pyhd t;tz f;w;f;S; KOTJkhf vupahky; f;w;f;shf Gk;par; k;l;Lk; t;bt;Jz L mi t t;tz ; t;bt;Jz L mi t t;tz ; t;bf;w;f;S; vdggl;f;pdwd.

Ji z fNfhs;fs;

- xU RwWgghi j a;py; #upakz l yj j pYss Nfhs;fi sr; Ji z fNfhs; vdwi of;f;ggL;f;pdwJ. k;dl;j dhy; c Uthf;f;gg;l; Ji z fNfhs;py;Ue;J NtWg;L;J;t;j w;f;h;f; , awi f; j ; Ji z fNfhs;hd e;py;t;pd; (rej;ud) k;U gLk; x;sp;ahdJ vj;n;u;h;s;p;f;f;ggL;t;j;hy; mi j ekkhy; ghuf;f; Kbf;pwJ. <ugG t;pi rapd; fhuz khf> , i t Nfhs;fi sr; Rwwp tUf;pdwd. #upakz l yj j pYss Nfhs;f;S;S; G; j d; kwWk; ntss; p Nfhs;fi sj ; j tpu kww mi dj j p;w;Fk; e;py;Tfs; c ssd.

fh] k;pf; Mz L

nehb;f;F 250 f;pk; (kz p;f;F 9 , yl;r;k; f;pk;) Nt;f;j;j;py; ghynts; t;pl; ar; Rwwp tu Gk; vL;J;f;nf;hs;S;k; f;hyk; fh] k;pf; Mz L vdggl;k; , J 225 k;py;pad; Gt; p Mz LfS f;F rkk;

Rwwpaf;f; j ; j pi rNt;fk;

- , awi f; j ; Ji z f; Nfhs;fs; Nfhs;fi sr; Rwwp tUti j ggwwp ehk; Kddh; mwpeNj hk; Nfhs;pw;Fk; Ji z fNfhs;pw;Fk; , i l Na <ugG t;pi r nraygLf;pwJ. j w;f;hy;j;j;py; gy nrawi ffNfhs;fs; Gk;pad; RwW t;l;l;gghi j a;py; nrY;j;j;ggL;f;pdwd. 1956- y; nrY;j;j;gg;l;] Gl d;pf; vdw nrawi ffNf;h;Ns K; j d;Ki wahf nrY;j;j;gg;l; nrawi fahd Ji z fNfhs; MFk; , ej;ah j dJ K; j y; nrawi ff; Nfhs;hd Mupaggl;i hi t Vguy; 19> 1975- y; nrY;j;j;paJ. nrawi ffNfhs;fs; rpy E;JW f;Nyhk;l;l;u; c au;j;j;py; Gk;pi ar; Rwwp tUk; ti f;ay; t;tz z py; nrY;j;j;ggL;f;pdwd. , ej; c au;j;j;py; fhwwp;d;hy; VwgLk; c uha;T Gw;f;f;z p;f;f;j;j;f;f;j;hf , Uf;Fk; , ej; c au;j;j;pw;F vL;J;r;

nrdw gpdG> nrawi ffNfhs; xU fpi lklj; jpi rNtfjij msjijhy; mJ fpljijl xU tli tbt RwWgghi japy; , aqfK;

- Nfhs; xU ephz apf;fggl; c auj;py> nrawi ffNfhs; xdW tli;gghi japy; RwwptUtj wF mj wF msp;f;fggLk; fpi lklj; jpi rNtfk; Rwwpaffj; jpi rNtfk; vdgLk;
- xU nrawi ffNfhs;fspd; Rwwpaffj; jpi rNtfk; vdgJ mJ Gtp;pyUeJ cSS cauj;ijg; nghWj;J Gkpf;F vej mst;w;F mUf;py; cSSNjh mej mst;w;F mjd; Ntfk; mj pfkhd , Uff;f Ntz Lk; 200 f;pk; njhi ytp; cSS nrawi ffNfhs; xdW fpljijl 27>400 f;pk; Ntfj;pw;Fk; rww mj pfkhd Ntfj;Jld; , aqf;f Ntz Lk; mt;thW , aq;FkNghJ mJ 24 kz p Neuj;py; Gkpi a RwwptUk; Gtp;pd; Row;pf;fhyKk; 24 kz pahf , Uggjhy> mej nrawi fNfhs;hdJ Gtp;pd; gugg;w;F Nky; xNu , ljj;py; , UggJ Nghy; NjhdWk; , t;thwhf> Gtpi ag; nghWj;J xNu epi yapy; , Uggjhy> , t;ti f nrawi ff; Nfhs;fS f;F Gtpi y nrawi ffNfhs;fs; vdW ngau; Rwwpaffj; jpi rNtfjij (v) gpd;Uk; thaghl bdi df; nfhz L fz f;pl yhk;

$$V = \sqrt{\frac{GM}{R+h}}, \text{ q;F}$$

G = <ugg;pay; khw;py = $6.67 \times 10^{-11} \text{ epk}^2 \text{ f;pf}^2$
M = Gtp;pd; epi w = $5972 \times 10^{-24} \text{ f;pf}$
R = Gtp;pd; Muk; = 6371 f;pk;
h = Gtp;ggugg;pyUeJ nrawi ffNfhs;pd; c auk;

Ez; <ugG vdgJ nghUs;fs; myyJ kdij ufs; vi lawW , UggJ Nghy; NjhdWk; epi y MFk; t;znst; t;lu;fSk> xU rpy nghUs;fSk; t;znst;py; kj f;FkNghJ> Ez; <ugg;pd; tpi sTfi s ehk; mw;payhk; Ez; <hgG vdw;hy; k;f;r;w;pa <ugG vdW nghUs;gLk;

nrawi ffNfhs;fspd; RwWf;fhyk;

- Gtpi a xU Ki w KOi kahf Rwwp tu xU nrawi ffNfhs; vLj;J fnfhs;Sk; fhyk; RwWf;fhyk; vdgLk;

RwWf;fhyk; T = $\frac{fLej \text{ nj hi yT}}{Rwwpaffj; jpi rNtfk;}$

$$T = \frac{2\pi r}{v}$$

vd; kj jgi g g;uj papl >

$$T = \frac{2\pi(R+h)}{\sqrt{\frac{GM}{R+h}}}$$

mi dj;J t;znst;fSk; f;pf;pyUeJ Nkw;fhf efut;J Nghy; Njhdw;dhYk; XNu xU t;znst; kld; kl;Lk; efuhky; cSSJ Nghy; nj upAk; mJ Jut t;znst; kld; vdW mi of;fggLfwJ. epi yahf mi ke;JSS Gtp;pd; Roy; mrr;w;F Neuhf mi ke;J Uggjhy> JUt t;znst; kld; xNu , ljj;py; cSSJ Nghy; NjhdWfwJ. Gtp;pd; nj wF mi ufnfhs;j;pyUeJ Jut t;znst; kld; nj hpt;ji y.

nfgsupd; tñ pfs;

- 1600 fspd; nj hl fñ j j py; N[hfd] ; nfgsu; Nfhsfspd; , affj j pwfhd %dW tñ pfi s ntsapl lhh; mtu; j kJ topfhl bahd i l Nfh guphNf vdgtyhy> ftdkhf Nfuf;fggl ; jftyfspd; %yk; Rupa-i ka mi kggpd; mbggi l ary; %dW tñ pfi sf; \$wpdhh; Nfhsfspd; , affj j pwfhd nfgsupd; fUj Jfs; , gNghJ xgGfnfhssgg l tñ y y vdpDk> mtuJ Nfhsfs; kwWk; Ji z f; Nfhsfspd; , affj j jg; gwwpa kpfrrupahd fz pggfK; mi t fNo j ugg l Lssd.

Kj y; tñ p eSt;l;l qfspd; tñ p

- #upadpd; i kak; xU Ftñ j j py; c ssthW> eSt;l;l g; ghi j ay; Nfhsfs; #upai dr; Rwwp tUfñ dwd.

, uz ;htJ tñ p - rk gugGfspd; tñ p

- Nfhspd; i kaj j j Ak; #upadpd; i kaj j j Ak; , i z fFk; fwgi df; NfhL> rk fhyqfspy; rk gugGfi sf; fl f;f;pwJ.

%dwhTJ tñ p - xj j pi rTfspd; tñ p

- vej ,U Nfhs;fS fFk> Rwwf;fhyqfspd; , Ukbfspd; tñ j k; #upadpñ Ue;J mtwwpd; ghj pãst NgurRfspd; (major axis) Kkkbfspd; tñ j j pwFr; rkk;

gddhl L tñ ntsp i kak;

- tñ ntsp tlhfs; j qFtj wfhd xU ngupa tñ ntsp;fyNk gddhl L tñ ntsp i kak; (g.tpi k) MFk; mJ jhothd Gtñ l;l gggi j ay; Rkhh; 400 flKp nj hi yty; , aqFf;pwJ. mJ xU mwptay; MatfkhfTk; nraygLf;pwJ. mj d; Kj y; gFj p 1998 - Mk; Mz by; Rwwgghi j ay; epi yeñ Wj j gg l;l J mj d; Kf;f;paggFj pfspd; fl Lkhdk; 2011-y; Kbf;fggl;l J. tñ z pYss nghUs;fspy; ntWk; fz z hy; ghuf;fggl f;\$ba> kdñ dhy; c Uthf;fggl;l ngupa nghUs; , Jnt MFk; , ki kaj j pwFk; Kj d; Kj yhf 2000- Mk; Mz Lj hd; kdñ ufs; nrdwdu; mj d; gpwF> xUnghOJk; mj py; kdñ ufs; , yyhky; , Uej J , yi y. xU Fwgg l;l ehsy; Fi wej J MW kdñ ufs; mqf , Ugghufs; j wNghi ja j pl;l ggb 2024-k; Mz Lt i u gddhl L tñ ntsp i kakhdJ , affggLk; vdWk> Nji tgg l;l hy; 2028 ti u , affgglyhk; vdWk; \$wggLfdwJ. mj d; gpwF mJ Rwwgghi j ay;Ue;J tñ y;f;f;fnfhssgglyhk; myyJ mj d; rñ y gFj pfs; tUq;fhy tñ ntsp i kaq;fS f;Fg; gadgLj j gg l;yhk;

gddhl L tñ ntsp i kaj j pd; gadfs;

- mnkhp;f tñ ntsp eñ Wtdkhd ehrhtpd; ghui tay; fbf;fz;l topfsy; gddhl L tñ ntsp i kak; ekf;F gyi d msj ;JssJ.(myyJ tUq;fhyqfspy; ms;f;f;\$Lk).

eñ; Rj j p;fup;Fk; Ki wfs;

- gddhl L tñ ntsp i kaj j py; gadgLj j pAss nj ho;py;El gj i j f; nfhz L j z z ßj ; j;lLghL css , lqfspy; Nkkglj j gg l;l eñ; tbf;lLj y; kwWk; Rj j p;fup;Fk; Ki wfi sg; ngwyhk; j z z ðj ; j;lLgghL epi wej , lqfspy; thOk; kf;fS f;F ca;u; fhf;Fk; topKi wahf , J , Ufff; \$Lk. gddhl L tñ ntsp i kaj j pwf;hf (ISS) c Uthf;fggl;l eñ; kl;G mi kgG (WRS) kwWk; Mf;rp;l d; c Uthf;Fk; mi kgG (OGS) Mf;pai t> <uhf; ehl by> Rj j khd Fbel; , yi y vdgj hy> fhgghwwp mtufi s kl;Lk; mqf tho topti f nra;Jssd.

fz i z j ; nj hl Uk ; nj horyEl gk ;

- Ez ; <ugG epi yary; Ma;Tfi sr; nrat;twfhf c Uthf;fggl; > fz i z j ; nj hl Uk ; fUtp gy Nyrh; mWi t rpfri rfsy; gadgl;LssJ. , afff;Fi wghL kwWk; Ngrny; Fi wghLsstufS f;F , ej fz i z j ; nj hl Uk ; nj horyEl gkhdJ ntFthfg; gadgLfpwJ. vLj;Jffhl;hf> jtpu , afff; Fi wghLss xU Foeij > mdwhl nrayghLfi s nra;J nfhz L ahi uAk; rhuej;uhj thofi fi a tho , aYk;

j hdpqf; i ffs; (robotic arms) kwWk; mWi t rpfri rfs;

- mWi t rpfri r %yk; mfw , ayhj flbfis (v.fh> %i sf; flbfs) eF;Ftj wFk; kpfj; Jyypakhd Ki way; clyj;R Ma;T nrat;twFk; (biopsy), gddhl L t; z ntsp i kajj; y; Muharr;Fj; Ji z ahf , Uggj wfhf c Uthf;fggl; > j hdpqf; i ffs; ngup;K; cjTf;pdwd. , jji fa fUtp;fshy; kpfj;Jyypakhd Ki way; cly; j;R Ma;Tfi sr; nraa KbAk; vdW , i j c Uthf;f;athfs; \$Wf;pdwdu;

- , twi wj ; jtpuTk; , dDk; gy topfsy; gddhl L t; z ntsp i kajj; y; NkwnfhssggLk; Ma;Tfs; ekfF gaDssjha; mi kfp;dw. mi tahtd; NkkgLj;ggL jLgG;rpi s c Uthf;Fj y> khugfg; GwWNe;hi af; fz ;wj y; kwWk; rpfri r> mZ fKbahf gFj;pfS f;Fs; nry;t;wfhd khahyp; fUtp;fs; c ssp;l , dDk; gy.

gddhl L t; z ntsp i kaKk; gddhl L \$l;LwTk;

- gddhl L t; z ntsp i kajj; y; mwp;ay; rhj;id fS f;F rwWk; Fi wahj rhj;id v;dn;tdwhy; , ej i kajj; c Uthf;Ftj wFj; Nj;itggL gddhl L xj;Ji ogG MFk; gddhl L t; z ntsp i kajj; , af;Ftj wFk> guhkup;gj wFk; 16 nttntW ehLf;sp; l eJ t; z ntsp epWtdq;fs;pd; xj;Ji ogG Nj;itggLfp;dwJ. mee;Wtdq;fs;htd NASA (mnkup;fh) Roskosmos (u~ah> ESA (l Nuhggh> JAXA ([gghd> CSA (fdl h> ngy;[pak> gp;Nurpy; nl dkhhf> gp;hd;] > n[ukd; , j j hyp ` hye;J> ehuNt>] ngap; Rtl d> Rtp; ruyhe;J kwWk; , qf;pyhe;J Mf;pa ehLf;S k; , ej f; \$l;li kgg;py; c sssd.

myF 2
#hpaF; FLkgKk; GtpAk;

mwKfk;

- Nkff; \$lk; , yhj njspthd , uty; eqfs; nkhl i l khaNyhb myyJ c qfs; tllbd; Kwwjj Nyh xantLj Jz ih? Mk; vdy; , uT thdy; xshfwd elrjjqfs; vz z pfi fapy; mj pfhggij NghdW fhlpasfjwJ. ehk; fhZk; , ej xshfwd elrjjqfs; Nguz ljjpd; xU gFj pahFk; , tNghJ ehk; Nguz lk> elrjjqfs> Nfhsfs; kwWk; gytwi wg; gwwAk; fyeJi uahlyk; Nguz lk; vdgJ mzlqfs> elrjjqfs> Nfhsfs; kwWk; gw gUgnghUI fi sAk> Mwwi yAk; nfhz Lss xU guej Kbtww thd; ntsq; gFj pfshFk;

Gtpad; Nj hwwk; gwwpaf; Nfhl ghL:

- Gtpad; Nj hwwk; Fwjj Mj hukhf gy Nfhl ghLfs; c ssd. Gtpad; Nj hwwk; gwwpa Kei ja gpyghd thjqfsy; n[hkd; Nguhrpah; , kkhDnty; fhd!; (Immanuel Kant) vdgTUi laJk; xdwhFk; , ij 1796 Mk; Mz L fz ij Nki j yhgNy]; (Laplace) GJggjjhh; , J neGyhh; fUJNfhs; (Nebular Hypothesis) vd mwaggllJ. , jd; gb nkJthf RoYk; , sk; #hpaDI d; njhlhGi la nghUI fspd; Nkff; \$ljjjpyUeJ Nfhsfs; c Uthf , Uffyhk; Gtpad; Nj hwwj ij g; gwwpa mfjjus;T Nfhl ghli l (Accretion Theory) yplbyl d; (Lyttleton) vdgth; Kdi tj jhh; , ej Nfhl ghli bd; gb Nj huhakhf 4.6 gpyyad; Mz LfS fF KdG> #hpa kz lykhdJ #hpa neGyh vdW mi offggLk; J}rp kwWk; thAffs; epi wej Nkff; \$lkhf , UeJ J.
- , ej #hpa neGyh Rodw NghJ <hgG tpi rahdJ nghUI fi s j fhj J #hpaF; FLkgjjpd; i kaj jpy; #hpa i d c UthffpaJ. #hpad; c UthdJk; kJ Kss nghUI fs; , Wfj; njhlqf d. rmpa Jfsfs; <hgG tpi rahy; xdWl d; xdW , i z eJ nghpa Jfs;fshf khwpd.

kz pfF 62.764.416 fpkl ih; Ntfjjpy; nryYk; thNa[h; 2 Ma;Tf; fyk> ekJ , uT thdj jpy; mj pf xspUk; elrjjpkhd rhpai a fleJ nryy 296000 Mz LfS fF Nky; vLj Jf; nfhs;syhk;

- #hpaF;fhwW Gtp Nghdw Nfhsfs; c Uthff; fhuz khfpa nghpa ghi wg; nghUI fi s tpiL tpiL i` lu[d; kwWk; `lyak; Nghdw , yFthd jdkqfi s i kaggFj pary; , UeJ ntsNawwpaJ. Mdhy; njhi yty> #hpaF; fhwWfs; , yFthd \$Wfspd; kU Fi wthd jhffjij VwgLjjpajhy; mi tfs; , i z eJ nghpa thA ngUqNfhs;fshf c Uthf d. , tthW Nfhsfs> Ji z fNfhsfs> FWqNfhsfs> thyelrjjqfs; Nghdwi t c Uthf d.
- fdkhd jdkqfs; xdNwhnl hdW Nkhjp , Wfp Kj ypy; Gtpad; c l fU c UthdJ. fdkhd jdkqfs; i kaj ij Nehffp %ofpaNghJ> nkyypa jdkqfs; NkNyhl i l c UthffpaJ. , eNeuj jpy; Gtpary; fhej gGyk; c UthffpaJ. Gtpad; <hgGtpi r nry thAffi s fthej jhy; GtpfF Nky; tspkz lyk; c UthffpaJ.

Nguz ljjpd; Nj hwwk; gwwpa etblfNfhl ghL:

- Nguz ljjpd; Nj hwwk; gwwpa kpf Kffpakhd Nfhl ghli l ngU ntbgGF; Nfhl ghL (Big Bang Theory) vdfpNwhk; , J thpti lAk; Nguz lk; fUJNfhs; (Expanding Universe Hypothesis) vdWk; mi offggLfjwJ. 1927 Mk; Mz by; ngy;[pa thdpayuhd mNg [hh[; Nykl Nu (Abbe Geotge Lemaitre) Nguz ljjpd; Nj hwwk; gwwpa Nfhl ghli l Kj d; Kj ypy; Kdi tj jhh; vlt;pd; `ggps; (Edwin Hubble) vdgth; Nguz lk; thpti leJ nfhz bUggj wfhd Mj huqfi s Kd; i tj jhh; , ij ngUntbgGF; Nfhl ghL (The Big

Bang Theory) vdWk; mi offpNwhk; , fNfhl ghl bd; gb 13.75 gpyyad; Mz lFS fF KdG Nguz ik; cUthf tthptilaj; njhlqfpaJ. kpf tpiuthf tthptilAk; gYhd; Nghy vyfihu dtpl rmpa mstpy; , UeJ jwNghi ja mstpwF xU nehbg; nghOjpy; ngUfpaJ.

- Nguz ljjpyUeJ gUgnghUI fs; ngUk; rfjAl d; mi djJj; jpi rfsYk; ntsNa tlggl d. , rrayghlbdhy; gy FOfshf cUthd elrjjµqfi sNa ehk; mz lqfs; vdfpNwhk; Xh; mz ik; gpyyad; fz fhd elrjjµqfs> elrjjµ vrrqfs> elrjjµ thAffs; J}R kwWk; GyggLhj nghUI fi s (Dark matter) c s s l f f p AssJ. Nfyf] p (mz ik) vdw nrhy; Nfyf] pah vdw f p Nuff nrhyypUeJ ngwggLJ. Nfyf] p vdw why; ghy; top vdw nghUs; ghy; top mz ik; vdgJ ek; #hpa FLkgk; mi keJss xU mz ikhFk;

mz lqfs; %dW ngUk; tbtqfi s nfhz lssJ.

1. RUs; tbt mz ik; (Spiral Galaxies):

, J elrjjµqfs> thAffs> kwWk; J}Rfshyhd jli lahd kwWk; RoYk; tli tbtjijf; nfhz lssJ. , j d; i kajjpy; elrjjµqfs; Ftpej pUggjhy; , jid 'tiffk;" (Bulge) vdfpNwhk; ghy; top kz l ykl; kwWk; Mdl Nuhkl h (Andraomeda) mz ik; Mfpat RUs; tbt mz lqfs; MFk;

2. eS; tli mz ik; (Elliptical Galaxies):

, J Fi wthd thAffs; nfhz l tajhd elrjjµqfi sf; nfhz lssJ. nk]] pah; 89 mz ikhdJ xU eS; tli mz ikhFk;

3. xUqfww mz ik; (Irregular Galaxies)

, J mjpf mstpy; J}RffSk; thAffSk; epi wej , si kahd mz l hFk; , J kpfTk; guphrkhdJ. vLj Jffhl L> nghpa Nknfyypd; (Magellanic) Nkfk;

- njhlffjjpy; Nguz ik; Mwwyhy; klLNk epi wej pUejJ. , ej Mwwyfs; rpy Jfsfshf khwpd. , J i` lu[d; kwWk; ` lypak; Nghdw Nyrhd mZ ffsf khwpaJ. , ej mZ ffs; xdwpi z eJ mz lqfshfTk> gpdh; elrjjµqfshfTk; kwWk; gpw jdkqfshfTk; Njhdwpd. , J nghJthf VwWf; nfhs sggL; Nguz ljjpd; Nj hwwk; gwmpa fUjj hf mwptpay; mw p Qhfs hy; kj pggL ggl LssJ.
- thdpayhshfspd; fUj Jggg ehk; fhz fpdw mz lqfs> elrjjµqfs; kwWk; Nfhsfs; Nghdwi t Nguz ljjpd; 4 rj t] gFj p klLNkahFk; Nguz ljjpy; kj k; c s s 96 rj t] nghUI fi s ehk; fhz Nth myyJ vsj py; GhpeJ nfhs sNth , aytpyi y.
- <hgG Gy xsptpyfy; (Gravitational lensing) vd mi offggLk; Gjpa msi t Elgk; Nguz ljjpd; taJ kwWk; GyggLhj Mwwypd; typi k Mfpatwi w c Wj pggLjjpaJ.
- Nguz ljjpd; tthpthffk; GyggLhj Mwwypdhy; Jhjj ggLjj ggLf p wJ. tpQQhd p fs; <hgG Gy xsptpyfi yg; gadgLjj p guphrkhd xU nraygLk; mz ljjpyUeJ GtpfFg; gaz g] xs p ad; J}ujijAk; kwWk; mz l tthpthffjjpd; rpy tptuqfi sAk; fz l wpej dh;

el rj j µqfs; kwWk; el rj j µqfs pd; \$ l i k;

- elrjjµqfs; vdgJ Ra ntsprk; kwWk; ntggjij nfhz l i tahFk; GtpfF kpf mUfpy; c s s elrjjµk; #hpad; MFk; #hpa i d tpl kpfTk; guphrkhd elrjjµk; rhp a] ; (Sirius) MFk; #hpa DfF kpf mUfpy; fhz ggLk; elrjjµk; guph f] p kh nrdl hhp (Proxima centauri) MFk; NghJkhd msT J}Rfs; kwWk; thAffs; <hgGr; rfj p adhy; xdw hf gpi z eJ elrjjµqfs; cUthf pdwd. xU elrjjµk; thoehs py;

ngħpa rptgG elrjjuk> ntz; Fss elrjjuk> epA# uhd; elrjjuk; kwWk; fUeJi s
Nghdw tbtqfshf khwwk; mi lfpwJ.

- elrjjµ \$l;k; (Constellation) vdgJ thdjy; xU Fwggpl tbtjij
cUthfFfjdw epi yahd elrjjµ \$l; mi kgghFk; 1929 Mk; Mz by> rhtNj r
thdpay; xdwak; (International Astronomical Unit), 88 elrjjµ FOFFs; c ssj hf
mj pfhugGhtkhf VwWf; nfhz lssJ. , j wF Kddh; j hykp (Ptolemy) j dDi la my;
Nkf] l; (Almagast) vdw Gj j fjj y; 44 elrjjµ \$l;qfs; c ssj hf
gl baypl Lssh;

Nguz l k; thpti l ti j Ak; kwWk; thpti l Ak; Ntfk; mj pfhggj j Ak; fz l wpej j pdhy; rTy;
nguy; kl l h; (Saul Permuter, Smith and Adam Riess) gnuad;] kj; kwWk; MI k; nua;] ;
, ej %dW mwptjayshfS k; , awgpaYf;hd Nehgy; ghpi r (2011) ngwwdh;

- c hrh Nk[h; (Ursa Major) vdw elrjjµf; \$l;jij t l mi uf; Nfhs k; kwWk; nj d;
mi uf; Nfhsjj pd; rpy gFj pfsy; fhz yhk; c hrh Nk[h; (ursa major) vdwhy; yjj d;
nkhopay; ngħpa fub (big bear) vdw nghUs;

#ħpaf; FLkgk;

- #ħpaf;FLkgk; vdgJ eLty; xU elrjjµKk; mi jrRwwp tyk; tUk; vlLNfhsfs>
Ji z fNfhsfs> rwpaf; Nfhsfs> thy; elrjjµqfs; Nghdwtwi wf; nfhz l xU
mi kgghFk; Gj d> ntssp> Gtp> nrttha> tħahod> rd> ANud] > negbA>d; Mfpa
vlL NfhsfS k; #ħpai d eS;tl;l ghi j ary; RwwptUfjdw. ngUkghyhd elrjjµqfs;
Nfhsfi s nfhz lssd. vdNt gpyyad; fz fffhd #ħpa FLkgqfs; ghy; top
mz ljj y; fhz ggLfjdw. xU #ħpaf; FLkgjj y; xdwWfF Nkwgl l elrjjµqfs;
fhz ggl yhk; , uz l elrjjµk; nfhz lss #ħpa FLkgjj j , uz l elrjjµf;
FLkgk; vdwk; %dW myyJ gy elrjjµqfi s nfhz lss #ħpa FLkgjj j gy
elrjjµf; FLkgk; vdwk; mi offpNwhk; ek; #ħpa FLkgk; ghy; top mz ljj pd;
ntspGw Royy; mi keJssJ. ekJ #ħpaf; FLkgk; ghy; top mz ljj pd;
i kajj yUeJ xU kz p Neujj wF 8.28-000 f;kl;l h; Ntfjj y; RwwfµwJ. ekJ
#ħpaf;FLkgk; , ej mz ljj jr; Rwwptu vLj j f; nfhsS k; fhyk; 230 kpyyad;
Mz Lfs; MFk;
- ekJ #ħpaf; FLkgk; Rkhh; 4.6 gpyyad; tUl qfS f;F KdG c Uthdj hf
ekgggLfµwJ. negbA>dpd; eS;tl;l gghi j ary; , UeJ nj hl qfK; “Faggh; kz l yk”
(Kuiper belt) , j Ds; ml qfK; , J gdpf;fl b fshy; Md ml hjj p Fi wthd ti sak;
MFk; , J FWqNfshd gSINI hi t t l rwpaj hFk; , ej Faggh; kz l yjj wF
mgghy; Chl; Nkf qfs; fhz ggLfjdw. , ej kpfngħpa Nfhs tbt XL Nghdw
mi kgghdJ ekKila #ħpa FLkgjj jr; #oeJssJ. , J , Jtiu Neu hf
fz l wagg l tyi y. Mdhy; rpy fz j khj ħf; kwWk; mqfUeJ tUk;
thyelrjjµqfi s fz l wpej j pd; mbggi l ary; , J , UggJ fz pffgg l LssJ.
- Chl; Nkf k; tiz ntsp gdp Jfsfshy; MdJ. , J ekJ #ħpai d 1.6 xsp Mz Lfs;
J}ujj y; , UeJ RwwfµwJ. , ej XL kpfTk; ml hjj pahd nghUl fshy; MdJ. , j d;
ml hjj p 5-000 thdpay; myfpyUeJ 100-000 thdpay; myF ti uahFk; xU thdpay;
myF vdgJ #ħpaDf;Fk; GtpfFk; , i lgl l J}uk; myyJ 150 kpyyad; fNyhkl;l h;
MFk; Chl; Nkfkh dJ #ħpadpd; GtpħgG rfj pad; vyi yahFk; , ej vyi yary; Rwwp
tUk; tiz nghUl fs; , ej , ljj y; j pUkgr #ħpai d Nehf;f; nry;Yk;
- ekJ #ħpa FLkgjj y; 163 fz l wagg l Ji z fNfhsfs; c s d. , dDk; gy
Ji z fNfhsfs; kdj d; fz Lg b j j mqf;f;huj j w;fhf fhj j pUf;f;dw. vlL
Nfhsfsy; Gj d; kwWk; ntssp j tµ kwi t mi dj j wFk; Ji z fNfhsfs; c s s d.
tħahodk> rdAk; kpf mj pf mST Ji z fNfhs;fi sf; nfhz lssd.

#hpad;

- ekJ #hpad; FLkgj jpd; i kag; gFj pary; #hpad; fhz ggLfjwJ. , J xU ntggkhd vhpthAfshy; Md geJ Nghdw mi kgGi la kQrs; epw FW elrjj juk; MFk; , jDi la <hgG rjj jahdJ KO mi kgi gAk; mj Di d; <hj J kpf gnggha NfhsfsypUeJ kpfrrwpa tiz ntsr rpi jTfs; ti u mj d; tll ggghij ay; , aqf i tffjwJ. #hpad; fhz ggLk; kprfj jahdJ xU fhej Gyjij j di drRwwp c UthfFfjwJ. , ej fhej gGykhdJ #hpad; FLkgk; topahf #hpad; fhwwhy; vLj J; nryyggLfjwJ.

#hpadpd; mi kgG:

- #hpadpd; 70.6% i ` lu[d; kwWk; 27.4% ` lypajj hy; MdJ. #hpad; <hgG tpi rahy; kpf mj pfsT gUgnghUl fi s xdwpi z jJ mstww mOj j j j Ak; kwWk; ntggepi yi aAk; mj d; i kag; gFj pary; c UthfFfjwJ. #hpadpd; c lGwj j py; %dW Kj di kahd mLfFfs; cssd. mi t c l fU (Cote), fj jhtR k z :yk; (Radiative Zone) kwWk; ntgg c kpoT Rowrp k z :yk; (Convective Zone) MFk; #hpadpd; i ka gFj pary; fhz ggLk; c l fU kpf ntggkhd gFj p MFk; , qF ei lngWk; mZ ffU , i z T Ntj pti d #hpaDfF mj pf Mwwi y nfhLffjwJ. , j wF mLj J ntsrgGwj j Nehffp mi kej mLfi f fj jhtR k z :yk; vdfjNwhk; , ej mLfF KOtJk; MwwyhdJ Nghl l hdfs; (photons) %yk; ntggf; fj jfi s vLj J; nry; t j hy; , ej mLfi f fj jhtR k z :yk; vdfjNwhk; #hpad; fhz ggLk; %dwhTJ kwWk; fi lrp mLfi f ntgg c kpoT Rowrp k z :yk; vdfjNwhk; , ej mLffjy; ntgg Mwwy; Rowrp topahf Mj pffk; nrYj J t j hy; , j i d ntgg c kpoT Rowrp k z :yk; vdfjNwhk; #hpadpd; c l gFj p fFk; #hpa tsjkz l y j j wFk; , i l ggl i vyi yggFj pi a xsp k z :yk; (Photosphere) vd mi offjNwhk; , i j jhd; ehk; #hpadpd; 'NkwgugG' Mf fhz fjNwhk;
- #hpaDfF tsjkz :yk; cz l #hpa tsjkz l y j j pd; fbggFj pi a tz z fNfhsK; (Chromosphere) vd mi offjNwhk; , ej nrhy; fjNuff nkhoparyUeJ ngwgg l j hFk; fjNuff nkhopary; FNuhNkh (Chroma) vdwhy; tz z k; (Colour) vdW nghUs; #hpa fufz j j pd; NghJ , J gpfhrkhd rptgG tz z j j py; NjhdWtj hy; , gngai ug; ngwwJ. ntggepi y kpf Ntfkhf caUk; nkyypa khWepi y gFj jahdJ (Transition Zone) tz z f; NfhsGGFj pi aAk; guej fNuhdh (Corona) gFj pi aAk; ghpffjwJ. #hpa tsjkz l y j j pd; cahej NkygFj p fNuhdh vdW mi offjggLfjwJ. , J #hpadpd; Nkwgugi g (xsp k z :yk) tpi kpf mj pf ntggkhf , UfFk; fNuhdhtpd; Nky; gFj p rpwj hf #hpa fhww k z :ykhf khWfjwJ. #hpa fhwwhdJ kpdk mi yfshf (Flow of Plasma) #hpad; FLkgk; topahf elrjj j uqfS fF , i l Na c ss tiz ntsr fFr; nry; f jwJ.
- MfNt #hpaDfF MW gFj pfs; cssd. mi t c l fU > fj jhtRk z :yk > ntgg c kpoT Rowrp k z :yk > xsp fNfhsK > tz z fNfhsK; kwWk; fNuhdh Nghdwi tahFk; #hpad; Nkwguggpd; ntggepi y 5-500° K j y; 6.000° nry] pa] ; MFk; , j d; i kaggFj p pd; ntggepi y 15 kryypad; (15-000-000°C) bfjhp nry] pa] ; MFk; , J ntgg c l fU gpi z gi g j ffi t j J f; nfhss NghJ khdj hFk; , ej epfotiy; rjWrjW mZ ffs; , i z eJ nghpa mZ ffi s c UthfFfjwJ. mgNghJ mj pfs t pyhd Mwwy; ntsr NawwggLfjwJ. Fwggghf rpwpa i ` lu[d; mZ ffs; , i z eJ nghpa ` l y ak; mZ i t c UthfFk NghJ mj pf ntggk; ntsr p l ggLfjwJ.

c Utk; kwWk; J }uk;

- #hpadpd; Muk; 6:95:508 fNyh klIh; MFk; , J Gtpi a tpi kpfngghpa gUki d nfhz iJ. xU #hpadpd; gUKDFf 3:32:946 Gtp rkk; MFk; xU #hpadpd; nfhsssi t epugg 1.3 kpyypad; GtpfNfhsfs; Nj i t.

#hpadpd; Rwwggh i j Ak; RowrAk;

- ghy; top kz Iyk; ehdF Kffpa ti sTg; gFj pfi sf; nfhz iJ. mi t Nehkh kwWk; rpf d] ; ti sT> rfp lhhpa] >] \$Ik; fuf] ; kwWk; ngh] pa] ; Nghdwi tahFk; #hpad; rfp lhhpa] ; vdW rWtistpy; mi keJssJ. mqfpuEj #hpadhdJ jdDila Nfhsfs> vhpwfs> thyelrjjµqfs; kwWk; tiz ntsngghUifis Nrhj Jfnfhz L ghy; top kz Iyjjpd; i kajij RwwptUfWJ. ekJ #hpa FLkgkhDJ kz pfF 8>28>000 fpkIh; jpi rNtfjjpy; RwwptUfWJ. ghy; top kz Iyjj j xU Ki w Rwwp tu #hpad; 230 kpyypad; Mz Lfs; vLj JfnfhspwJ. #hpad; jdJ mrrpy; 7.25° rhathf Nfhsfspd; eStIlg; ghi j jsjjpy; RoYfwJ. #hpad; jpl gnghUsyyhj j hy; mj d; xtnthU ghfKk; NtWgl Ntf tpfjjpy; RwwfwJ. #hpa eLfnfhllg; gFj ppy; #hpadhdJ xUKi w Rwwptu 25 ehlfs; vLj Jf; nfhsfwJ. Mdhy; #hpad; JUtggFj ppy; xUKi w Rwwp tu 36 ehlfs; vLj Jf; nfhsfwJ. ekJ #hpa FLkgjjpd; nkjj epi wapy; #hpad; klLNk 99.8 rj tjj j j f; nfhz LssJ.
- kww elrjjµqfi sg; Nghy #hpaDk; xUehs; jdJ Mwwi y , off NehlLk; #hpad; , wfFk; jUthapy; kpfngghpa mstpy; thptileJ Gj d> ntssp kwWk; Gtpi af; \$I KOtJkhf tQqfyhk; #hpad; jd; thoespy; ghjpi af; fleJtpl iJ. , J RUqfp xU FWk; ntz Gsspahf khw , dDk; 6.5 gpyypad; tUiqfs; Mfyhk; vdW mwptpy; mwqQfs; fz j Jssdh;

Nfhsfs;

- fNuff nkhopay; Nfhsfs; vdwhy; “Rwwgth” (Wanderer) vdW nghUs; NfhsfS fF Rakhf xspAk; ntggKk; fpi lahJ. xU Nfhs; fbffhZ k; gz Gfi sf; nfhz bUff Ntz lK;
 - v , J #hpa i dr; Rwwp tuNtz lK;
 - v , J NtW vej NfhsfwFk; Ji z fNfhshf , Ufff\$I hJ.
 - v , J jdDila epi w kwWk; <hgGrfj pad; %yk; , J Nfhs tbi tg; ngwmpUffNtz lK;
 - v NtW vej thdnghUSk; , j d; eStIlgghi j apy; FWffpl f\$I hJ.
- #hpadpl kpUeJ J}uk; kwWk; j di kfi sf; nfhz L Nfhsfs; fbff; fz j thW ti fggLj j ggl Lssd.
 1. cINfhsfs; myyJ epyk; rhh; Nfhsfs; myyJ ghi wNfhsfs; Gj d> ntssp Gtp kwWk; nrttha; Nfhsfs; Nghdwi t , tthW mi offggLfpdwd.
 2. ntsfNfhsfs; myyJ thANfhsfs; myyJ kpfngghpa Nfhsfs; tpaod> rdp ANud] ; kwWk; negbAd; Nghdwi t , tthW mi offggLfpdwd.
- xtnthU NfhsK; mj d; mrrpy; Rwwp tUfWJ. , ej , affjjpwF RoYjy; vdW ngah; , tthW xU Nfhs; xUKi w Rwwp tUkNghJ xU Nfhsehs; cUthfwJ. Nfhsfs; #hpa i d eStIlgghi j apy; RwwptUtJ tyktUjy; myyJ xU ‘Nfhs; tUI k’ vdW mi offggLfWJ.

#hpaf; FLkgj j py; c ss Nfhs;fs;
Gj d; (Mercury):

- #hpaDfF kpf mUfpy; Nfhs; Gj d; MFk; , J #hpaf; FLkgj j py; c ss Nfhs;fs;NyNa kpf; rwp NfshFk; , jwF Ji z fNfhs;fs; vJTk; fpi lahJ. , J jd; mrrpy; j di d j hNd Rwwp tu 58.65 Gtp ehlf; vLj;Jfnfhs;fwpJ. mNj Neuj j py; , J #hpa d xU Ki w tyk; tu 88 Gtp ehlf; vLj;Jfnfhs;fwpJ. Gj d; #hpadp kUe;J 0.4 thdpay; myF J}uj j py; , Uf;fwpJ. #hpa xsp Gj i d nrdwila 3.2 epkl qfs; vLj;Jfnfhs;fwpJ. Gj d; #hpaDfF kpf mUfpy; , Uej hYk; , J #hpaFLkgj j py; , uz ;htJ ntggkhd NfshFk;

ntssp (Venus):

- ntssp #hpaDfF mUfpy; c ss , uz ;htJ NfshFk; , J epi wapYk; mstpYk; Gtpi agNghy; , Uggj hy; 'Gtpapd; rNfhj hp' vdWk; mi offggLfwpJ. , J #hpaf; FLkgj j pd; kpf ntggkhd NfshFk; , j Di la ruhrhp ntggepi y 462° nryrpa] ; MFk; , J fpfNF #hpa c j aj j wF KdGk; NkwNF #hpad; ki wej gwFk; thdpay; NjhdWtj hy; , J fhi yary; 't; bntssp' vdWk; khi yary; "m] j kdntssp" vdWk; mi offggLfwpJ. , J tyQRoahf fbhuj pi rary; fpf;fypUe;J Nkwfhf j dJ mrrpy; RwwptUfwpJ. , ej Nfhs; RwwtJk; , j Di la e;stl;ggghj j Ak; gytj j j py; t; j j j ahrkhdJ. #hpa FLkgj j py; tyQRoahf Rwwk; , uz L Nfhs;fs;py; , JTk; xdW. ntsspAk; ANud] Rk; klLNk gpdGwkhf Roy;fwpJ. , J j di kj j hNd xU Ki w Rwwptu 243 Gtp ehlf; i s vLj;Jfnfhs;fwpJ. ekJ #hpaf; FLkgj j py; , J xU kpf e; ; ehshFk; , J #hpa d tyk; tu 224.7 ehlf; vLj;Jfnfhs;fwpJ. , jwF , awi fahf Ji z fNfhs;fs; fpi lahJ. , J #hpa d t; l 0.7 thdpay; myF J}uj j py; mi ke;JssJ. #hpa xspahdJ ntsspi a mila 6 epkl qfs; vLj;Jfnfhs;fwpJ.

ntssp	Gj i d	tpl	mj pf
ntggkhdJ	Vnddwhy;	ntssp	
kpfTk;		ml hj j pahd	
ts; k; ;lyk;	kwWk;	Vwf;Fi wa	
KOtJk;	fhhgd;	i l	
Mfi] l hy;	MdJ.		

Gtp (Earth):

- Gtp #hpaDfF mUfpy; c ss %dwhTJ Nfhs; MFk; , J #hpa FLkgj j pd; l e; htJ nghpaf; NfshFk; , j Di la Rwwgghj j ntsspf;Fk; nrt;thaf;Fk; , i l ary; c ssJ. Gtp j d; mrrpy; j di dj; j hNd Rwwp tu 23 kz pNeuk; 56 epkl k; kwWk; 4 t; pdhbfs; vLj;Jfnfhs;fwpJ. Gtp #hpa d tyk; tu 365.25 ehlf; vLj;Jfnfhs;fwpJ. Gtpapd; ntggepi y -88° nryrpa] p;Ue;J 58 nryrpa] ; ti u fhz ggLfwpJ. , J #hpaf; FLkgj j pd; kpf ml hj j pahd Nfhs; MFk; Gtp;Fk; #hpaDf;Fk; , i l Na c ss J}uk; mi rTfs> Mf;] p[NdhL \$ba ts; k; ;lyk; e;h; kwWk; kj j khd ntggepi y Nghdwi t Gtp xU j d; j ;tk; thaej Nfshf mi kej j wF fhuz khFk; , J #hpaDfF kpf mUfpy; , yi y kpf J}uj j py; , yi y. c a; pdqfs; fhz ggLk; xNu Nfhs; GtpahFk; , qF , Uf;Fk; e;h; fhuz khf , J "e; yfNfhs;" vdWk; mi offggLfwpJ. Gtp;F; rej ;ud; vdW xNu xU Ji z fNfhs; klLNk cz L. #hpa xsp Gtpi a te; j i la 8.20 epkl qfs; vLj;Jfnfhs;fwpJ.

nrt;tha; (Mars):

- nrt;tha; #hpaDfF mUfpy; c ss ehdfhtJ Nfhs; MFk; tbtj jpy; , uz lhtJ rmpa NfshFk; , jDila Nkwguggy; , UkG Mfi] L fhz ggL t jhy; , J nreepwkhff; fhz ggLf p wJ. vdNt , ij “rptgGf; Nfhs” vdWk; mi offpNwhk; nrt;tha; kwWk; Gtpad; epyj Nj hwwk; xdW Nghy; fhz ggLf p wJ. , J j d; mrrpy; j di dj j hNd Rwwp tu 24 kz p Neuk; kwWk; 37 epkl qfs; vLj Jfnfhs; f p wJ. #hpa i d tyk; tu 687 eh l fs; vLj Jfnfhs; f p wJ. nrt;thapd; NkwgugG ntggepi y - 153° nryrpa] p p UeJ 20° nryrpa] ; ti u fhz ggLf p wJ. Gtpi aj; j t p c ahp d qfs; thof; \$ba kwnwhU Nfhs; vJ vdwhy; mJ nrt;thahf j jhd; , Uff KbAk; nrt;thaf; gUt fhyqfs> JUt gdp f f t p g Gfs> v hki yfs> MwWf; Fi l Tf s; kwWk; th d pi yfs; c z L. , j wF NghNgh] ; (Phobos) kwWk; Ni aNkh] ; (Deimos) vdW , uz L Ji z fNfhs; fs; c ssd.

tjahod; (Jupiter):

- tjahod; #hpa f; FLkgj jpy; l e j htJ NfshFk; , J #hpa f; FLkgj j pd; kpf g; nghpa NfshFk; , J ngUkghYk; thAffshy; klLNk Mdjhy; , J “kpf g ngghpa thAffNfhs” vdW mi offggLf p wJ. , J j di dj j hNd xUKi w Rwwp tu 9 kz p Neuk; 55 epkl qfs; vLj Jfnfhs; f p wJ. Mdhy; #hpa i d tyk; tu vLj Jfnfhs; S k; fhyk; 11.86 tUl qfs; MFk; #hpa f; FLkgj jpy; kpf Fw f pa ehs; nfhz l Nfhs; tjahod; klLNk. , i j rRwwpYk; xU kq f pa ti sak; fhz ggLk; , e j ti sak; ngUkghYk; J}rpfshy; Mdi t. tjahodfF 67 Ji z fNfhs; fs; c z L. fdNknl (Ganymede) vDk; tjahodpd; Ji z fNfhs; jhd; #hpa FLkgj j pd; kpf g; nghpa Ji z fNfhs; Fk; (, J Gji dtpl nghpaj hFk).

rdp (Saturn):

- rdpNfhs; #hpa FLkgj jpy; MwhtJ NfshFk; , J mstpy; , uz lhtJ nghpa NfshFk; , fNfhi sr; Rwwp nghpa> mofhd ti sa mi kgi g nfhz Lssjhy; , J ti safNfhs; (Ringed Planet) vdWk; mi offggLf p wJ. , J gdj j f s; fs; kwWk; fhakpy J}rpfshYk; (Carbonaceous dust) MdJ. ek; #hpa f; FLkgj jpy; eil utpl ml hj j pf; Fi wthd xNu Nfhs; rdpahFk;
- rdpNfhs; 30 ti saqfS k; 53 cWj nraaggl l Ji z fNfhs; fS k; fhz ggLf pdwd. , J j d; mrrpy; j di dj j hNd xUKi w Rwwp tu 10 kz p Neuk; 34 epkl qfS k; #hpa i d xUKi w tyk; tu 29.4 tUl qfS k; vLj J f; nfhs; f p wJ.

ANud] ; (Uranus):

- ANud] ; #hpa f; FLkgj jpy; c ss VohtJ NfshFk; , i j ntWk; fz fshy; fhz , ayhJ. , J ntsspi ag; NghdW f p f f p UeJ Nkwf hfr; Rwwf p wJ. ANud] ; j d; mrrpy; 98° rha; thf mi keJ fpi lkl; khfr; #hpa i d tyk; tUf p wJ. ngUkghyhd #hpa xspi a , fNfhs; pd; JUtqfs; klLNk ngWf pdwd. , j d; ts k z i yk; i ` l u[d> ` byak; kwWk; k j Nj d; NghdW %dW Kf f pa thAffi s nfhz LssJ. , J #hpa dpl k p UeJ e l z l nj hi y tpy; mi ke j p Uggj hy; kpf f; Fsh; eJ fhz ggLf p wJ. f j Nuff f l Tsp d; ngauhd ANud] ; vdgij , fNfhs; fFr; #l bAssd; , j d; ts k z i yk; ml hj j pahff; fhz ggLf p wJ. , fNfhs; Kf f pakhf k j Nj d; thAi tf; nfhz Lssjhy; e y gri rahf Nj hwwksp f f p wJ. , fNfhs; fF ti saqfS k; 27 Ji z fNfhs; fS k; c z L.

negbAd; (Neptune):

- negbA;d; #hpa FLkgj j pd; vl;htJ NfshFk; , J j di dj j hNd xUKi wr; RwwTj wF 16 kz p NeuKk; #hpa id tyk; tUtj wF 165 tUl qfS k; vLj Jfnfhs;fwJ. , j wF 13 Ji z f; Nfhs;fS k; l eJ ti sqfS k; cz L. , J #hpadl kpUe;J kpfj; nj hi yty; mi ke j pUggj hy; #hpa FLkgj j pd; kpf Fspuhd NfshFk; negbA;d; fz p j f; fz pggpd; gb fz Lgpbffgg l i K j y; NfshFk; , J ekJ #hpa f; FLkgj j pd; fhwW mj p fkhf tRk; NfshFk;

#hpadl kpUe;J Nfhs;fspd; J}uk;

Nfhs;pd; ngah;	Gj d;	ntssp	Gkp	nrt; tha;	tjahod;	rdp	ANud] ;	negbA;d;
tp l i k; fpkl i h;	4,879	12,104	12,756	6,794	1,42,984	1,20,536	51,118	49,528
ml hj j p (Kg/m ³)	5,427	5,243	5,514	3,933	1,326	687	1,271	1,638
RwWk; Neuk; (kz p)	1,407.6	5,832.5	23.9	24.6	9.9	10.7	17.2	16.1
ehspd; mST (kz p)	4,222.6	2,802	24	24.7	9.9	10.7	17.2	16.1
#hpadl kpUe;J ruh rhp J}uk; (fpkl i hpy;	57.9	108.2	149.6	227.9	778.6	1,433.5	2,872.5	4,495.1
Rowrp fhyk; (ehs;fspy)	88	224.7	365.3	687	4331	10,747	30,589	59,800
Ji z fNfhs;f spd; vZ z p f i f	0	0	1	2	67	52	27	13

FssfNfhs;fs; (Dwarf planets):

- FssfNfhs;fs; #hpa FLkgj j pd; kpf r; rwp a Nfhs;fshFk; j kJ <hgG rfj p adhy; j kfnfdr; Rwwgghi j , yyhky; #hpa i dr; RwwptUK; t l i tbt c Utj i j f; nfhz i mi dj J thdntsigng hUl fS k; FssfNfhs;fs; vdW mi offggLfdwd. , i t vej Nfsh f;Fk; Ji z fNfhs;f , Uf;fhJ. #hpa f; FLkgj j py; nk h j k; l eJ Fssf; Nfhs;fs; c ssd. mi t nrru] ; (Ceres), g@lNI h (Pluto), `AkNa (Heumea), Nkfnkf; (Makemake) kwWk; vhp] ; (Eris) MFk; gSINI h j dnf d xU eStl i g; ghi j , yyhky; mUfpyUf;Fk; Nfhs; ti sa j j py; tyk; tUtj hy; 9 tJ Nfhs; vDk; j Fj pi a , oej J vdW 2006 k; Mz L mj p f h u g G h t k h f m w p t p f f g g l i J.

Ji z fNfhs;fs; (Satellites):

- Ji z fNfhs; vdwhy; “Nfhs;fspd; Ji z ” vdg; nghUshFk; 1610 Mk; Mz L ti u> epyT klLNk Ji z fNfhs;f mwpaggl L tej J. , di wa fz f;fpdgb 163 Ji z fNfhs;fs; ek; #hpa f; FLkgj j py; fhz ggLfdwd. Ji z fNfhs;fs; Nfhs;fi s Nkw;fpyUe;J f p f;fhfr; RwwptUf;pdwd. , twwwF Rakhf xspUK; j di k fpi lahJ. Mdhy; , i t #hpa xspi ag; guj py p f;fwJ. Ji z fNfhs;fS fF ts p k z i yk; kwWk; eh; fpi lahJ.

rej pud; - Gtpad; Ji z fNfhs; (Moon – The earth’s satellite):

- rej pudhdJ GtpapyUe;J 884x401 fpkl i h; nj hi yty; mi keJssJ. rej pud; j di dj j hNd RwwTj wFk; Gtpi arRwwp tUtj wFk; xNu Neuj i j mj htJ 27 ehl fs; kwWk; 7 kz p 43 ekpl qfs; vLj Jfnfhs;tj hy> Gtpary; , Ue;J ghhf;FkNghJ rej pudpd; xU gf;fj j j klLNk fhz KbfwJ. rej pudhdJ #hpa f; FLkgj j py; l e j h t J nghpa Ji z fNfshFk; nrt;tha; mST epi wTila nghUs; Gtpi a Nkhj p a j hy; , J

c Uthf; Uff; yhk; vdf; fUj ggLf; wJ. rej; ud; pd; Nkwgugg; py; epi y c Uthf; Fk; gssq; fSk; nrq; Fj; jhd ntt; NtW mst; pyhd ki yf; S k; fhz ggLf; pdwd. rej; ud; py; gl; L vj; pnuhs; pf; fgg; Lk; xsp; ah; dJ 1/4 t; pd; hbs; py; Gtpi a tej; i l f; wJ. rej; ud; Gtpi a t; pl r; wpaJ vdg; jhy; m; j d; <hg; G rf; j p Gtp; ap; d; <hg; G rf; j p; py; 1/6 kl; q; F kl; LNK. vd; Nt> kd; j; hfs; rej; ud; py; Gtpi a t; pl 6 kl; q; F vi l Fi wthf , Ugg; h; f; s;

mggy; Nyh il kd; j; Kawr; pa; dhy; epy; T; F; F mD; ggg; gl; i t; p; z nts; p; fy; kh; Fk; , J mnk; h; p; f; h; t; p; d; NAS A ep; W; t; dk; %y; k; mD; ggg; gl; i; J. , uz; l mnk; h; p; f; t; p; z nts; p; t; h; f; s; e; y; M; k;] l; u; h; q; kw; W; k; v; l; t; p; d; M; y; l; h; p; d; M; f; p; a , U; t; U; k; 1969 [_ i y 20 md; W rej; ud; py; e; h; p; y; y; h; j mi k; j; p; f; f; l; y; py; (Sea of Tranquility) f; h; y; i t; j; j; d; h; m; t; h; f; s; m; q; F 21 k; z p; Neuk; 38 ep; k; p; q; f; s; kw; W; k; 21 t; p; e; h; b; f; s; , U; e; j; d; h;

FWqNfhs;fs; (Asteroids):

- FWqNfhs;fs; vdg; J kw; w Nfhs; f; i s; g; Nghy #h; p; ai dr; Rww; p t; U; k; ghi wahy; M; d t; p; z ; nts; p; f; f; w; f; s; M; F; k; , J r; w; p; a Nfhs; f; s; v; d; T; k; mi of; f; gg; L; f; w; J. #h; p; a FLk; g; j; j; py; m; j; p; f; s; t; y; h; d FWqNfhs; f; s; fhz ggLf; pdwd. , q; F mst; py; ngh; p; a; j; h; f; fhz ggLk; FWqNfhs; f; s; “thdNfhs; f; s;” vd mi of; f; gg; L; f; pdwd. , i t; f; s; nrt; t; h; a; kw; W; k; t; p; a; h; od; Nfhs; f; S; f; F , i l; a; y; fhz ggLf; pdwd. , e; j; g; g; F; j; p; i a “FWqNfhs; gl; i l” vd; W mi of; f; p; Nwhk; , j; d; t; p; l; k; h; d; J 100 f; p; k; l; i; h; p; y; U; e; J r; w; p; a \$oh; q; f; w; f; s; m; s; T ti u; f; fhz ggLf; w; J. , i t; f; s; fl; e; j; f; h; y; j; j; py; nt; b; j; J r; j; w; b; f; gg; l; Nfhs; f; s; m; y; y; J th; y; el; r; j; j; p; q; f; s; p; d; xU g; F; j; p; a; h; f , Uff; yhk; vd; ek; gg; L; f; w; J. j; p; d; K; k; G; J; g; G; J FWqNfhs; f; s; f; z; L; g; b; f; f; gg; L; f; pdwd.

th] el rj j p; q; f; s; (Comets):

- th; y; el; r; j; j; p; k; k; p; f; T; k; c; w; r; h; f; j; j; m; s; p; f; f; f; \$; b; a xU th; d; n; g; h; U; s; M; F; k; , J M; h; t; j; i; j; A; k; m; N; j; N; t; i; s; a; y; ; g; a; j; i; j; A; k; V; w; g; L; j; j; f; \$; b; a; J. f; h; n; k; l; ; (Comet) v; d; f; w; M; q; f; y; n; r; h; y; f; p; N; u; f; f; n; k; h; o; p; a; y; ; c; s; s; m;] l; h; N; f; h; k; l; b;] ; (Aster kometes) v; d; f; w; %y; r; n; r; h; y; y; p; U; e; J n; g; w; g; g; l; i; J. , j; d; m; h; j; j; k; “e; s; K; b; T; i; l; a; el; r; j; j; p; k;” M; F; k; , i t; f; s; r; w; r; w; g; d; g; n; g; h; U; s; f; s; kw; W; k; v; h; p; w; f; s; p; d; J; f; s; f; s; h; y; M; d; i; t. , i t; f; s; xO; q; f; w; w; R; w; W; g; g; i; j; a; y; ; #h; p; a; i; d; r; R; w; w; p; t; U; f; p; d; w; d. r; y; N; e; u; q; f; s; p; y; , i t #h; p; a; D; f; F; k; p; f; m; U; f; p; Y; k; (Perihelion) r; y; N; e; u; q; f; s; p; y; ; #h; p; a; D; f; F; n; t; F; n; j; h; i; y; t; p; Y; k; fhz ggLk; (Aphelion).

- i l l l d; (Titan) – Nkfk; kwWk; tsp kz l y j J l d; \$ba xNu Ji z fNfhs;
- rd; p; f; Nfhs; p; d; k; p; f; g; n; g; h; p; a Ji z fNfhs; , J. , J #h; p; a; f; FLk; g; j; j; py; , uz; l; h; t; J n; g; h; p; a Ji z fNfhs; Nkfk; kwWk; ml; h; j; j; p; a; h; d; t; s; p; k; z; l; y; j; J; l; d; \$ba xNu Ji z fNfhs; , J; Nt.
- Gtp; ap; d; fl; e; j; f; h; y; q; f; s; p; y; fhz ggL; mNj #o; e; p; i; y; i l l l d; p; y; c; s; s; J (#h; p; a; D; f; F; m; U; f; p; y; , Ugg; j; h; y; v; g; N; g; h; J; k; n; t; g; g; k; h; f , Ugg; J; j; h; d; N; t; W; g; h; L).
- e; h; r; h; f; U; j; J; g; g; b; > i l l l d; j; h; d; , J; t; i; u; e; h; k; f; z; l; j; p; y; G; t; p; N; g; h; d; w; c; y; f; k; h; f; n; j; h; p; f; w; J.
- 1655 , y; l; r; R; t; h; d; t; p; a; y; h; s; h; f; w; p; bad; ` {n[d;] ; (Christian Huygens) v; d; g; t; u; h; y; i l l l d; f; z; L; g; b; f; f; gg; l; i; J. ` {n[d;] ; N; y; d; l; h; M; a; T; N; f; r; p; d; p; t; p; z; nts; p; Xl; j; j; j; l; N; u; h; g; g; p; a; d; t; p; z; nts; p; M; a; T; i; k; a; k; %y; k; h; f; i l l l D; f; F; m; D; g; g; p; a; J; m; t; i; u; n; f; s; u; t; p; f; F; k; t; i; f; a; y; ; m; t; u; j; n; g; a; h; p; y; ; m; D; g; g; g; l; i; J.
- i l l l d; J; i; z; f; N; f; h; s; p; d; t; p; l; k; 5; 150 f; p; k; p; , J Gtp; ap; d; mst; py; gh; j; p; Ak; nrt; t; h; ap; d; ms; T; f; F; r; r; k; k; h; f; T; k; fhz ggLf; w; J. , j; d; Nkwgug; G; n; t; g; g; e; p; i; y; – 179 n; r; y; r; p; a;] ; , e; j; n; t; g; g; e; p; i; y; e; l; u; g; h; i; w; N; g; h; d; W; fl; b; a; h; f; r; t; p; l; f; w; J. , J; k; j; N; j; d; th; A; i; t; j; u; t; e; p; i; y; a; y; ; i; t; j; j; p; U; f; f; w; J. Nkwgug; G; mO; j; j; k; Gtp; ap; d; mO; j; j; j; i; j; t; p; l; n; f; h; O; r; k; m; j; p; f; k; Gtp; ap; d; mO; j; j; k; fl; y; k; l; l; j; j; j; py; 1

kpyyqghh; , J i l l dpy; 1.6 kpyyqghh; eS; t l i g h i j r R w W 15.945 e h l f s ;
; j d ; e p i w K f f p a k h f g d p k w W k ; g h i w g ; n g h U s ; t b t p y ; f h z g g L f w J .
; j w F f h e j G y k ; f p i l a h J .

t p z f w f s ; (Meteors):

- r p y N e u q f s p y ; , u T N e u j j y ; t h d p y ; x U g u f h r k h d x s p f f w W r p y t p e h b f S f F j ; N j h d W k ; , i j v h p e l r j j p u q f s ; v d f p N w h k ; , i t F q N f h s ; g l i l f s p d ; n j h F g g y p U e J n t s p N a w w g g l l g h i w j ; J z L f s h F k ; , i t f s ; t z p k z l y j j p w F s ; t U t j w F K d ; t p z n t s p f ; f w f s ; (Meteoroids) v d m i o f f g g L k ; , i t t s p k z l y j j p w F s ; m j p f N t f j J l d ; E i o f p d w d . M d h y ; n g U k g h y h d t p z f w f s ; (Meteors) t s p k z l y j j p w F s ; E i o a k ; K d g h f v h p e J t p L f p d w d . e k J t s p k z l y j j p w F s ; E i o e j T I N d r p y v h p f w f s ; K O t J k ; v h p a h k y ; G t p a y ; t p O e J n g U k ; g s s q f i s c U t h f F p d w d . , t t h W K O t J k ; v h p a h k y ; G t p a y ; t p O k ; k p f g n g h p a t p z f w f i s v h p f w f s ; (Meteorites) v d m i o f f p d N w h k ; t l m h p N] h d h t p y ; c s s v h p f y ; g s s j j h f F , e j p a h t p y ; k f h u h ~ b u h k h e y k ; G y j h d h ; (Buldhana) k h t l i j j p y ; c s s N y h d h h ; (Lonar) v h p A k ; , t t i f v h p f w f s p d ; j h f f j j p w F r p w e j v L j J f f h l i h F k ;

G t p a d ; c U t K k ; t b t K k ;

- x U f h y j j y ; G t p j l i l v d T k ; f l y y ; g a z p f F k ; N g h J f g g y f s ; G t p a d ; t s p k G f s p y ; g a z p f f K b A k ; v d T k ; e k g g l i J . , i l f f h y t u y h W t i u f F k ; , e j f U j J j h d ; e k g g l i J . k h Y k p i s j ; N j h e n j L f F k ; N g h J n f h y k G] { f F , J x U r p f f y h f , U e j J > g z i l a f p N u f f f U j j p d ; g b G t p a h d J f l y h y ; # o g g l b U e j J . f l y ; j h d ; v y y h M W F S f F k ; g w g g l k ; v d e k g g l i J . m d h f j p k d i h p d ; (600 n g h . M . K) m w p f i f g g b c U i s t b t G t p t h d N f h s t b t h y ; # o g g l L s s J . g j j h f u] ; (582 - 507 n g h . M . K) G t p a h d J N f h s t b t k ; v d W e k g p d h h ; , e j t b t N k m w p Q h f s ; V w W f n f h z l t b t k h f f ; f U j g g l i J . m h p] i h l b y ; (384 - 322 n g h . M . K) G t p N f h s t b t k ; c i l a J v D k ; N f h l g h l i l n t s p a l i h h ; , t h p d ; \$ w W f s p y ; r p y r e j p u d p d ; e p y ; r e j p u f p z j j p d ; N g h J t l i k h f f h l r p a s p g g J k w W k ; e h k ; n j d J U t k ; N e h f f p g a z p f f g a z p f f e l r j j p f \$ l i q f s ; t h d p y ; m j p f c a u j j p y ; f h z g g L t J N g h y c z h t J M F k ; v u N i h] j d p] ; (275 - 195 n g h . M . K) v f g j p y ; , U e j g h h f F k ; N g h J # h p a d p d ; V w w k ; G t p N k w g u g g p d ; e p i y g g h l b w F V w w h w ; N g h y ; k h W t i j f ; n f h z l G t p a d ; g h p k h z j i j f ; f z l w e j h h ;

f b f z l M u h a r r p K b T f s ; G t p x U N f h s t b t k ; n f h z l J v d f ; \$ W f w J .

1. k i y K f g G f s ; # h p a d ; k i w e j g p d G k ; # h p a x s p a h y ; x s p U t J .
2. f g g y f s ; m b t h d j i j n j h l i g p d ; k i w e j N g h t J
3. r e j p u d ; x U t l i j j i l N g h y N j h d W t J
4. G t p x U t l i t b t e p i y r e j p u f p z j j p d ; N g h J V w g L j J t J .

- G t p x U N f h s t b t k h F k ; e p y e L f N f h l b y ; g U j J k ; J U t j j p y ; j l i l a h f T k ; f h z g g L f w J . , j i d "G t p t b t k ;" (Geoid) v d f p N w h k ; m j h t J G t p i a g ; N g h d w m i k g G M F k ; i k a t p y f F t p i r a p d ; f h u z k h f e p y e L f N f h l l g ; g F j p g U j J f h z g g L f w J . G t p a d ; < h g G t p i r J U t j j p y ; m j p f t y p i k A s s j h f T k ; e p y e L f N f h l l g ; g F j p a y ; t y p i k f F i w e J k ; f h z g g L f w J .
- # h p a d p d ; < h g G r f j p a h d J J U t q f s p y ; N t W g L k ; G t p # h p a i d r ; R w W k ; N g h J t l J U t k h d J t l J U t e l r j j p j i j N e h f f p , U f F k ; , e j G t p a h d J j d ; m r r p y ; r h a e J f h z g g l t p y i y v d p y ; , u T k ; g f Y k ; v y y h f h y e p i y f s p Y k ; x N u f h y m s T n f h z l j h f , U f F k ;

G t p a d ; , a f f q f s ;

GtpfF , uz L mbggi l , affqfs; cz L. mi t

1. Gtp j di dj j hNd Rwwj y; (RoYj y)
2. j di dj j hNd Rwwpfnfhz L #hpa dAk; Rwwj y; (tyktUj y)

mz l , affk; (Galactic Movement); , J #hpa; FLkgk; nkj j khf ghy; top
mz l; j nj hFj pad; i kaj j r; Rwwp tUtj hFk; , UggpDk; , J Gtpad;
#oeji y khwwj j py; rwwpa mST khwwj j j Na VwgLj j fwwJ.

1. j di dj j hNd Rwwj y; (Rotation)

- Gtp j d; mrry; j di dj j hNdr; Rwwp tUtij GtpRowrp (Rotation) vdfpNwhk; Gtpad; mrR vdgJ Gtpad; i kaj j py; fleJ nry;Yk; xU fwgi dFNfhl hFk; Gtp j di dj j hNd Rwwpfnfhss 23 kz pNeuk> 56 epkl k; kwWk; 4.09 tpehbfi s vLj j ffnhs; fwwJ. , J #hpad; Nj hww , affj j pwwF vj thj pi rary; fpo;F Nehf;fp Roy;fwwJ. Gtpad; mrrhdJ #hpa dr; Rwwk; j sj j pwwF 66½° rhae;Jk; j d;Di la mrry; nrqFj j hf 23½° rhae;J fhz ggLfwwJ. Gtp Rwwk; Ntfk; epyeLfnfhl bypUe;J JUtj j j Nehf;fp nryy nryy khWgLk; Gtp Rwwk; Ntfk; Gtpad; eLggFj pary; mj pfkhff; fhz ggLfwwJ. , q;F Gtpad; j pi rNtfk; kz pf;F 1x70 fp;kl MFk; Gtp Rwwk; Ntfk; JUtj j py; Vwf;Fi wa Ro;ak; MFk;

Gtp Rowrp; tpi sTfs;

Gtp RoYtj hy; fbfz l tpi sTfs; VwgLf;pdwd.

1. #hpad; c j pggJ kwWk; ki wtJ Nghdw Nj hwwk; Gtp RoYtj hy; VwgLf;pwJ. , j dhy; Gtpad; Nkwguggpy; , uT gfy; khw;khwp Nj hd;Wf;pwJ.
 2. Gtpad; nttNtW , lqfs;py; nttNtW Neuk; fhz ggL;twF Gtp RowrpNa fhuz khf mi kf;pwJ. 360 bf;thpi a 24 kz pNeuj j hy; tFj j hy; #hpa d fl f;Fk; xtntH U j h;ff Nui ff;Fk; 4 epkl k; t; j j pahrk; VwgLf;pwJ. , j dhy; xU kz pNeuk; vdgJ (60 epkl q;fs) xUehs;py; 1/24 gq;F MFk;
 3. xLk; uary;py; eb;fs; gaz pf;Fk; NghJ c wW ftd; j j h;fs; vd;why; uary; ghi j f;F mUf;py; c ss kuq;fs> tL;fs; kwWk; taynts;pf;fs> uary; nry;Yk; j pi rf;F vj thj ; j pi rary; efhtij NghdW #hpaDk> GtpAk; kwWk; gpw thdnts;g; nghUl;f;S k; Nj hwwks;pf;f;pdwd. Gtp Nkw;f;py;Ue;J f;po;f;hf RoYtj hy; #hpad> epy;T> Nfhs;fs; kwWk; elr; j j uq;fs; mi dj ;Jk; f;po;f;NF Nj hdwp Nkw;NF ki wtJ NghdW Nj hwwks;pf;f;pwJ.
 4. Gtp Rowrp;pdhy; nfh;h;pahyp;] ; tpi r c Uth;f;pwJ. , j dhy; fhwW kwWk; fl y; mi y;fs; j q;fs; ghi j a;py; , Ue;J t;py;F;f;pwJ.
 5. fl y; Xj q;fs; c UthtJ #hpad; kwWk; rej pud;pd; <hgG tpi rfs;pdhy; kl ;Lk; , dwp Gtp Rowrp;ahYk; c Uth;f;pwJ.
- , ej Gtp Rowrp , affk; jhd; Gtpad; JUtq;fs; j l i lah;FTk; eL;tpy; nghj j hf gUj ;Jk; , Uggj wF fhuz khFk; vdNt Gtpad; t;pl ;k; JUtq;fs;py; k; epyeLfnfhl ;L gFj pap;Yk; khWgLf;pwJ.

RoYtj wFk; tyk; tUtj wFk; , i l Na c ss NtWghL;

RoYj y; (Rotation)	tyktUj y; (Revolution)
Gtp NkwfjyUeJ fipf,fhf j dJ mrrjy; RoYtJ	eS;tIlgghi j ary; #hpa dr; Rwwpt Uk; Gtpad; , affk;
xU RwwfF 24 kz pNeuk; vLj Jf; nfhs,fwJ. (xUehs)	xU Ki wtyk; tu 365¼ ehl fs; (xUtUIk) MFk;
, J xU mdwhl epfo:T	, J xU tUI epfo:T
, J , uT - gfy> Xj qfs> fhWw tpyf,fk; kwWk; fly; eNuhl j qfs; VwgLtj w,F fhuz khfwJ.	, J , uT gfy; VwgLk; Neu khwwqfs> ez gfy; Nti sfsy; #hpad; epi yary; / , UfFk; , ljjjy; VwgLk; NtWghL kwWk; gUt fhyqfsy; VwgLk; khwwj j w,F fhuz khfwJ.

xspA t j j pd; t l j k; (Circle of Illumination):

- xspi aAk; , Ui sAk; ghpfFk; Gtpi a RwwpAss Nfhl j l xspA t j j pd; t l j k; vdfpNwhk;
- , J JUtqfi sf; fleJ nry;YkNghJ rkkhd , uTk; gfYk; VwgLfWJ. , ej Nfhl j l t j z ntsary; , UeJ kl j Lnk ghf,f KbAk; nttNtW fhyepi yf; Nfwg , ej Nfhl bd; mi ktpl k; khWgLfWJ.

Gtp j d j dj j hNd Rwwf nfhz L #hpa dAk; RwWj y; (Revolution).

- Gtp j d j eS;tIlgghi j ary; #hpa d fbfhu j pi rfF vj th; j pi rary; Rwwp tUti j #hpa d RwWj y; vdfpNwhk; Gtp j d;Di la ghi j ary; #hpadl kpUeJ 150 kpyypad; fplkl j h; nj hi yty; RwwfWJ. Nfhsfspd; eS;tIlgghi j adhy; #hpaDfFk; GtpfFk; , i l Na c ss Jjuk; fhyj j w,F Vwg khWgLfWJ. [dthp 3k; Nj j p Gtp #hpaDfF kpf mUfpy; fhz ggLk; mi j #hpa mz i kgGssp (Perihelion) vdfpNwhk; (Perihelion - peri vdwhy; mUfpy> Helion vdwhy; #hpad). , ej Gsspary; GtpfFk; #hpaDfFk; , i l NaAss Jjuk; 147 kpyypad; fplkl j h; MFk;
- [j y 4k; Nj j p GtpahdJ #hpa d t pl L ntFj nj hi yty; fhz ggLk; , i j #hpanj hi yJ }uGssp (Aphelion) vdfpNwhk; (Aphelion = 'ap') vdwhy; nj hi yty> 'helion' vdwhy; #hpad) , ej Gsspary; GtpfFk; #hpaDfFk; , i l NaAss Jjuk; 152 kpyypad; fplkl j h; MFk;
- Gtp #hpa dr; Rwwptu vLj Jf; nfhsSk; fhy msT 365 ehl fs; 6 kz pNeuk; (5 kz pNeuk> 48 epkl k; kwWk; 45 tpdhbfS) myyJ 365 ehl fs; MFk; Gtp #hpa dr; Rwwp tUk; Ntfk; kz pfF 1x07x000 fplkl j h; myyJ xU tpehbfF 30 fplkl j h; Ntfk; MFk; Jggghf;fary; , UeJ tUk; Nj hl j htpd; Ntfk; \$l xU tpehbfF 9 fplkl j h; jhd;

Gtp tyk; tUj Yk; yb; tUI Kk;

- Gtp #hpa d xU Ki wg; Rwwp tu vLj Jf; nfhsSk; fhy msi t xU Mz l vdfpNwhk; Gtp #hpa d xU Ki wr; Rwwp tu 365 ehl fs; kwWk; 6 kz pNeuk; myyJ 365¼ ehl fs; vLj Jfnfhs,fwJ. , ej mj pfggbahd ¼(6 kz pNeuk) ehi s ehs,fhl bary; Fwj J fhl LtJ xU rthyhFk; ek; ehs; fhl bi a Gtp RowrpfF Vwg epi yahf i t j Jf; nfhs ehdf Mz l fS fF xUKi w \$Lj yhd xU ehi s gguthp khj j j y; Nrhj Jf; nfhs,fpNwhk; , ej Mz i l yb; Mz L (Leap Year) vd mi of,fpNwhk; , ej yb; Mz by; gguthp khj k; 29 ehl fs; nfhz j j hf , UfFk;

Gtp tyk; tUj yhy; VwgLk; tpi sTfs;

Gtp #hpa d tyk; tUtj d; %yk; fbfz l tpi sTfs; VwgLfpdwd.

- gUtfhyqfspd; Rowrp
- gfy; kwWk; , utpd; fhy NtWghL
- Gtp Nkwguggpy; #hpad; fj ph; guty; kwWk; ntgg kz l y NtWghL

gUtfhyqfs; (Seasons):

- Gtp #hpa d tyk; tUtjhYk; j d; mrrpy; Mz L KOTJk; 23½° xNu jpi rapy; rhaeJ , Uggj hYNk gUtfhyqfs; VwgLfpdwd. gUtfhyqfs; nghJ thf trej fhyk> Nfhi lffhyk> , i yAj phfhyk; kwWk; Fshfhyk; vd ehd;F gUtfhyqfshf ghpffggLfWJ. Gtp j d; eStl;g; ghi jary; #hpa d tyk; tUtjhy; #hpad; fj ph; nrqFjjhf tOk; mlrNui ffs; khWfPdwd. NkYk; #hpadhdJ Mz L KOTJk; tlfF NehffNah myyJ nj wF NehffNah gaz pggJ Nghdw xU Nj hwwj i j j UfWJ , j wF “#hpadpd; Nj hww efh;T” vdWngah; , J #hpad; epyeLfnfhl bwF nj wFk; tlfFk; mi ytJ Nghdw xU Nj hwwj i j j; j UfWJ. Mdhy; cz i kapy; Gtp jhd; j dJ rhaej mrrpy; #hpa dr; Rwwp , aqFfWJ. jdrhp myyJ khj mbggi lapy; Mz bd; NtWNtW fhyfl; j j py; , J NtWgLfWJ. khhr; 21 kwWk; nrgl kgh; 23y; #hpad; kpr; rhpahf ffofNf Nj hdwp Nkwnf ki wfwJ.

rkehs; (Equinox) kwWk; eZ l gfy; - , uT ehs; (Solstice)

- #hpad; fj ph; ez gfy; nrqFjjhf tOk; vdGJ c qfS fFj; nj hpAk; , ej nrqFj; J ffj phs; xU Fwggpl l , l j j py; klLk; tOkNghJ mj pf ntggj i j f; nfhLf;fwJ.

rkehs;

- Gtp #hpa dr; Rwwk; j sKk; epyeLfnfhlk; xdi w xdW rej pfFk; NghJ rk, uT gfy; VwgLfWJ. khhr; 21y; #hpad; epyeLfnfhl bwF Nky; nrqFjjhf fhz ggLthj; cyfk; KOTJk; , uTk; gFYk; rk mstpy; fhz ggLfWJ. #hpadpd; , ej epi yi a trej fhy rk ehs; (Spring Equinox) vd mi off;fnwhk; mNj Nghy nrgl kgh; 23y; #hpad; epyeLfnfhl bwF Nky; nrqFjjhf fhz ggLthj; cyfk; KOTJk; , uTk; gFYk; rk mstpy; fhz ggLfWJ. #hpadpd; , ej epi yi a , i yAj phfhy rk ehs; (Autumn Equinox) vd mi off;fnwhk; , uz l JUtqfSk; #hpa xspi a ngwWf; nfhs;tjhy; cyfd; vyyh , l qf;spYk; , uTk; gFYk; rkkhf , UfFk; , J t l JUtj j wF trej fhykhfTk; nj dJ Utj j wF , i yAj ph; fhykhfTk; , UfFk;

eZ l gfy; , uT ehs;

[{d; 21 mdW #hpadpd; epi y;

- t l JUt; #hpa d Nehff; rhaeJ fhz ggLfWJ. vdNt , ggFj p 24 kz pNeuKk; #hpa xspi a ngWk; Mdhy; mNj ehs; nj dJ Ut; #hpa d t pl tpyf , Uggj hy; 24 kz pNeuKk; , Ushf , UfFk; meehs; #hpadpd; xspffj phs; fl fNui fapy; (23½° tlfF) nrqFjjhf tOk; t l JUtj j py; gfy; , ui t t pl eZ l j hf , UfFk; , j dhy; t l JUtj j wF Nfhi l fhykhfTk; nj dJ Utj j wF Fshf;fhykhfTk; fhz ggLfWJ. , i j Nfhi l fhy eZ l gfy; ehs; (Summer solstice) vd mi off;fnwhk;

brkgh; 22 mdW #hpadpd; epi y;

- , eepi yapy; nj dJ Ut; #hpa d Nehff; rhaeJ fhz ggLfWJ. Mdhy; t l JUt; #hpa d t pl tpyf fhz ggLfWJ. , eehs; kfuNui fapy; (23½° nj wF) #hpadpd; xspffj phs; nrqFjjhf tOfpdwd. , j dhy; nj dJ Ut; mj pf #hpa xspi a ngwWfWJ. vdNt , qF gfy; eZ l j hfTk; , uT Fwfpaj hfTk; fhz ggLfWJ. mNj Neuj j py; t l JUtj j py; eZ l , l T fhz ggLfWJ. , f;fhyk; nj dJ Utj j wF

Nfhi l f fhykhfTk; t i J Utj j wF FshfhykhfTk; c ssJ. , i j Fsh; fhy ełz ;
, uT ehs; (Winter solstice) vd mi offiNwhk;

tuyhw i w , i z fFk; Gtjapay;

ngħpa gukld; kpfrrlhd xOqfi kggpd; , ufrpak; fpllj j l l
fz Lgpbffgglltpl l J.
fpl htj d; ngUk; gukL Vwj j ho 4500 Mz LFS fF Kd; fz L gpbffggll
gukll hfK; , J fl bl ffi yard; tuyhwpy; xU mUQnrayhf myyJ xU rthyhf
NghwwggLfwJ. j wngħOJ xU mfothuharrpahsh; vt;thW , ej gukLfs; Gtjapy;
Kffja ehd; j pi rGsspsy; xOqfi kffggllssJ vdDk; , ufrpaj j j f;
fz Lgpbj Jsshh; , j wF vfgj pahfs; , i yAj hfhy rk ehi s c gNahfggllj j p
, Uffyhk; vdW fUj ggLfwJ. , j wnf dW vfgj pahfs; c gNahfj j Ki w kpf
JyyakhdJ.

, i yAj hfhyj j d; rk eh sdW epyk; msggth; xU Frpi a Gtjapy; el L i t j J
mj d; epi y mdW KOtJk; msej pUffpwhh; mj d; KbT epyd; Nfhl hdJ
rhpahf f pofF Nkwfhf teJssJ. Nfhi l ełz ; gfy; ehS fF gwF rhpahf 91
ehl fi s fz fpl L , i yAj hfhy rk ehi sf; fz Lgpbj Jssdh;

fufz qfs; (Eclipse):

- Gtjapd; RowrpahdJ , uT gfy; kU VwgLj j k; tpi sTfi sg; gwwp ehk; mwpe;J
nfhsNthk; gfy; xspad; fhy msT mlrNui f kwWk; gUtfhyqfi sg; nghWj J
khWgLfwwJ.
- fufz k; vdgJ xU tizntsp nghUsypUeJ tUk; xspi a NtnwhU tizntsp
nghUs; fl fFk; NghJ mj d; epyhy; KOtJkhfNth myyJ gFj pahfNth
ki wffggltJ MFk; fufz k; , uz L ti fggLk; mi t>

1. #hpa fufz k; (Solar Eclipse):

- #hpaDfFk; GtjafFk; , i l ay; rej ud; mi kej pUfFk; ngħOJ #hpa fufz k;
epfofwwJ. mgngħOJ GkparpUeJ fhZ k; #hpadpd; xU rmpa gFj p rej udhy;
ki wffggLfwJ. Mdhy> cyfid; xU rmpa gFj pypUeJ klLNk , i j f; fhz f\$Lk;
, J xU rpy epkl qfs; klLNk epOk; rej ud; #hpa tlj j d; xU gFj pi a
ki wggij mi u #hpa fufz k; (Partial solar eclipse) vdfpNwhk; ti sa #hpa
fufz k; (Annular solar eclipse) rej ud; #hpa id eLty; fleJ nry;Yk; NghJ
VwgLfwwJ. KO#hpa fufz j j d; (Total solar eclipse) NghJ rej udpd; epyhdJ
#hpa id KOtJk; ki wffpdwJ. KO #hpa fufz j j d; NghJ #hpadpd;
ntsppgFj pahdJ xsptpl l khf gpufhrpffwwJ. , ej epfoi t i tu Nkhj puk; (Diamond
Ring) vd mi offiNwhk;

2. rej pufufz k; (Lunar eclipse)

- rej pufufz k; KO rej u eh sdW GtjapdJ rej uDfFk; #hpaDfFk; , i l ay;
tUkNghJ VwgLfwwJ. GtjapypUeJ ghhfFk; NghJ Gtjapd; epyhdJ rej udpd; xspi a
kqfr; nraAk; rej udpd; xspahdJ Gtjapd; epyhy; gFj pahf ki wffggLk; NghJ
mi urej pufufz k; (A Partial lunar eclipse) VwgLfwwJ. rej udhdJ Gtjapd; Gwepoy;
gFj pary; fleJ nry;Yk; NghJ Gwepoy; rej pufufz k; VwgLfwwJ. GtjapdJ rej udpd;
xspi a KOtJkhf ki wffk; NghJ KOrej pufufz k; (A total lunar eclipse)
VwgLfwwJ. rej ud; kpfrrmpaj hf , Uggj hy; , fufz k; rpykz p Neuqfs; klLNk
ebfFk;

rej udpd; tshrrp epi y;

- Gtp rej pud > kwWk; #hpaDfF , i l aiy; khWk; Nfhz qfs; rej pudpd; tshrrp epi yi a ehz apf;fpdwd. rej pudpd; epi yahdJ xtntu khjKk; 'mkhthi r' mdwypUeJ Mukgpf;fwJ. mj dgwF rej pudpd; xUrpwa gFjp klLNK xshf;fwJ. , j wF "gpi wrrej pud;" (Crescent) vdW ngah; , ej gpi wrrej pud; Kjy; fhy; rej pudhf c Uthf;fwJ. mj pfhpf;Fk; xspAl d; %dwhTJ fhy; epi yfF tsheJ tUtij Kf;fhygFjp vdTk; gpwF KO rej pudhfTk; khWf;fwJ. , J ngshz kp vd mi of;fggLf;fwJ. ngshz kp;Fg; gpd; rej pud; Nj aeJ myyJ ki weJ Kf;fhy; rej pud > fi l rpfhy; rej pud > gpi wr; rej pud; kwWk; KOtJk; ki weJ Ngha; fhz Kbahj fUGG mkhthi r rej pudhf khwptpLf;fwJ.

gyNtW ml rNui fary; fhz ggLk; NtWgLk; gfy; Neu mST:

- NkNy nfhLf;fggl;l ml;ti z aiyUeJ epyeLNFhl;l gFj;ary; klLNK Mz;l KOtJk; 12 kz p Neuk; gfy; , uT , Uf;Fk; vdgJ nj s;thfj; nj hf;fwJ. epyeLNFhl;bypUeJ t;pyfnry;YkNghJ gfy; Neu NtWghL mj pfhpf;fwJ. , ej gUthfhy khwwqfshy; gfy; Neu NtWghL JUt gpUNj r;qf;sy; kp;f mj pfk;hf , Uf;Fk;

Gt;Nfhs tbt;khf , Uggj d; tpi sTfs;

1. Gtp ngWf;pdw #hpa t;rypd; mST khWgL;fwJ.

- GtpahdJ #hpaDfF tyJ Nfhz j;jr; rhheJ j;l;l ahd Nkwgugi gf; nfhz;l , Ue;hy; vyyh gFj;pf;Sk; xNu mST #hpa;f; fj;th;rg; ngWk; Mdhy; GtpahdJ Nfhstbt;khf; nfhz;lJ. vdNt Gtp;pd; c aukhd gFj;pf;S; ntgg kz;l yggFj;pi ag; Nghy ntggk; ngWt;pyi y. rpy Fwggpl;l ml rNui f;f;sy; fhz ggLk; gFj;pf;S; kl;Lnk Fwggpl;l j;pdqf;sy; #hpa;pd; fj;th;f; s n;rq;Fj;jhf ngWf;pdwd. ehk; t;lf;F myyJ nj wF Nehf;f;pr; nryy nryy #hpa fj;th;f;S; t;Ok; Nfhz qfs; Fi w;fwJ. , t;thW #hpa;f; fj;ju; t;Ok; Nfhz k; kwWk; gfy; Neuqf;sy; VwgLk; khwwkhdJ #hpa Rwwggh; j;ary; 66½° rhathf #hpa;id; Rwwk; Gtp;pd; epi yggh;l;l g; nghWj;J mi k;fwJ.

2. Gtp;pd; gy gFj;pf;S mi lAk; #hpa fj;th;f;S;pd; NtWgl;l Nfhz k;

- epyeLNFhl;l;l; jhz;b #hpa xsp;f; fj;th;f;S; xU Fwggpl;l Nfhz j;j;ry; Gtp; a t;ej;l;lAk; , ej rha;Tf; fj;th;f;S; guej gugg;ry; t;Ot;j;hy; mtw;wpd; ntggk; n;rq;Fj;Jf; fj;th;f;S;pd; ntggj;j NghdW fLi kahf , Uggj;pyi y. ehk; JUt gFj;pi a Nehf;f;pr; nryy nryy Mhbf; t;l;k; kwWk; mz;l h;hbf; t;l;j;j;wF mgghy; #hpa;f; fj;th;f;S; kp;fTk; rhathf t;Of;fwJ. , j dhy; jhd; ek;f;f NtWNtW ntgg kz;l yqf;S; fhz ggLf;pdwd.

- jho;ej ml rNui fary; c ahej ntg;gepi y fhz ggLf;fwJ. mJ kl;lky;yhky; Fi wej Nfhz j;j;ry; t;Ok; xsp;f;fj;th;f;S; c ahNfhz j;j;ry; t;Ok; xsp;f;fj;th;f;S; stpl ml hj;j;pahd ts;kz;l yk; to;ahf fle;J nry;fwJ. Fi wej Nfhz j;j;ry; t;Ok; xsp;f;fj;th;f;S; ts;kz;l y gp;j;gy;gg kwWk; c l;f;th;j;yhy; ghj;pf;fggLf;fwJ.

ntgg kz;l yqf;S; : (Heat Zones):

- Gtp;pd; Nfhs tbt;Kk; Gtp #hpa;id; Rwwk; , af;f;Kk; #hpa fj;th;f;S; Gtp Nkwgugg;ry; NtWNtW Nfhz j;j;ry; t;Ot;j;wF fhuz khf;fwJ. , J Gtp;pd; Nkwgugg;ry; fhz ggLk; ntgg guty;py; NtWgh;l;l VwgLj;JfwJ.
- , j dhy; Gtp %dW NtWgl;l ntggkz;l yk; myyJ ntg;gepi y kz;l yqf;shf gh;pf;fggLf;fwJ. mi tfs; ntggkz;l yk > kj; ntggkz;l yk; kwWk; Fshkz;l yk; MFk; myF 6y; ts;kz;l yk; vdW j;i yggpd; fb; , i;j;f; Fw;j;J eb;f;S; , d;Dk; t;h;thf gbggh;f;S;

c yf;pd; Neukz;l yqf;S; (World Time Zones):

- , i l f f h y k d j h f s ; # h p a f f b f h u q f s ; k w W k ; e h f b f h u q f i s f ; n f h z l # h p a d ; j h f f N u i f i a f l g g i j f z f h z g j j d h . 17 M k ; E j w w h z b y > k d j h f s ; C r y ; f b f h u q f i s g ; g a d g L j j M u k g j j d h ; , J f l y p y ; n r y Y k ; N g h J r h p a h d N e u j i j f h l L t j p y i y . g p d d h s p y ; f h y f f b f h u k ; (1764 , y) f z L g p b f f g g l j J . , f f h y f f b f h u k ; N e u j i j J y y p a k h f f h l f \$ b a J . f g g N y h l b f s ; 19 M k ; E j w w h z b y ; , i j m j p f m s t i y ; g a d g L j j p d h ; M d h y ; n g U k g h y h d r p W e f u q f s ; k w W k ; n g U e f u q f s p y ; f b f h u q f s ; # h p a c j a k ; k w W k ; # h p a k i w i t i t j N j f z p f f g g l j J . , g g b c U t h f f g g l j c s @ H # h p a f b f h u q f s ; , u a p y ; N g h f F t u j J k w W k ; n j h i y n j h l h G r h j d q f s p d ; t s h r r p f F j ; j i l a h f , U e j J . N e u k z l y k ; v d g J G t p a d ; x U g F j p a y ; N g h f F t u j J t p a h g h u k ; k w W k ; r K j h a e y d f S f f h f x N u r h f e p i y a h d N e u j i j g u h k h p g g J M F k ; c j h u z k h f > n t t N t W N e u k z l y k ; g p d g w w g g l j h y ; n t t N t W g F j p f s p y ; , U e J t U k ; , u a p y f s ; x N u , u a p y g i j a y ; t e J t p j J f F M s h f N e h p L k ;
- j h f f N u i f k w W k ; R w W k ; G t p i a n j h l h G g L j j p c y f p d ; N e u k z l y q f s ; c U t h f f g g l j J . K j d i k (0 °) j h f f N u i f N a N e u k z l y j j p w F i k a k h F k ; , J 7 1 / 2 ° N k w F k w W k ; 7 1 / 2 ° f p o f F j h f f N u i f a p y U e J e l b f f g g l L s s J . m i d j J N e u k z l y q f S k ; f h b d t p r ; k j j p a N e u j i j g p d g w W k ; g b a h f 24 k z p N e u q f i s n f h z l N e u k z l y k h f c U t h f f g g l L s s d . G t p 24 N e u k z l y q f s h f g h p f f g g l L s s J . x t n t h U k z l y K k ; x U k z p N e u j i j f ; F w p f F k ; V n d d w h y ; G t p a h d J x U k z p N e u j j p y ; 15 ° j h f f N u i f i a f l f f p w J (360 ° / 24 k z p N e u k) # h p a d ; K j d i k j h f f N u i f a p y ; t U k ; N g h J 7 1 / 2 ° N k w F k w W k ; 7 1 / 2 ° f p o f F , i l a p y ; c s s m i d j J g ; g F j p f S k ; e z g f y h f f U j g g L f p w J .

gfy; NrkpgG Neuk;

k j j p a m l r N u i f a p y ; f h z g g L k ; l N u h g g h > t l m n k h p f f h > M] j p N u y p a h k w W k ; n j d ; m n k h p f f h M f p a e h L f s p y ; N f h i l f h y q f s p y ; g f y N e u k ; , u T N e u j i j t p l \$ L j y h f , U f F k ; g f y ; N e u f h y m s i t n r a y g L j j p a N g h J k ; g f y ; N e u j i j t r e j f h y q f s p y ; x U k z p N e u k ; K d g h f T k ; , i y A j p h ; f h y q f s p y ; x U k z p N e u k ; g p d g h f T k ; r h p n r a a g g L f p w J . , J n g h J t h f g f y ; N r k p g G N e u k ; (Daylight Saving Time) v d m w p a g g L f p w J .

Neu kz l y q f s ; (Time Zones):

- G t p a h d J j d ; m r r p y ; 360 i a x t n t h U 24 k z p N e u j j p w F k ; x U K i w R w w p t U f p w J . G t p j d ; x U R w i w K b f f x U e h s ; v L j J f ; n f h s ; t i j e b q f s ; f h z y h k ; N e u t p f j j j p d ; g b x U k z p N e u j j p y ; 15 ° f l f f p w J . (360 ° / 24) R w W t i j f ; f h z y h k ; (360 ° / 24) . , e j v z ; N e u k z l y q f i s e h z a g g j p y ; x U K f f p a g q F t p f f p w J . e b q f s > V w f d N t c q f s ; f b t F g G f s p y ; m l r N u i f k w W k ; j h f f N u i f m t w w p d ; g a d f s ; F w j J g b j j p U g g h f s ;
- N e u k z y q f i s e h z a g g j p y ; m l r N u i f f s ; k w W k ; j h f f N u i f f s ; K f f p a g q F t p f f p d w d . , i t f s ; G t p i a g ; g h p f F k ; f w g i d f ; N f h L f s h F k ; m l r N u i f v d g J G t p i a r ; R w w p f p o f F N k w f h f n r y Y k ; m i t t l J U t k ; k w W k ; n j d J U t j j p y ; c s s , l q f i s m s f f c j T k ; , f N f h L f s ; e p y e L f N f h l b y p U e J M u k g j J 0 ° y p U e J 90 ° t i u t l f f h f T k ; N k Y ; 0 ° a p y U e J 90 ° t i u n j w f h f T k ; n r y Y k ; , i t f s ; e p y e L f N f h l b y p U e J n j h i y t p y ; n r y y r ; n r y y r p w a j h f p d w d . M d h y ; j h f f N u i f f s ; t l f F n j w f h f t i u a g g L f p d w d . m i t f s ; N k w F f p o f F J U t q f s p y ; c s s g F j p f i s m s f f p d w d . , i t K j d i k j h f f N u i f a p y ; M u k g j J 0 ° y p U e J 180 ° t i u f p o f f h f T k ; N k Y k ; 0 ° y p U e J 180 ° N k w f h f T k ; n r y f p d w d . m l r N u i f f s ; N g h y , y y h k y ; , i t r k e s N f h L f s h F k ; , e j N f h s x U q f p i z g G j p l k ; 0 ° j h f f N u i f a p Y k ; m l r N u i f a p Y k ; m i k e J s s J . , e j g G s s p m l y h z b f ; n g U q f l y ; g F j p a y ; c s s n j d N k w F M g g h p f f h t p w F m U f p y ; f h z g g L f p w J . N k Y k ; , e j , u z l

NfhLFS k; 180° myyJ rhtNj r Nj j p Nfhl by; rej pffpdwd. , J cyfpy; nttNtW
Neukz l yqfi s ephz apff cj TfWJ.

- Nkwfz l mi dj J jftyfS k; , uz l mi ktpl qfS fF , i l Na css Neu
tj j pahrj i j fz ffl cj TfWJ.
- 1. Kj ypy; vej j hff Nui ffs py; , uz l , l qfs; mi keJ s s J vdgi j ehk; nj hpeJ
nfhssNtz l k;
- 2. mLj j j hf> mej , uz l , l qfspd; j hff Nui fapd; tj j pahrj i j (ghi fapy)
fz l g b f f Ntz l k; xUNti s , uz l , l qfS k; Kj di k j hff Nui fapd; xNu
gf f j j py; mi keJ , Uej hy; mej , U ghi ffi sAk; foj j Neu tj j pahrj i j
fz ffl yhk; , U , l qfS k; Kj di k j hff Nui fapd; nttNtW gf f j j py;
mi keJ , Uej hy; mtwWpd; ghi ffi sf; \$ l b Neu tj j pahrj i j f; fz ffl
KbAk;
- 3. %dwhTj hf ehk; ghi f msi tapd; tj j pahrj i j 15 My; tFff Ntz l k;
Vnddwhy; xtntH U kz p fFk; 15 ghi ffs; cz l . , J , uz l , l qfS fF
, i l Na css Neu tj j pahrj i j j; j UfWJ. vdNt xU , l j j pd; Neu j i j Ak>
fz ffl Ntz ba , l j j pd; j hff Nui fAk; nj hpej pUej hy; ehk; vsj hf , uz l
, l qfspd; Neu tj j pahrj i j f; fz ffl yhk;
- , dp ehk; kwnwhU topay; , uz l , l qfS fFk; , i l Na css Neu tj j pahrj i j
fz ffl yhk; mJ rhtNj r Nj j p Nfhl i l i kakhf i tj J fz ffl Ltj hFk; , ej f;
Nfhl hdJ gad; glj j ff ti fapy; grppf; ngUqfly py; mi kffgg l s s J. vdNt>
mUfpyUfFk; , uz l efuqfS fF xUehs; tj j pahrk; fhz gg Ltj py; i y. , J rhtNj r
Nj j p Nfhl by; mi keJ pUej hYk; mUfpy; css , uz l , l qfspd; Neu tj j pahrj i j
fz ffl KawrpfFk; NghJ rwW fbdkhf , Uffyhk; , ej fz ffl Kj di k j hff
Nui fi a i tj J fz ffl i j g; NghyNt fz ffl ggLk; Kj ypy; , uz l gFj p fS fF
, i l Na css j hff Nui fapd; (°) ghi f (bfhp) tj j pahrqfi s fz l wpa Ntz l k;
, i j ehk; , U vz fi sAk; \$ l Ltj d; %yk; fz ffl yhk; gwF \$ l j gg l vz i z
xtntH U kz p Neu j j pWfK; fpi l fFk; 15° ahy; tFff Ntz l k; , J rhtNj r Nj j p
Nfhl by; css , U , l qfS fFk; , i l Na css Neu tj j pahrj i j j; j UfWJ.
NkYk; ekfF VwfdNt nj hpej Neu j i j \$ l b Nah foj j Nj h Gj pa Neukz l yj j pYss
Gj pa Neu j i j fz ffl yhk;