

lgj f{gkl5sf klqmfaf/]sf6{ ; {6/sf]j Qmlo
g{kfnsf]@)&\$; fnsf]k{z tyf kl|t|glw ; ef lgj f{gsf]c{t/f{6 lgj f{g ko_]f0f ldzg
kfj ^, @)&\$

kl/ro

dl+ / @# df sf6{ ; {6/n]g{kfndf b0{r/0fdf -dl+ / !) / @!_ ; DkGg k{z tyf kl|t|glw ; ef lgj f{gaf/]
kf/IDes ljj /0f k\$zgzdf Nofof]. lgj f{gkl5sf klqmfaf/]of]j Qmlo dtu0fgf ; dfkg / dt kl/0ffdsf]
tflnsls/0fsf] ; ?cftkl5sf]cBfj lws xf]. lgj f{g kl/0ffd / rbfj ; DaGwl sb}klg ljj fbx{sf] km} nf
afsl /x\$fn] ; {6/n]kQf nufPsf tYo / lgisif{? kf/IDes xg\ c{td kl|t|j dg ; g\@)!*

gkfnst]dtu0fgf klqmf w})cl3sf lgj f{gblv g}aflemf]/ clt ; :t /x\$]b]V65 . ; d; fdlos cj :yf
xpf{/ x/\$ kphzdf rf/j 6f lgj f{gsf]nflu tlgj 6f dtkqsf]kpf]u ePsf]h]ubf{; g\@)!& sf]kfb]zs /
kl|tlglw ; efsf]lgj f{gsf]u0fgfdf rgf]Lx? ylkq]ck]ff ul/Psf]lyof].³ kl|tlglw ; efsf nflu klxnf]xg]
lgj f{rt xgdf Pp6f dtkq, kfb]zs rgf] sf nflu klxnf]xg]lgj f{rt xgdf Pp6f dtkq / b0{j 6f
; dfgkflts klqmf]tkm(Pp6f dtkqsf]kpf]u ul/Psf]lyof].

o; cl3sf lgj f{gx?df h:t} lgj f{g lqdf v; \$f ; a}dt lhNnfsf]; b/dsfddf /x\$ dtu0fgf s]>df
Nof0{ulPsf]lyof].⁴ bj }ylkg h-4(t)Td()Tj 0.3332w02(h)4(N)w 0.333 0 Td[(-3 ; 9-10); .299 d

sf6ł ; 06/sf koł]fsxč ePsf @& lhNnfxč dWb]!^ j 6fdf koł]fsxčnf0{u0fgfdf k0f{kxF kłfg eof] .⁵ c6o !! lhNnfx?df sf6ł ; 06/sf koł]fsn]ljleġ vfn]kłtaġw ; fdġf u/šf lyP . ; ft koł]fs 6fłhxčn]uDel/ kłtaġw cġej u/]hxFSxł ldġđdf jf Ps 3ġ6f; Dd dfq koł]f0fsf nflu cġdlt lb0of].⁶ tġ 6fłhxčn]ldl>t kxFaf/]hfgsf/L lbP, hxFkoł]fsxčn]Ps lgj fčg lfqsf] dtu0fgf koł]f0fsf]nflu cġdlt kP t/ cf8šf]sf]7fdf ePsf]csf]lgj fčg lfqsf] dtu0fgf xġšf]nflu cġdlt kPpgg\cyj f pxl dtu0fgf sđ>df km/s lbgdf koł]fssf]kxF km/skm/s /Xof].⁷

Ps lhNnfd -aš8ldf, sf6ł ; 06/ 6fłldfly pu|Joł xf/ ul/Psf]lyof]/ dtu0fgsf]; ?j ft xġ{lb0Psf] lyPg . lgj fčg cfołusf]x:t lřkkl5, eflřnkł6 kġžsf]cġdlt t lb0of] t/ sdčf/lx?, bnsf kłtlġwx? / pkl:yt cġosf]c; xh Joł xf/sf]sf/0f ldzgn]koł]f0f 6fłlnf0{cs}lfqdf v6of].

koł]f0fdf kxF ; lldt ug{sf/0fxč :ki6 lyPgg\ kłoh; f]cj:yfdf lgj fčg clwsłn]:yfg cefjnf0{sf/0f blyP . c6o cj:yfdf, lgj fčg clwsłn]sg}sf/0f atfPgg\]f lgj fčg cfołusf] lgbłzsfdf cġt/fł6 koł]fsnf0{cġdlt kłfg ug{elġP kġ slt ; do eġġf/]gtłsPsf]atfP . Ps 7fpłf, bnx?sf kłtlġwalr lj j fb a9šfn]koł]fsx?nf0{sł a]sf]nflu dtu0fgf :ynaf6 aflx/ hfg elġof].

o/fłkog ; šsf]lgj fčg koł]f0f 6fłln]kġ w}u0fgf sđ>xčdf kxFdf ePsf]kłtaġwaf/]płnly u/]. /fli6 koł]fsx?n]eg] dtu0fgf sđ>x?df sł nlrnf] u/L kxF kPsf] blyof] oBlk, ol ; dXxčn] kxFsf]:t/ jf To; kxFsf]u0f:t/af/]clxn] Dd sł plnly u/šf 5ġg\

o; dxłj k0f{kłqmofdf koł]fssf] kxF ; lldt ug{cġt/fł6 dfkb08, lgj fčg cfołusf] lgbłzsfdf cfzo, / koł]fs cġdlt sf ; t? lj k/Lt xf]. lgj fčgsf]kf/blzčf / k0fčf ; lġZrt ug{ koł]fssf] pkl:yłt ckl/xfo{5, / koł]fsnf0{; wřkof]t kxF lġu/L kġj wfġx? aġf0ġk5{.

koł]fsx?dfly kxFdf ; ldf eP kġ bnsf kłtlġwx?sf]pkl:yłt dtu0fgf sđ>df lġ/Gt/ blyof]. sf6ł ; 06/n]dtu0fgf :yndf bnsf kłtlġwx?nf0{cfkłmf]sfđ ug{glb0Psf]kPpg / bnsf kłtlġlwn]dtu0fgf :yndf u0fgf; Daġwł sg}ph/L u/šf]va/ kġ ; ġġ .

dtu0fgf sfo{/ kłqmof

dtu0fgf sđ>sf] nčfp6 / 6fłlsf] Joł:yfkg- lhNnf ; b/dšfdx?df /xšf dtu0fgf sđ>sf] nčfp6 ; fdfġotof lgj fčg cfołusf] lgbłzsf]n] tšđđdf]nd ġ]lyof]. w}lgj fčg lfq / dtbfg sđ>xč xġ ePsf]n] zx/L lfqčdf -lj ž]f u/L sf7df8f]+pkłosdf_ ljleġ ; /sf/L ejġxčnf0{ dtu0fgf :yn aġf0of]hxřFu0fgsf nflu plrt :yfg pknAw lyof].

; /lff ansf]pkl:yłt- ; a}dtu0fgf :yndf cłolws ; /lff an v6f0Psf]lyof]. dtkqnf0{/fhġllts bnsf kłtlġwx?n]ġi6 ugaf6 hřlyfpg eġ}tf/hfnl nuf0Psf]lyof]lsġeg]lřtjġdf :yġlo lgj fčgsf]

⁵ sf6ł ; 06/sf koł]f0f 6fłln aš8l, afł] eQmk/, lřtjġ, 88]hw/f, bħly, wġlff, ułdl, emkf, sħfnl, sflnsfđ, s-rgk/, slknj :t, sf:sl, sf7df8f]+sfełknfġrfs, nlnřk/, ndh^a, df] ^a, ġj nk/f; L, ġj fsfđ, křFy/, k; fč /fčx6, /řkf, l; /xf / ; Včdf lyP .
⁶ lřtjġ, ułdl, emkf, sħfnl, s-rgk/, ġj fsfđ, l; /xf .
⁷ afł] sf:sl ; Vč .

dt u0fgfsf]qmdf bnsf k|tlglwn]dtkq gi6 u/k|5 ljj fb pTkGg ePsf]lyof]. ;/lff ansf]cTolws
pkl:y|t /x] klg, koj]fsx?n] To:tf] pkl:y|tn] dtu0fgf ug{ sdf{f/L, /fhgllts bn / pDdDj f/sf
k|tlglwx?nf0{cfZj :t agfPsf]kfP . oBlk, ;/lff ann]sxl cj :yfdf koj]fssf]kxF vDRofpB}cfkmYf]
lhDd]f/leGbf aflx/sf]sfd u/].

/fhgllts bnsf k|tlglwx?sf] pkl:y|t- koj]f0f ul/Psf ;a} dtu0fgf s|>df /fhgllts bnsf
k|tlglwx? pkl:y|t lyP / ;Dk0f{u0fgf k|qmf]sf] cj lwe/ ToxLFa:g cgdlt kfP . lgj f{g cfof]ysf]
lj :t[lgb]zsfX; xBfxB}klg dtu0fgf sdf{f/L / bnX?sf k|tlglwx;n] u0fgf ug{cl3 dt u0fgfsf]
k|qmfaf/] ; dembf/L u/]. o; sf]p2Z;o ; xdltdf klg' / ; Deflj t ; d:ofX;nf0{cl3 g}; Daf]vg ug{lyof]
. o; n] ; duDf k|qmf / lgj f{gsf] kl/0ffdnf0{ :yfglo txd f ;jLsfo{ agfof] t/ o; cEof; n] ubf{
lhNnflkR5]km/s tl/sf ckgf0of]/ lj z]fu/L ab/ dtaf/]Ps?ktf gePsf]kf0of].

dtu0fgf k|qmf- a]hfa]hdf dtu0fgf lgb]zsf]sf]; xl kfngf gul/P klg cyj f Ps?ktf ; lxt nfu"gul/P
klg sf6{ ; [6/sf koj]fsx?n] koj]f0f ug{ kfPsf dtu0fgf s|>df dtu0fgf k|qmfnf0{ ; fdfgotof
; sf/fTds dflgPsf] lyof]. sf6{ ; [6/sf koj]fsx?n] koj]f0f ug{ kfPsf dtu0fgf s|>df (^
k|tzt dtu0fgf s|>df ; duDf k|qmf ; sf/fTds lyof] vf; u/L u0fgf lj Zj ; glo / ; xl lyof]. oBlk,
koj]fsX;sf] k|talGwt kxFn] ubf{ k|qmf]sf] ; du| kf/blz{fnf0{sdhf] kf/\$f] 5 . sf6{ ; [6/sf
koj]fsX;n]cgdlt gkfPsf jf

lt
2Bf/L T(j 59Tw 0.667 000.0;) (ks)3(w).

u0fgf s[>n]dt u0fgfsf]cflzs kl/0ffd 3f]f0ff ; fj hlgS ?kdf lglZrt ; dosf]c[t/fndf u/\$f lyP .
klxnf]xg]lgj f[r-t xg]dt u0fgf ; dfg e0; skl5 / ; dfgkflts tkm[sf]u0fgf rfn' /x6f u0fgf qmd
cgf]rfl/s a6of]/ sxl u0fgf s[bdf /fhgllts bnsf kltlgwswf]; Wof 36\$]lyof].

ab/ dt 3f]f0ff- dtu0fgf klqmofdf dt ; b/ of ab/ ubf{lgod / sfo]j lwdf Ps?ktf xg; s] x/\$
dtbftsf] ; dfg dtflwsf/sf]xssf] ; Af0fdf d2t k05 . o; ; Da6wdf lj Bdfg sfgg tyf lgj f'g
cfof]usf lgbzgx? lj :t[Pj +:ki6 5g\⁸ k]om kfj wfgx? cGt/f]60 dfkb08sf]txsf 5g\eg]sxl cln
s8f vfnsf 5g\ . vf; u/l :j|:ts 5fk kpf]u ePsf]dtkqnf0{dfq}; b/ dflg65, c? 5fk df6o x6g .
o; sf]tflko{dtbftsf]cfzo :ki6 bl]vP klg dtkq ab/ x65 .

cfof]un] dt ; b/ of ab/ egl lglZrt ug{u0fgf clwsf/lx?sf nflu dfkb08sf] ; Hfkt ?k ; lxtsf
kf]6/x?sf]Joj :yf u/]klg o:tf]lg0f6 eg]:yfglo txdf cfk; L ; xdltdf g}ul/Psf]kf0of]. o; n]ubf{
slxn\$fxlFpxl u0fgf s[>leq klg Ps?ktf gePsf]e]6of]. dt bftsf]cfzonf0{; Ddfg ug]/ u0fgf
klqmofnf0{cem}; dfj zl ug]nf0{o; ; Da6wl lgodfj nl / Joj xf/ ; wfg{cfj Zos bl]v65 .

tflnsls/of Pj -klxnf]xg]lgj f[r-t xg]kl/0ffdsf]3f]f0ff

klxnf]xg]lgj f[r-t xg]sf]u0fgf dt+ / @& df ; lsof] hg tf]sPsf]ldlte6bf rfB}lyof]. ; dfgkfltssf]
dtu0fgf k; @ df ; lsof] z b]10 Tdst u/(|l)(f)2(5Tlc 0.0Tlw j 0.00)13; Daf /gdfj]