

lgj f{gkl5sf klqmfaf/]sf6{ ; {6/sf]j Qmlo  
g{kfnsf]@)&\$ ; fnsf]k{z tyf kl|tlglw ; ef lgj f{gsf]cgt/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|tlglw ; 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|Gtd kl|tj Gg ; 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].<sup>3</sup> kl|tlglw ; efsf nflu klxnf]xg]  
lgj fl{rt xgdf Pp6f dtkq, kfb]zs rgf] sf nflu klxnf]xg]lgj fl{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].<sup>4</sup> bj }ylykq]h-4(t)Td( )Tj 0.3332w02(h)4(N)w 0.333 0 Td[(-3 ; 9-10); .299 d

sf6 $\lambda$  ; Q6/sf koj]fsx $\zeta$  ePsf @& lhNnfx $\zeta$ dWb]!^ j 6fdf koj]fsx $\zeta$ nf0{u0fgfdf k0f{kxF k $\phi$ fg eof]  
. <sup>5</sup> cGo !! lhNnfx?df sf6 $\lambda$  ; Q6/sf koj]fsn]lj leGg vfn]k|taGw ; fdgf u/\$f lyP . ; ft koj]fs  
6f $\eta$ lx $\zeta$ n]uDel/ k|taGw cgej u/]hx fFs $\lambda$  Idg $\phi$ df jf Ps 3G6f; Dd dfq koj]f0fsf nflu cgdlt  
lb0of]. <sup>6</sup> tlg 6f $\eta$ lx $\zeta$ n]ldl>t kxFaf/]hfgsf/L lbP, hx fFkoj]fsx $\zeta$ n]Ps lgj f{g lf $\phi$ sf] dtu0fgf  
koj]f0fsf]nflu cgdlt kfP t/ cf8 $\phi$ ]sf]7fdf ePsf]csf]lgj f{g lf $\phi$ sf]dtu0fgf x $\phi$  $\phi$ ]nflu cgdlt  
kfPgg\cyj f pxl dtu0fgf s $\phi$ >df km/s lbgdf koj]fssf]kxF km/skm/s /Xof]. <sup>7</sup>

Ps lhNnfd -a $\phi$ 8ldf, sf6 $\lambda$  ; Q6/ 6f $\eta$ ldfly pu|Joj xf/ ul/Psf]lyof]/ dtu0fgfsf]; ?j ft x $\phi$ {lb0Psf]  
lyPg . lgj f{g cfof $\psi$ sf]x:t lf $\phi$ kl5, efl $\eta$ kn6 kj  $\phi$ sf]cgdl t lb0of] t/ sd{f/lx?, bnsf k|tlglwx?  
/ pkl:yt cGosf]c; xh Joj xf/sf]sf/0f ldzgn]koj]f0f 6f $\eta$ lnf0{cs}lf $\phi$ df v6of].

koj]f0fdf kxF ; lldt ug[ $\psi$ /0fx $\zeta$  :ki6 lyPgg\ k $\phi$ h; f]cj:yfdf lgj f{g clws[n]:yfg cefjnf0{  
sf/0f b $\psi$ lyP . cGo cj:yfdf, lgj f{g clws[n]sg}sf/0f atfPgg\jf lgj f{g cfof $\psi$ sf]lgb $\psi$ zsfdf  
cGt/f $\phi$ 6 $\phi$  koj]fsnf0{cgdl k $\phi$ fg ug[elgP klg slt ; do eGg $\phi$ /]gtf]sPsf]atfP . Ps 7fp $\phi$ f,  
bnx?sf k|tlglwalr ljj fb a9 $\phi$ fn]koj]fsx?nf0{s $\lambda$  a]sf]nflu dtu0fgf :ynaf6 aflx/ hfg elgof].

o/f $\eta$ kog ;  $\phi$ sf]lgj f{g koj]

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|qmf]nf0{ ; fdfgotof  
; sf/]f]ds dflgPsf] lyof]. sf6{ ; [6/sf koj]fsx?n] koj]f0f ug{ kfPsf dtu0fgf s|>df?d]wo] (^  
k|tzt dtu0fgf s|>df ; duDf k|qmf ; sf/]f]ds 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/]sf] 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 flgs ?kdf lglZrt ; dosf]c[t/fndf u/\$f lyP .  
klxnf]xg]lgj fl[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\$fl]yof].

ab/ dt 3f]f0ff- dtu0fgf klqmfdf 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\<sup>8</sup> 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]el]6of]. dt bftsf]cfzonf0{; Ddfg ug]/ u0fgf  
klqmfnf0{cem}; dfj zl ug]nf0{o; ; Da6wl lgodfj nl / Joj xf/ ; wfg{cfj Zos bl]v65 .

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

klxnf]xg]lgj fl[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]