ANSWERS TO END-OF-CHAPTER PROBLEMS

CHAPTER – 6

Q 6.2) $\omega_B = \dfrac{\lambda t a^2 \omega_A(0)}{(M_B + \lambda t) b^2}$

Q 6.3) $\omega = \dfrac{mv}{R(M + 2m)}$

Q 6.5) $N_1 = 1674.04$ lb; $N_2 = 924.04$ lb

Q 6.6) $N_1 = \dfrac{1}{2}Mg - \dfrac{2Mv^2}{(2R+d)}\dfrac{L}{d}$

$N_2 = \dfrac{1}{2}Mg + \dfrac{2Mv^2}{(2R+d)}\dfrac{L}{d}$

Q 6.7) $\dfrac{5ML^2}{12}$

Q 6.9) Rod will undergo SHM with angular frequency $\omega = \sqrt{\dfrac{\mu g}{l}}$

Q 6.10) $\tau = \sqrt{2}\,\dfrac{\mu MgR}{1+\mu^2}$

Q 6.11) $I_0 = \dfrac{2FL}{\omega_0^2}$

Q 6.12) $M_1(M_2 + M_3)l_1 = 4M_2M_3l_2$

Q 6.13) In *(a) angular momentum* and in case $v_f = \dfrac{r}{R}\,v_0$

(b) kinetic energy is conserved $v_f = v_0$

Q 6.14) $(a)\tau_B = Mgl/2$ $(b)\alpha = 3g/2l$

Q 6.15) $T = 2\pi\sqrt{\dfrac{R^2 + l^2}{gl}}$

Q 6.16) $\boldsymbol{l = R/\sqrt{2}}$

Q 6.17) $\omega = \sqrt{\dfrac{15k}{4M} - \dfrac{3g}{2l}}$

Q 6.18) $T = 2\pi\sqrt{\dfrac{\left(MR^2/2\right)+\left(M+m/3\right)l^2}{\left(M+m/2\right)gl}}$

If disk is free to rotate then $T = 2\pi\sqrt{\dfrac{\left(M+m/3\right)l}{\left(M+m/2\right)g}}$

Q 6.19) $(a)\ \omega = \sqrt{\dfrac{2C}{MR^2}}$

$(b)\ (1)\ \omega = \sqrt{\dfrac{C}{3MR^2}}\quad (2)\ \theta_{\max} = \dfrac{\theta_0}{\sqrt{3}}$

Q 6.20) $\boldsymbol{\left|\vec{F}\right| = Mg\sqrt{\dfrac{10}{16}};\quad angle\ with\ horizontal\ axis = \tan^{-1}\left(\dfrac{1}{3}\right)}$

Q 6.23) $(a)\ a + A = R\alpha$ If a = 2A then $\alpha = \dfrac{3\mathrm{A}}{\mathrm{R}}$

$\boldsymbol{(b)\ \alpha = \dfrac{4mg}{R\left(M+3m\right)};}\quad a = \dfrac{3m-M}{\left(M+3m\right)}g\ ;\qquad A = \dfrac{M+m}{\left(M+3m\right)}g$

Q 6.24) $\boldsymbol{A = \dfrac{4g}{5}}$

Q 6.25) $\boldsymbol{l = \dfrac{7v_0^2}{10g\sin\theta}}$

Q 6.26) ***Sphere* will reach first.**

Q 6.27) $\boldsymbol{F = \dfrac{3\mu MgR}{\left(2b+R\right)}}$

Q 6.28) $Sin\theta = \dfrac{Mg}{F} - \dfrac{b}{\mu R}$

Q 6.29) $a)\ T = \dfrac{Mg\,R^2}{(2b^2+R^2)}\qquad b)\ Mg + \dfrac{2Mv^2}{\pi b}$

Q 6.31) $\omega_f = \dfrac{\omega_0}{3}$

Q 6.32) $\omega_R = \dfrac{\omega_0 M}{m+M}$

Q 6.33) $(a)\,\varpi = \dfrac{I_0 \varpi_0}{I_0 + mR^2} \quad (b)\, v = \sqrt{\dfrac{I_0^2 \varpi_0^2 R^2}{\left(I_0 + mR^2\right)^2} + 2gh + \dfrac{I_0 \varpi_0^2 R^2}{\left(I_0 + mR^2\right)}}$

Q 6.35) $L < 2R$

Q 6.37) $(a)\, v_f = v_0 \left(\dfrac{\dfrac{4m}{M} - 1}{\dfrac{4m}{M} + 1} \right); \quad (b)\, v_f = v_0 \left(\dfrac{\dfrac{3m}{M} - 1}{\dfrac{3m}{M} + 1} \right)$

Q 6.39) **(a) The system will rotate about its CM with** $\varpi = \dfrac{6v_0}{5l}$

Q 6.40) $(a)\, l - b/\sqrt{2}; \quad (b)\, l + b/2$