Chap 8 CQ (1-7, 9, 10)

(1) ($\vec{T} > \vec{w}$) otherwise not enough $\vec{F}_{centripetal}$ to make him move in circle

(2) ((a) correct)
(see above & no forward force)

(3) $T \propto a_c$, $F_T = \frac{m v^2}{r}$

($T_c > T_a = T_d > T_b$)

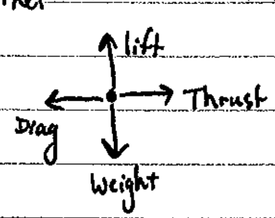
(4) ($\vec{T} > \vec{w}$) see #1

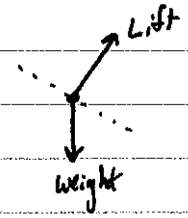
(5) a) equal v_T
then $\vec{T}_A > \vec{T}_B$

b) equal ω
$F_T = m r \omega^2$
then $\vec{T}_B > \vec{T}_A$

(6) Both true ~ sort of
The centripetal force is directed toward center, but also forward force to cause it to speed up.
Net force is parallel to track but points in & forward

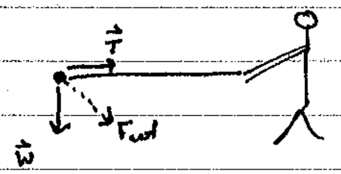
(7) a) $F_{net} = 0$ - level & constant vel.

b)


c) from behind


d) so lift force points partially centripetally.

(9) Minimum speed corresponds to Tension in string approaching zero. Then at top only $\vec{F}_g$ acting. if v_{min} not met then F_g doesn't "match". $F_c = \frac{m v^2}{r}$

(10)


a_c & a_T

((c) golfer's feet)

Chap 8 EP (4, 5, 7, 8, 10, 13)

(4) Friction, inward, 4700N

$F = \frac{mv^2}{r} = \frac{(1500)(25)^2}{200}$

(5) $\frac{(1500)(15)^2}{50} = 6750N$

(7)

$(8.2\,E{-}8N) = 9.1E{-}31 \frac{v^2}{5.3E{-}11}$

$v = 2{,}185{,}365.913$ m/s

$F = mr\omega^2$

$8.2E{-}8 = (9.1E{-}31)(5.3E{-}11)\,\omega^2$

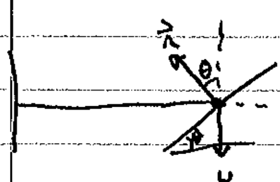
⋮ $\omega / 2\pi =$

6.6×10^{15} rev/sec

(8) 90 Km/hr $= \frac{90\,000\,m}{3600\,s}$

$= 25$ m/s

$r = 500$m



$\vec{n}\cos\theta = \vec{w} = mg$

$\vec{n}\sin\theta = m\frac{v^2}{r}$

divide $\vec{n}\cos\theta = mg$

$\frac{\sin\theta}{\cos\theta} = \frac{v^2}{gr}$

$\tan\theta = \frac{v^2}{gr}$

$\tan\theta = \frac{(25)^2}{(9.8)(500)}$ $\theta = 7.3^\circ$

(10) $m = 0.030$kg

$r = .20$m

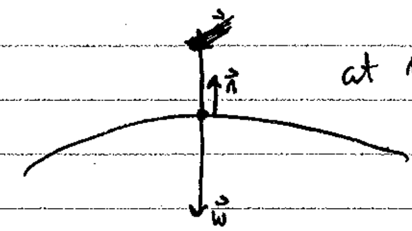
$\omega = \frac{60\text{ rot}}{\text{Min}} \times \frac{2\pi}{1\text{ rot}} \times \frac{1\text{ min}}{60} = 6.28$ rad/s

$F_c = mr\omega^2$

$= (.03)(.20)(6.28)^2$

$.24N$

(13)



at v_{min} $\vec{n} \to \emptyset$

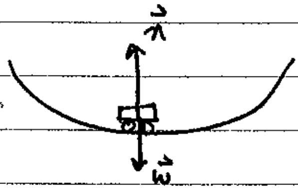
only $\vec{w}$

$mg = \frac{mv^2}{r}$ $g = v^2/r$ $(9.8)(50m) = v^2$

$v = 22$m/s

Chap 8 EP (14, 16, 18, 35, 36, 46)

(14)



$\vec{n} = 1.5\vec{w}$ (50% more)

$F_{net} = ma$

$\vec{n} - \vec{w} = m\vec{a}_c$

$1.5mg - mg = m\,a_c$

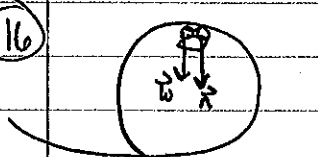
$.5mg = m\,a_c$

$(.5g) = v^2/r$

$(.5)(9.8) = v^2/30m$

$v = 12 m/s$

(16)



$\vec{w} = \vec{n}$, $r = 20m$

$F_{net} = ma$

$\vec{w} + \vec{n} = ma_c$

$mg + mg = m\,v^2/r$

$2g = v^2/r$

$\sqrt{2gr} = v$

$v = 20 m/s$

(18) $r = 100m$

$a_T = 1.5 m/s^2$

find v_T for $a_c = 1.5 m/s^2$

$a_c = 1.5 m/s^2 = \frac{v_T^2}{100}$

$150 = v_T^2$

$v_T = 12.25 m/s$

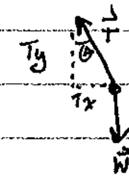
$a_T = \frac{\Delta v}{t}$

$1.5 = \frac{12.25}{t}$

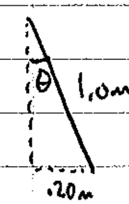
$t = 8.2 sec$

(35) $r = .20m$ $L = 1.0m$

$m = .50 kg$



$\vec{w} = 4.9N$



$\tan^{-1}\frac{.20}{1} = \theta$

$\theta = 11.31°$

$T_y = \vec{w} = 4.9N$

$T\cos\theta = 4.9N$

$T\cos 11.31° = 4.9$

a) $T = 5N$

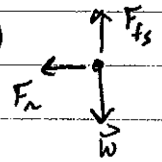
b) ω in RPM $T_x = mv^2/r = mr\omega^2$

$T_x = T\sin\theta = .98N = .5(.20)(\omega^2)$

$\omega = 3.13 rad/s$

$\frac{3.13 rad}{s} \times \frac{1 rev}{2\pi rad} \times \frac{60}{min} = 30 rev/min$

(36)



$m = 30kg$

$\mu_s = 0.60$

$r = 2.5m$

$F_R = mr\omega^2$

$F_{f_s} = \mu_s F_R = mg$

$\mu_s mr\omega^2 = mg$

$(.60)(2.5)\omega^2 = 9.8$

$\omega = 2.556 \text{ rad/s}$

$2.556 \frac{rad}{s} \times \frac{1 rev}{2\pi rad} \times \frac{60 sec}{min}$

$\boxed{\omega = 24.4 \text{ RPM}}$

(minimum mass sign unecessary!)

(46) $F_c = m_1 v^2/r$

$m_2 g = m_1 \frac{v^2}{r}$ (Tension = $m_2 g$ since m_2 at rest)

$\boxed{\sqrt{\frac{m_2 g r}{m_1}} = v}$