Circular Motion Practice Problems.

1) a) $T = \frac{1}{f} = \frac{1}{4 \frac{cyc}{sec}} = 0.25\,sec$ $\quad f = \frac{100\,cyc}{25\,s} = 4\,\frac{cyc}{s}$

b) $f = \frac{100\,cyc}{25\,sec} = 4\,\frac{cyc}{sec} = 4\,Hz$

2) a) $T = \frac{1}{f} = \frac{1}{100 \frac{cyc}{sec}} = 0.01\,s$

b) $f = \frac{2500\,cyc}{25\,s} = 100\,\frac{cyc}{s} = 100\,Hz$

3) a) $f = \frac{1}{T} = \frac{1}{12\,s} = 0.08\,Hz$

b) Time for 86 rotations =

$86 \cdot \frac{1}{f} = 86 \cdot \frac{1}{0.08 \frac{cyc}{sec}} =$ ~~1075 sec~~ $1032\,sec$

7) A 5.0 Kg object is spun in circle of $r = 1.0\,m$ and $T = 4.0\,s$.

a) $f = \frac{1}{T} = \frac{1}{4.0\,s} = 0.25\,Hz$

b) $v = \frac{2\pi r}{T} = \frac{2\pi \cdot 1.0\,m}{4.0\,s} = 1.6\,\frac{m}{s}$

c) $a = \frac{v^2}{r} = \frac{(1.6\,\frac{m}{s})^2}{1.0\,m} = 2.6\,\frac{m}{s^2}$

8) A 15.0 Kg mass is spun in a circle of radius 5.0 m with f = 25 Hz.

a) $T = \frac{1}{f} = \frac{1}{25 \frac{cyc}{sec}} = 0.04 \text{ sec.}$

b) $v = \frac{2\pi r}{T} = \frac{2 \cdot \pi \cdot 5.0m}{0.04 \text{ sec}} = 785 \frac{m}{s}$

c) $a = \frac{v^2}{r} = \frac{(785 \frac{m}{s})^2}{5.0 m}$ = 123, ~~370~~ 245 $\frac{m}{s^2}$ or $1.2 \times 10^5 \frac{m}{s}$

11) a = ? $v = 25 \frac{m}{s}$ r = 10 m

$a = \frac{v^2}{r} = \frac{(25 \frac{m}{s})^2}{10 m} = 62.5 \frac{m}{s^2}$

12) r = ?, $a = 12 \frac{m}{s^2}$ $v = 3.1 \frac{m}{s}$

$a = \frac{v^2}{r}$, so $r = \frac{v^2}{a} = \frac{(3.1 \frac{m}{s})^2}{12 \frac{m}{s^2}} = 0.80 m$

13) v = ? m = 61 Kg F = 25 N r = 35 m

$F = \frac{mv^2}{r}$, so $v = \sqrt{\frac{F \cdot r}{m}} = \sqrt{\frac{25 \frac{Kgm}{s^2} \cdot 35 m}{61 Kg}}$ = ~~[illegible]~~ $\frac{m}{s}$

$= 3.8 \frac{m}{s}$

14) $r = ?$ $m = 0.25\,Kg$ $F = 15\,N$ $v = 21\frac{m}{s}$

$F = \frac{mv^2}{r}$, so $r = \frac{mv^2}{F} = \frac{0.25\,Kg \cdot (21\frac{m}{s})^2}{15\frac{Kg\,m}{s^2}}$

$= 7.4\,m$

15) $V = ?$ $a = 36\frac{m}{s^2}$ $r = 15\,m$

$a = \frac{v^2}{r}$, so $v = \sqrt{a \cdot r} = \sqrt{36\frac{m}{s^2} \cdot 15\,m}$

$= 23\frac{m}{s}$

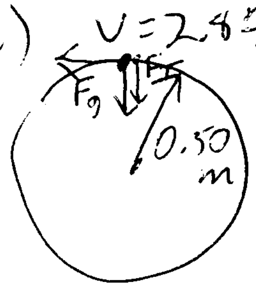
16) $V = ?$, $m = 61\,Kg$, $F = 250\,N$, $r = 1.5\,m$

$F = \frac{mv^2}{r}$;, $v = \sqrt{\frac{F \cdot r}{m}} = \sqrt{\frac{250\frac{Kgm}{s^2} \cdot 1.5\,m}{61\,Kg}}$

$= 2.5\frac{m}{s}$

23) a) $m = 0.65\,Kg$

$V = 2.8\frac{m}{s}$



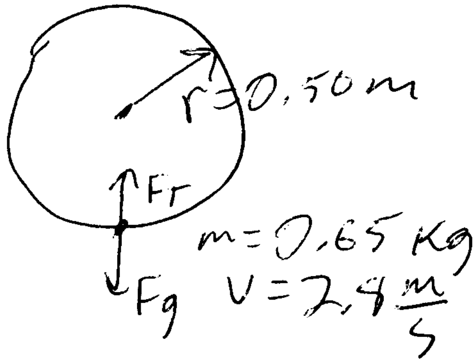
b) $F_{NET} = F_T + F_g$

c) $F_T = F_{net} - F_g$

$F_T = \frac{mv^2}{r} - mg = \left(\frac{0.65\,Kg \cdot (2.8\frac{m}{s})^2}{0.50\,m}\right) - (0.65\,Kg \cdot 9.8\frac{m}{s^2})$

$F_T = 3.8\,N$

(24) a)



b) $F_{NET} = F_T - F_g$

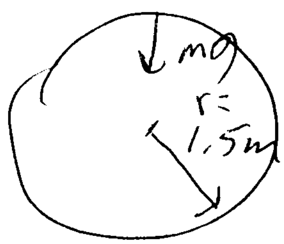
$F_T = F_{net} + F_g$

$F_T = \frac{mv^2}{r} + mg = \left(\frac{0.65\,kg\,(2.8\,\frac{m}{s})^2}{0.50\,m}\right) + \left(0.65\,kg \cdot 9.8\,\frac{m}{s^2}\right)$

~~= 6.5 N~~

= 16.6 N

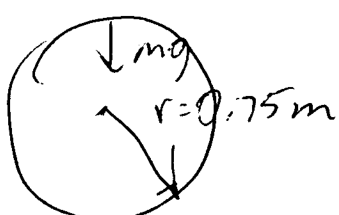
(27)



set $\frac{mv^2}{r} = mg$

$v = \sqrt{gr} = \sqrt{9.8\,\frac{m}{s^2} \cdot 1.5\,m} = 3.8\,\frac{m}{s}$

(28)



set $\frac{mv^2}{r} = mg$

$v = \sqrt{g \cdot r} = \sqrt{9.8\,\frac{m}{s^2} \cdot 0.75\,m} =$

$2.7\,\frac{m}{s}$

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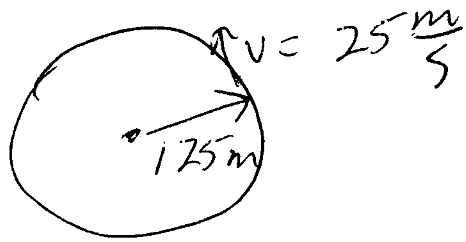
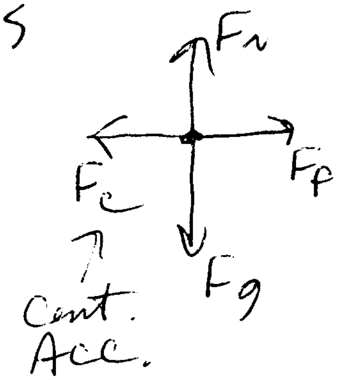
a)





b) $F_f = F_c = \frac{mv^2}{r} =$

$\mu \cdot F_N = F_f$ $\quad$ $F_f = \frac{mv^2}{r}$ and

$F_N = mg$

substitute, so

$\mu \cdot mg = \frac{mv^2}{r}$

c)

$\mu = \frac{\frac{mv^2}{r}}{mg} = \frac{v^2 g}{r} = \frac{\left(25\frac{m}{s}\right)^2 \cdot 9.8\frac{m}{s^2}}{125\,m}$

$\mu = \frac{\frac{v^2}{r}}{g} = \frac{v^2}{r} \cdot \frac{1}{g} = \frac{v^2}{r \cdot g} = \frac{\left(25\frac{m}{s}\right)^2}{125\,m \cdot 9.8\frac{m}{s^2}} =$

$\mu = 0.51$