Roundup Ride

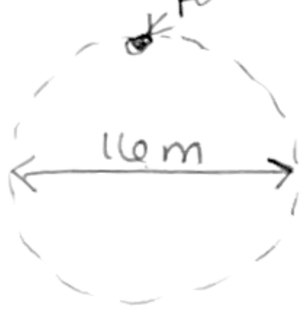
Name: _____

Date: _____

Do Ch 8 p.201 #51

Show the problem-solving steps. Solutions are posted.

a.

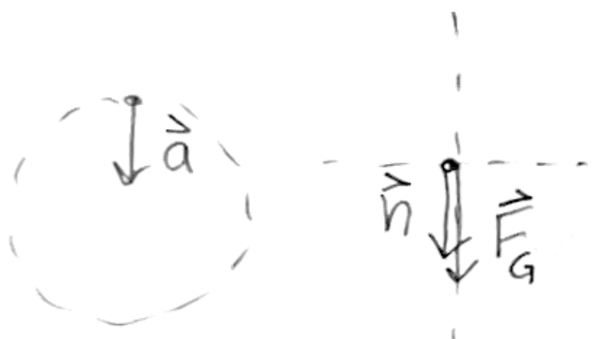


person at top

$T = 4.5\,s$

$m = 55\,kg$

$n = ?$



$\vec{F}$	F_r
$\vec{F}_G$	$F_{Gr} = +mg$
$\vec{n}$	$n_r = +n$

At the Top

use radial direction, find n at top:

$$a_r = \frac{\Sigma F_{on\,s\,m}}{m_s}$$

$$\frac{v^2}{r} = \frac{+n + mg}{m}$$

$$\frac{mv^2}{r} = n + mg$$

$$n = \frac{mv^2}{r} - mg$$

I need v, which I can find from T:

$$v = \frac{2\pi r}{T}$$

$$v = \frac{2\pi(8m)}{4.5s}$$

$$v = 11.2\,m/s$$

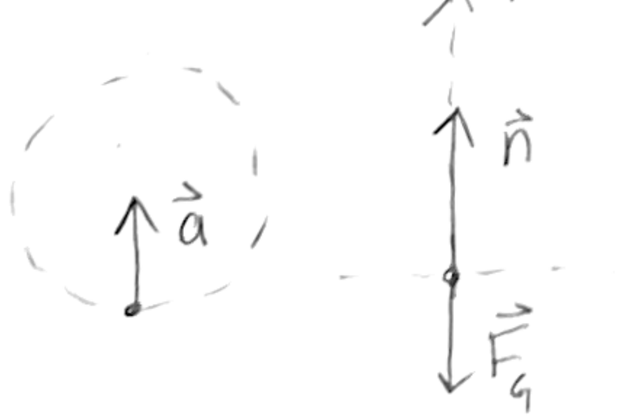
$$n = \frac{(55kg)(11.2\,m/s)^2}{8m} - (55kg)\left(10\frac{N}{kg}\right)$$

$$n = 862.4\,N - 550\,N$$

$$n = 312\,N$$ — at the top!

part a, cont'd: At the Bottom

same info as above



$\vec{F}$	F_r
$\vec{n}$	$n_r = +n$
$\vec{F}_G$	$F_{Gr} = -mg$

use radial direction, find n at bottom:

$$a_r = \frac{\Sigma F_{on\,s\,r}}{m}$$

$$\frac{v^2}{r} = \frac{+n + -mg}{m}$$

$$\frac{v^2}{r} = \frac{n - mg}{m}$$

$$n = \frac{mv^2}{r} + mg$$

$$= \frac{(55\,kg)(11.2\,m/s)^2}{(8m)} + (55kg)\left(10\frac{N}{kg}\right) = 1412\,N$$

(b) Longest period means slowest speed. I'll find slowest speed, and then calculate the period.

because $\vec{n}=0$ at minimum v.

$\vec{F}$	F_r	
$\vec{F}_G$	+mg	

Apply N2L to radial direction, Find V_{min}:

$$a_r = \frac{\Sigma F_{on\,s\,r}}{m_s}$$

$$\frac{V_{min}^2}{r} = \frac{+mg}{m}$$

$$V_{min} = \sqrt{gr}$$

$$V_{min} = \sqrt{(10\,\frac{N}{kg})(8m)}$$

$$V_{min} = 8.9\ m/s$$

Find period

$$V_{min} = \frac{2\pi r}{T_{max}}$$

$$T_{max} = \frac{2\pi r}{V_{min}}$$

$$T_{max} = \frac{2\pi(8m)}{(8.9\,m/s)}$$

$$T_{max} = \boxed{5.6s}$$