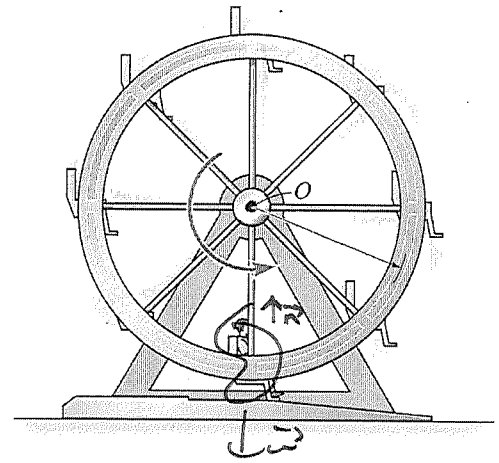
PHYSICS 151 TEST 5

Name: _____



(a.) A 65-kg man rides a ferris wheel as shown. The ferris wheel is rotating at 1.6 RPM. If the man's apparent weight at the bottom of the ride is 675 N, what is ferris wheel's radius? *(4pts)*

At Bottom of Ride: Forces on man are Normal up and weight Down.

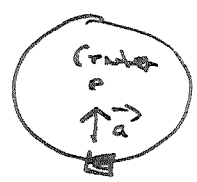
$\uparrow \vec{n}$

$\downarrow \vec{w}$

n = apparent weight = 675N

$w = mg = (65kg)(9.8m/s^2) = 637N$

Also, centripetal Acceleration points upward:



So $a_y = a$ ($a_x = 0$)

$\sum F_y = ma_y \Rightarrow n_y + w_y = ma_y \Rightarrow +n - w = ma$

$\Rightarrow 675N - 637N = (65kg)a \Rightarrow 38N = (65kg)a \Rightarrow a = \frac{38N}{65kg}$

$= 0.58461 m/s^2$

RPM $\Rightarrow$ given Angular velocity $\Rightarrow a = \omega^2 r$ but must use rad/s

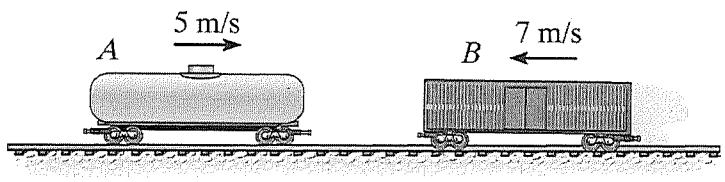
$\omega = \frac{1.6 rev}{min} \times \frac{2\pi rad}{rev} \times \frac{min}{60s} = 0.1675516 rad/s$. $a = \omega^2 r \Rightarrow r = \frac{a}{\omega^2}$

$r = \frac{0.58461 m/s^2}{(0.1675516 rad/s)^2} = 20.8m = 21m$

Unit: $\frac{m}{s^2} \times \frac{s^2}{\cancel{rad^2}} = m$

inconvenient

(b.) A 1500-kg tanker car going $5\,m/s$ to the right collides with a 2000-kg boxcar going $7\,m/s$ to the left. If they stick to each other after the collision, how fast and in what direction will they be going the instant after their collision? *(5pts)*



Conservation of Momentum when objects stick:

$$M_A(V_{Ax})_i + M_B(V_{Bx})_i = (M_A + M_B)(V_x)_f$$

$M_A = 1500\,kg$, $(V_{Ax})_i = +5\,m/s$ (to the right)

$M_B = 2000\,kg$, $(V_{Bx})_i = -7\,m/s$ (to the left)

$$\Rightarrow 1500\,kg(+5\,m/s) + 2000\,kg(-7\,m/s) = (1500\,kg + 2000\,kg)(V_x)_f$$

$$\Rightarrow 7500\,kg\cdot m/s - 14000\,kg\cdot m/s = (3500\,kg)(V_x)_f$$

$$\Rightarrow -6500\,kg\cdot m/s = (3500\,kg)(V_x)_f$$

$$\Rightarrow (V_x)_f = \frac{-6500\,kg\cdot m/s}{3500\,kg} = -1.857\,m/s = -1.9\,m/s$$

Negative $\Rightarrow$ to the left.