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CIRCULAR MOTION

FHW CIRCULAR MOTION PRACTICE (2.1)

Directions: Solve the following problems.

1) A 40g stopper is whirled around in a circle at the end of a 60cm long string such that it goes around 25 times in 6 seconds. Determine period.

$T = \frac{Sec}{Rev} = \frac{6s}{25 Rev} = .24\ s/Rev$

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2) A 40g stopper is whirled around in a circle at the end of a 60cm long string such that it goes around 25 times in 6 seconds. Determine linear speed.

$$v = \frac{2\pi r}{T} = \frac{2\pi(.6m)}{.24s/Rev} = 15.7\,m/s$$

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3) A 40g stopper is whirled around in a circle at the end of a 60cm long string such that it goes around 25 times in 6 seconds. Determine the centripetal acceleration.

$$a_c = \frac{v^2}{r} = \frac{(15.7\ m/s)^2}{(.6\ m)} = 410\ m/s^2$$

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4) A 40g stopper is whirled around in a circle at the end of a 60cm long string such that it goes around 25 times in 6 seconds. Determine centripetal force.

$F_c = \frac{mv^2}{r} = ma_c = (.04kg)(410 m/s^2)$

$F_c = 16.4N$

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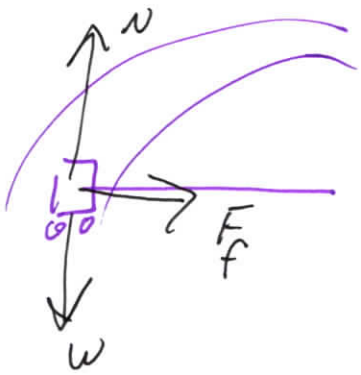
5) A 1500kg car is traveling at a constant speed of 40 mi/hr (18 m/s) when it encounters a turn of radius 15m. Determine the coefficient of friction between the tires and the road needed to negotiate the turn.



$\Sigma F_y = N - w = 0$

$N = w$

$N = mg$

$\Sigma F_x = F_f = ma_c$

$F_f = \frac{mv^2}{r}$

$\mu N = \frac{mv^2}{r}$

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

$\mu g = \frac{v^2}{r}$

$\mu = \frac{v^2}{gr}$

$\mu = \frac{(18\ m/s)^2}{(9.8\ m/s^2)(15m)}$

$\mu = 2.2$

note this Is Really High...

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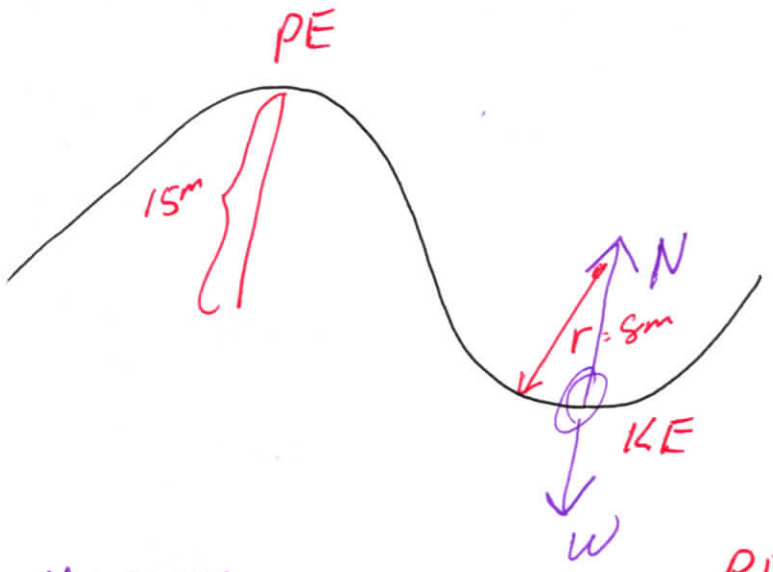
6) A roller coaster is 15 m tall. The train goes down the first hill to the ground and curves upward on a curve with a radius 8m. Determine how heavy a 60Kg person will feel at the bottom of the "curve."



$\Sigma F_y = N - w = ma_c$

$N - w = \frac{mv^2}{r}$

$N = \frac{mv^2}{r} + w$

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

$N = m\left(\frac{v^2}{r} + g\right)$

$PE = KE$

$mgh = \frac{1}{2}mv^2$

$gh = \frac{1}{2}v^2$

$2gh = v^2$

$N = m\left(\frac{2gh}{r} + g\right)$

4.75 × Heavier than Normal

$N = mg\left(\frac{2h}{r} + 1\right) = (60kg)(9.8m/s^2)\left[\frac{(2)(15m)}{8m} + 1\right] = 2793\,N$

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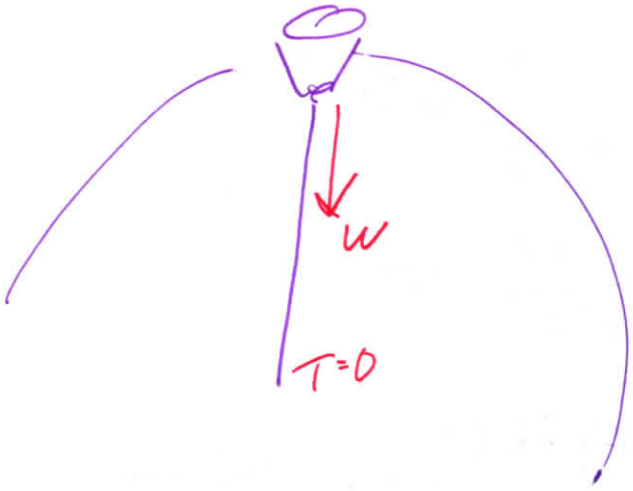
7) A 20g stopper is whirled around in a vertical circle at the end of a 75cm long string. Determine the slowest frequency the stopper can have and still stay in the circle (not fall at the top).



$$\Sigma F_y = -w = -ma_c$$

$$w = \frac{mv^2}{r}$$

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

$$g = \frac{v^2}{r}$$

$$\sqrt{gr} = v$$

$$\sqrt{(9.8\,m/s^2)(.75m)} = 2.7\,m/s$$

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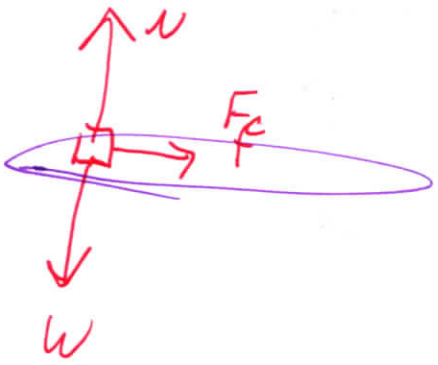
8) A penny is going to "ride around" on a turntable. The coefficient of friction between the penny and turntable is 0.6. The turntable will rotate at 33 rev/s. What is the greatest distance the penny can have from the center and not slide off the turntable?



$\Sigma F_y = N - w = 0$

$N = w$

$N = mg$

$\Sigma F_x = F_p = ma_c$

$\mu N = \frac{mv^2}{r}$

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

$\mu g = \frac{v^2}{r}$

$v = 2\pi r f$

$\mu g = \frac{(2\pi r f)^2}{r}$

$\mu g = \frac{4\pi^2 r^2 f^2}{r}$

$\mu g = 4\pi^2 r f^2$

$\frac{\mu g}{4\pi^2 f^2} = r$

$\frac{(.6)(9.8\ m/s^2)}{4\pi^2 (33\ Rev/s)^2} = .000137\ m$

$.0137\ cm$

Basically ... at the Center