key Level II Physics Pd 2

# CIRCULAR MOTION

FT CIRCULAR MOTION (21 S2)

Directions: Solve the following problems. Your work will be graded, not just the answer. Each question is worth 5 points. The test is worth 50 points.

1) Determine the frequency of a wheel that rotates 25 complete rotations in a time of 27 seconds.

$$\frac{25\,Rev}{27s} = \boxed{.93\ Rev/s}$$

$.185\ Rev/s$

2) You are driving your car through a turn of radius 15 m. What is the fastest you could go through this turn know the turn has a radius of 15 m, and the coefficient of friction between the road and your tires is 0.53.
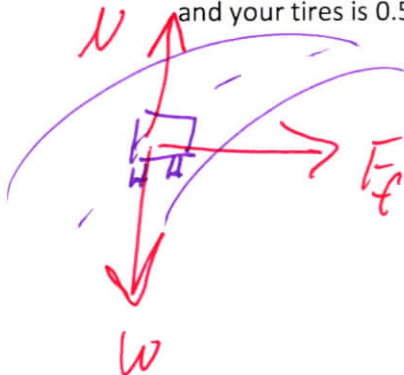
$$\Sigma F_x = F_f = ma$$

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

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

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

$$\sqrt{(.53)(9.8\,m/s^2)(15m)} = \boxed{8.83\ m/s}$$

$$\Sigma F_y = N - W = 0$$

$$N = mg$$

3) A stopper attached to a string that is 1.2 m long, and spun in a vertical circle. Determine the lowest frequency possible for the stopper to make it through the circle without falling out of the circle at the top.

$$\Sigma F_y = -W = -ma_c$$

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

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

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

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

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

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

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

$$\boxed{.46 \frac{rev}{s} = f}$$

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4) Imagine that you have a mass of 65 kg, and you will ride a looping roller coaster that has a loop of radius 8m. Determine how heavy you will feel at the top of the loop if the train is going at 12m/s a the top of the loop. Assume the train goes through the loop on the inside of the loop, which is typical.

$$\Sigma F_y = -W - N = -ma_c$$

$$W + N = ma_c$$

$$N = ma_c - W$$

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

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

$$N = 65kg\left[\frac{(12\,m/s)^2}{8m} - 9.8\,m/s^2\right]$$

$$N = 533\,N$$

5) A wheel with a radius of 22cm rotates 25 rotations in a time of 27 seconds, determine the linear speed on the outer edge of the wheel.

$$v = 2\pi r f$$

$$v = 2\pi (.22m)\left(\frac{25 \, rot}{27s}\right)$$

$$v = 1.28 \, m/s$$