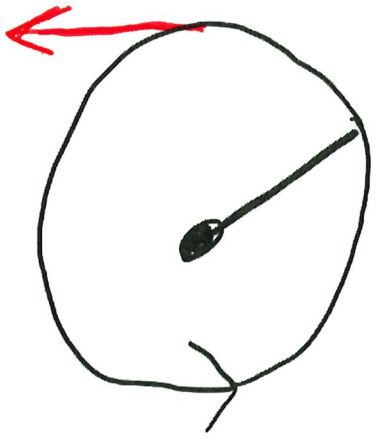
Uniform Circular Motion Practice Name:_____

1. A ball is being swung in a counterclockwise circle connected to a string, at the top of the circle the string is released, show what direction the ball will move after being released.



2. A 2.3 kg object is travelling at a constant velocity around a circle of radius 0.66 metres. It completes 52 circles per second.

   a. What is the frequency of the object?

   $52\ Hz$

   b. What is the period?

   $\frac{1}{52} = 0.019\ sec$

   c. What is the speed of the object?

   $Speed = \frac{distance}{time} = \frac{2\pi(0.66m) \times 52}{1\ sec} = 215.64\ m/s \approx 220\ m/s$

   d. What is the centipedal acceleration of the object?

   $a_c = \frac{v^2}{r} = \frac{(215.64\ m/s)^2}{0.66m} = 70455.47\ m/s^2 \approx 7.0 \times 10^4\ m/s^2$

   e. What is the centipedal force acting on the object?

   $F_c = m a_c$

   $= 2.3kg \times 70455.47\ m/s^2$

   $= 1.6 \times 10^5\ N$

Uniform Circular Motion Practice Name:_____

3. A 550 kg plane flies in a circle of radius 250 metres at a constant velocity of 255 m/s.
   a. What is the period?

Time to complete 1 circle

$$t = \frac{d}{\text{speed}} = \frac{2\pi(250m)}{255 m/s} = 6.16 \text{ sec}$$

   b. What is the frequency?

$$F = \frac{1}{T} \rightarrow F = \frac{1}{6.16 \text{ sec}} = 0.16 \text{ Hz}$$

   c. What is the centipedal acceleration of the object?

$$a_c = \frac{4\pi^2 r}{T^2} = \frac{4\pi^2(250m)}{6.16^2 \text{ sec}} = 260.099 m/s^2 \simeq 260 m/s^2$$

   d. What is the centipedal force acting on the object?

$$F_c = m a_c = 143054 \text{ N} \simeq 1.4 \times 10^5 \text{ N}$$

Uniform Circular Motion Practice Name:_____

4. A 0.25m long string can withstand of a force of 23 N before breaking. If a 0.50 kg mass is put on the end of the string and it is swung around in a horizontal circle what is the maximum speed it can be swung before the string breaks?

$$F_c = \frac{mv^2}{r} \rightarrow \sqrt{\frac{F_c r}{m}} = v$$

$$\sqrt{\frac{23N \times 0.25m}{0.5\,kg}} = 3.4 m/s$$

5. A 1500kg car is turning a corner of radius 85m at a constant speed of 26 m/s.
   a. What is the centripetal force acting on the car?

$$F_c = 1500kg \times \frac{(26m/s)^2}{85m} = 11929\,N$$

   b. What is the minimum coefficient of friction that will allow this to happen?

$$F_{Fric} = F_c = 11929\,N$$

$$F_N = F_g = 1500kg \times 9.8 = 14700\,N$$

$$\mu = \frac{F_{Fric}}{F_N} = \frac{11929N}{14700N} = 0.81$$

Uniform Circular Motion Practice Name:_____

1200kg

6. A car is turning a corner of radius 122 m, the coefficient of friction between the car are the ground is 0.27. What is the maximum speed it can safely round the corner?

$F_c = F_{Fric} = \mu F_N = 0.27 \times mg$

$= 3175.2N$

$F_c = \frac{mv^2}{r} \rightarrow \sqrt{\frac{F_c \times r}{m}} = v$

$\sqrt{\frac{3175.2 \times 122m}{1200}} = 18m/s$

7. A 1.2 kg ball is swung in a horizontal circle of radius 0.45 metres. The force on the string is 46 N. At one point the ball is released. How fast will the ball be moving when it is released?

$F_c = \frac{mv^2}{r} \rightarrow \sqrt{\frac{F_c \times r}{m}} = v$

4.2m/s