Physics **Circular & Rotational Motion** **Mr. McMullen**

Name_____ Date _____ Period _____

Circular & Rotational Motion – Problem Set 1

Answer the following questions a separate sheet of paper. Show all work and circle your answer.

1. Sue is swinging a yo-yo around her head. What happens to the size of the centripetal acceleration if the mass of the yo-yo is doubled without changing the period or length of the string?
2. What relationship must exist between an applied force and the velocity of a moving object if uniform circular motion is to result?
3. Sue whirls a yo-yo horizontally above her head. What is the direction of the force that acts on the yo-yo?
4. What is the direction of the force that acts on clothes in the spin cycle of a washing machine?
5. The frequency unit of hertz is equivalent to…
   a. that of the speed b. cycle c. radian/sec d. s^{-1}
6. A 0.013 kg rubber stopper is attached to a 0.930 m length of string. The stopper is swung in a horizontal circle, making one revolution in 1.18 seconds.
   a. Find the velocity of the stopper.
   b. Find the centripetal acceleration of the stopper.
   c. Find the force the string exerts on the stopper.
7. How would the answers (velocity, acceleration, and force) change for the last problem under the following conditions?
   a. The mass of the stopper is doubled (length and period remain unchanged).
   b. The radius is doubled.
   c. The period is half as large.
8. A runner moving at a speed of 8.80 m/s rounds a bend with a radius of 25.0 m.
   a. Find the centripetal acceleration of the runner.
   b. What supplies the force needed to give this acceleration to the runner?
9. Racing on a flat track, a car going 22.0 m/s rounds a curve 56.0 m in radius.
   a. What is the car's centripetal acceleration?
   b. What would be the minimum coefficient of static friction between the tires and road that would be needed for the car to round the curve without skidding?

10. It takes a 615 kg racing car 14.3 seconds to travel with a uniform speed around a circular racetrack of 50.0 m radius.
    a. What is the acceleration of the car?
    b. What average force must the track exert on the tires to produce this acceleration?

11. An athlete whirls a 7.00 kg hammer tied to the end of a 1.30 m chain in a horizontal circle. The hammer moves at the rate of 1.00 Hz. What is the centripetal acceleration of the hammer?
12. Sue whirls that yo-yo again in a horizontal circle. The yo-yo has a mass of 0.200 kg and is attached to a string 0.800 m long. If the yo-yo makes one complete revolution each second, what force does the string exert on it?
13. A coin is placed on a stereo record revolving 33.33 revolutions per minute.

    a. In what direction is the acceleration of the coin, if any?
    b. Find the acceleration of the coin when it is placed 5.00, 10.0 and 15.0 cm from the center of the record.
    c. At which of the three radii listed in b would the coin be most likely to fly off? Why?
14. Friction provides the centripetal force necessary for a car to travel around a flat circular racetrack. What is the minimum speed at which a car can travel around a circular track of radius 80.0 m if the coefficient of friction between the tire and the road is 0.300?