Circular Motion Review Problems

Name: _____ Date: _____

1. During their physics field trip to an amusement park, Abbie and Natalie took a rider on the Whirligig. The Whirligig ride consists of long swings which spin in a circle at relatively high speeds. As part of their lab, Abbie and Natalie estimate that the riders travel through a circle with a radius of 6.5 m and make one turn every 5.8 seconds. Determine the speed of the riders on the Whirligig.
   [7.0 m/s]

2. The tallest Ferris wheel in the world is located in Singapore. Standing 42 stories high and holding as many as 780 passengers, the Ferris wheel has a diameter of 150 meters and takes approximately 30 minutes to make a full circle. Determine the speed of riders (in m/s and mi/hr) on the Singapore Flyer. (*GIVEN:* 1.00 m/s= 2.24 mi/hr)
   [0.26 m/s or 0.59 mi/hr]

3. During the spin cycle of a washing machine, the clothes stick to the outer wall of the barrel as it spins at a rate as high as 1800 revolutions per minute. The radius of the barrel is 26 cm.

   a. Determine the speed of the clothes (in m/s) which are located on the wall of the spin barrel.
   b. Determine the acceleration of the clothes.

   [a) 49 m/s b) 9.2×10^3 m/s/s]

4. Elmira, New York boasts of having the fastest carousel ride in the world. The merry-go-round at Eldridge Park takes riders on a spin at 18 mi/hr (8.0 m/s). The radius of the circle about which the outside riders move is approximately 7.4 m.

   a. Determine the time for outside riders to make one complete circle.
   b. Determine the acceleration of the riders.

   [a) 5.8 s b) 8.7 m/s/s]

5. A manufacturer of CD-ROM drives claims that the player can spin the disc as frequently as 1200 revolutions per minute.

   a. If spinning at this rate, what is the speed of the outer row of data on the disc; this row is located 5.6 cm from the center of the disc?

   b. What is the acceleration of the outer row of data?

   [a) 7.0 m/s b) 880 m/s/s]

6. In the display window of the toy store at the local mall, a battery-powered plane is suspended from a string and flying in a horizontal circle. The 631-gram plane makes a complete circle every 2.15 seconds. The radius of the circle is 0.950 m. Determine the velocity of, acceleration of, and net force acting upon the plane.
   [v=2.78 m/s, a=8.11 m/s/s, F_{net}=5.12 N]

7. In an effort to *rev up* his class, a teacher does a demonstration with a bucket of water tied to a 1.3-meter long string. The bucket and water have a mass of 1.8 kg. The teacher whirls the bucket in a vertical circle ("making Gravity"!! ???) such that it has a speed of 3.9 m/s at the top of the loop and 6.4 m/s at the bottom of the loop.

a. Determine the acceleration of the bucket at each location.
b. Determine the net force experienced by the bucket at each location.
c. Draw a free body diagram for the bucket for each location and determine the tension force in the string for the two locations.

[a) t:12 m/s/s b:32 m/s/s b) t: 21 N b: 57 N c) t: 3.4 N b: 74 N]

8. A 76-kg pilot at an air show performs a loop de loop with his plane. At the bottom of the 52-m radius loop, the plane is moving at 48 m/s. Determine the normal force acting upon the pilot.
[4100 N]

9. Mr. Braun is in his Toyota Echo and trying to make a turn off an highway at 19.0 m/s. The turning radius of the level curve is 35.0 m. His car has a mass of 1240 kg. Determine the acceleration, net force and minimum value of the coefficient of friction which is required to keep the car on the road.
[1.05]

10. Dana (m=62 kg) is riding the Demon roller coaster ride. The turning radius of the top of the loop is 12 m. Sheila is upside down at the top of the loop and experiencing a normal force which is one-half of her weight. Draw a free body diagram and determine Sheila's speed.
[13 m/s]

11. In 2002, professional skateboarder Bob Burnquist became the first to successfully navigate a 360° full pipe turn. Determine the minimum speed which would be required at the top of the circular loop to make it through the 1.8-m radius pipe.
[4.2 m/s]

12. Josh is driving his 1500-kg Lamborghini through a horizontal curve on a level roadway at a speed of 23 m/s. The turning radius of the curve is 65 m. Calculate the minimum value of the coefficient of friction which would be required to keep Josh's car on the curve.
[0.83]

13. A loop de loop track is built for a 938-kg car. It is a completely circular loop - 14.2 m tall at its highest point. The driver successfully completes the loop with an entry speed (at the bottom) of 22.1 m/s.

a. Using energy conservation, determine the speed of the car at the top of the loop.
b. Determine the centripetal acceleration of the car at the top of the loop.
c. Determine the normal force acting upon the car at the top of the loop.

[a) 14.5 m/s b) 30 m/s/s c) 19000 N]

REFERENCE

http://www.physicsclassroom.com/calcpad/circgrav/problems.cfm