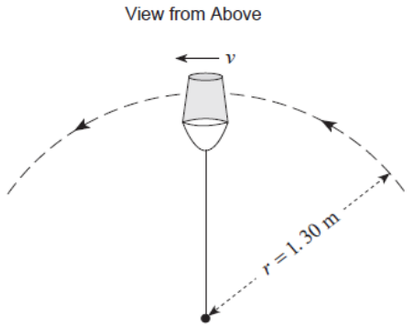
Centripetal Motion
Assignment 7

Name:_____

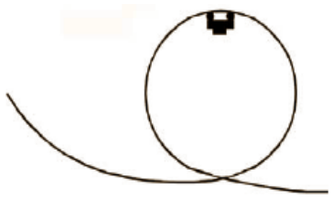
Multiple Choice: Circle the correct response. Show all workings for multiple choice.

1. A physics student swings a 5.0 kg pail of water in a vertical circle of radius 1.3 m. What is the minimum speed, *v*, at the top of the circle if the water is not to spill from the pail?



A. 3.6 m/s
B. 6.1 m/s
C. 8.0 m/s
D. 9.8 m/s

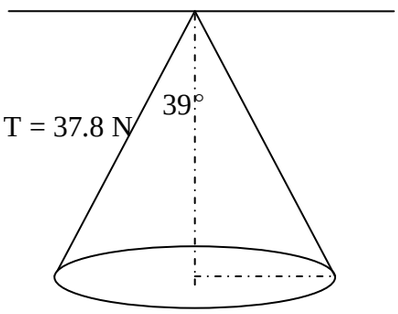
2. The roller coaster cart shown below, passes the point at the very top of a loop, which has a radius of 7.00 m. If the normal force is equal to one half the weight of the cart, what is the speed of the roller coaster at this point?



A. 4.14 m/s
B. 8.28 m/s
C. 10.1 m/s
D. 14.3 m/s

3. Which force is responsible for holding a car in a frictionless banked curve?
A. the vertical component of the car's weight
B. the vertical component of the normal force
C. the horizontal component of the car's weight
D. the horizontal component of the normal force

4. The diagram below shows a 3.0 kg ball, suspended by a string, travelling in a horizontal circular path. If the tension in the string is 37.8 N and the radius of the circle is 1.2 m, what is the speed of the ball?



r = 1.2m

A. 3.1 m/s
B. 3.4 m/s
C. 3.9 m/s
D. 9.5 m/s

5. A car travels at 21 m/s around a banked curve. If the radius of the curve is 75 m and assuming friction is negligible, what is the banking angle?
A. 0.54^{o}
B. 1.6^{o}
C. 31^{o}
D. 81^{o}

6. A car, travelling at 25.0 m/s, successfully moves around a banked, frictionless turn angled at 7.32^{o}. What is the radius of this banked curve?
A. 19.9 m
B. 37.7 m
C. 63.8 m
D. 496 m

7. How fast must a plane fly in a loop-the-loop stunt of radius of 2.0 km if the pilot experiences no force from either the seat or the safety harness when he is at the top of the loop? {3}

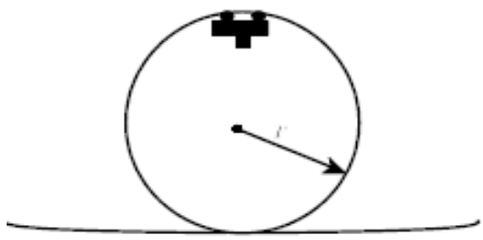
8. A 1.5 kg object is swinging from the end of a 0.62 m string in a vertical circle. If the time of one revolution is 1.2 s, what is the tension in the string at the top and bottom of the path? {7}

9. A string used to make a pendulum has a breaking strength of 12.0 N and a length of 0.80 m . A 1.0 kg mass is used as a bob and set in motion.

   A If the bob moves with a speed of 1.00 m/s at the bottom of the swing, will the string break? {4}

   B What is the critical speed (the highest speed at the bottom of the arc so that the string does not break)? {4}

10. The diagram below represents the loop of a roller coaster. If the radius of the loop is 12.0 m, what is the minimum speed, at the top of the loop, required top prevent passengers from falling out? {3}



11 What happens to the motion of an object undergoing uniform circular motion if the net force on the object becomes zero? {2}

12 A pail of water on the end of a string revolves at a uniform rate in a vertical circle of radius 85.0 cm. Its speed is 4.15 m/s and the mass of the pail and water together is 1.00 kg.

(A) Calculate the magnitude of the tension in the string when the pail is at the top of its path. {3}

(B) At what minimum speed must the pail be travelling when upside down at the top of the circle so that the water does not fall out? {2}

12 A car of mass 1.3×10^3 kg travels around a frictionless, 21^o banked curve of radius 95 m.

a) What force causes the centripetal acceleration? {1}

b) What constant speed must the car maintain in order to turn the curve safely? {2}

c) How would the safe speed for a heavy truck be different? {2}

13 Curves on the TCH are banked so that cars can proceed safely even when the road is slippery (at least in theory!). What is the proper banking angle where the speed limit is 100 km/hr and the radius of the curve is 350 m? {3}

14 Two curves are banked at identical angles of 25.0^{o}. One is in a fast speed zone of 100.0 km/hr and one is in slow speed zone of 50.0 km/hr. Compare the radii of the curves if cars are to navigate the turns in frictionless conditions without slowing down. {4}

15 Calculate the angle at which a frictionless curve of radius 500.0 m must be banked so that a car is able to round it safely at a speed of 75 km/h. {2}