Name_____

Date_____Pd____

UNIT II: Worksheet 4

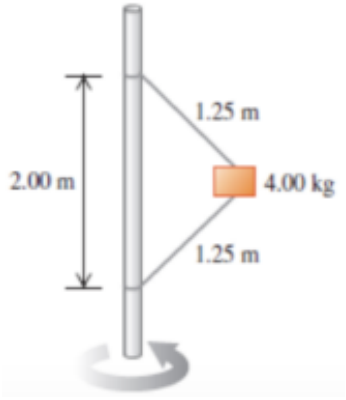
1. A bowling ball weighing 71.2 N (16.0 lb) is attached to the ceiling by a 3.80 m rope. The ball is pulled to one side and released; it then swings back and forth as a pendulum. As the rope swings through the vertical, the speed of the bowling ball is 4.20 m/s.
   a. What is the acceleration of the bowling ball, in magnitude and direction, at this instant?

   b. What is the tension in the rope at this moment?

2. One problem for humans living in outer space is that they are apparently weightless. One way around this problem is to design a space station that spins about its center at a constant rate. This creates "artificial gravity" at the outside rim of the station.
   a. If the diameter of the space station is 800 m, how many revolutions per minute are needed in order for the "artificial gravity" acceleration to be 9.80 m/s^2?

   b. If the space station is a waiting area for travelers going to mars, it might be desirable to simulate the acceleration due to gravity on the Martian surface (3.70 m/s^2). How many revolutions per minute are needed in this case?

3. A 4.00 kg block is attached to a vertical rod by means of two strings. When the system rotates about the axis of the rod, the strings are affixed to the rod 2.00 m apart, are 1.25 m in length, and completely taut. The upper string is 80.0 N.
   a. What is the tension in the lower cord?



   b. How many revolutions per minute does the system make?

   c. Find the number of revolutions per minute at which the lower cord just goes slack.

4. A curve with a 120 m radius on a level road is banked at the correct angle for a speed of 20 m/s. If an automobile rounds this curve at 30 m/s, what is the minimum coefficient of static friction needed between tires and road to prevent skidding?

5. A 540 kg car is merging onto a banked curve. The curve is banked 7.1^0 from the horizontal and is rated at 35 mph. The car takes the turn at 52 mph (23 m/s). The radius of curvature is 210 m. The coefficient of friction between tires and asphalt is 0.9.
   a. Does the car stay in its lane?

   b. What is the maximum speed for the car to stay in its lane if the road was wet? The coefficient of friction between tires and wet asphalt is 0.6.

   c. Is the 35 mph rating for the road appropriate for 35 mph in dry conditions, wet conditions, both, or neither?