Name_____

Phys 2010 (NSCC), Fall 2007
Problem Set #12

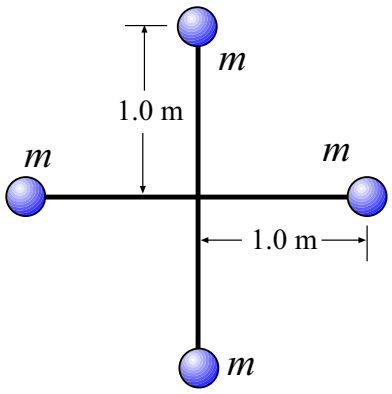
1. A 6.00-kg cylinder rolls without slipping on a rough surface. At an instant when its center of mass has a speed of $8.00\,\frac{\text{m}}{\text{s}}$, determine (a) the translational kinetic energy of its center of mass (b) the rotational kinetic energy about its center of mass and (c) its total kinetic energy. (I didn't give the radius... do you need it?)

2. A solid sphere of mass 1.40 kg and radius 5.0 cm rolls without slipping on a horizontal surface; its *total* kinetic energy is 8.80 J.

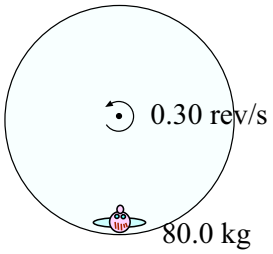
Find the speed of the center of mass of the sphere. (Recall that for a rolling object $v_c = \omega r$.)

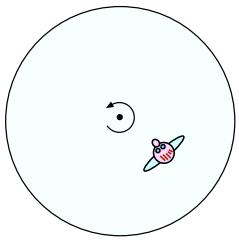
3. The system of small objects shown at the right is rotating at an angular speed of 2.0 rev/s. The objects are connected by light, flexible spokes which can be lengthened or shortened.

What is the new angular speed if the spokes are shortened to 0.50 m? (Assume that the shortening of the spokes does not change the angular momentum of the system.)



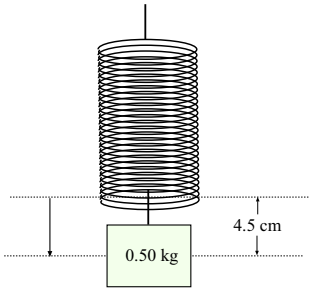
4. A merry-go-round rotates at a rate of 0.30 rev/s with an 80-kg man standing at a point 2.0 m from the axis of rotation. What is the new angular speed when the man walks to a point 1.0 m from the center? Assume that the merry-go-round is a solid 30-kg cylinder of radius 2.0 m.





5. For the situation in Problem 4, find the change in kinetic energy of the man–merry-go-round system due to the man's movement.

6. When a 500 g mass is hung from a vertical spring (and is motionless) the spring's length has increased by 4.50 cm. What is the force constant of the spring?



7. A 0.50-kg object is attached to a spring with force constant 180 N/m so that the object is allowed to move on a horizontal frictionless surface. The object is released from rest when the spring is compressed 0.15 m. Find (a) the force on the object and (b) its acceleration at that moment.

8. An archer pulls her bowstring back 0.400 m by exerting a force that increases uniformly form zero to 250 N. (a) What is the equivalent spring constant of the bow? (b) How much work is done in pulling the bow?