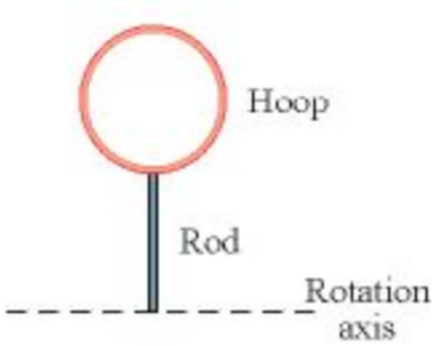
1. **The momentum of an car is $p(t) = 4t^2$ [m/s]. What is the force acting on the car at t = 3 [s]?**

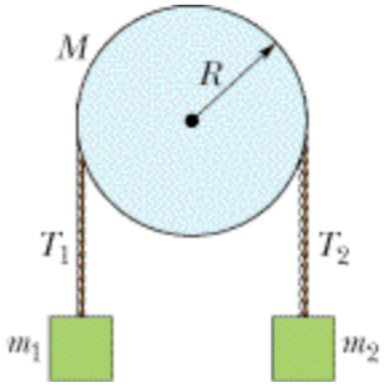
2. **The acceleration of an object as a function of time is given by a(t) = 4/(6+6t) [m/s]. What is the change in velocity of the object from time 4 [s] to 5 [s]?**

3. **A meter stick is held vertically with one end on the floor and is then allowed to fall. Find the speed of the other end when it hits the floor, assuming that the end on the floor does not slip. (Hint: Consider the stick to be a thin rod and use the Conservation of Energy Bucket Model.)**

4. **The figure below shows a rigid assembly of a thin hoop (of mass m and radius R = 0.120 m) and a thin radial rod (of mass m and length L = 1.00 R). The assembly is upright, but if we give it a slight nudge, it will rotate around a horizontal axis in the plane of the rod and hoop, through the lower end of the rod. Assuming that the energy given to the assembly in such a nudge is negligible, what would be the assembly's angular speed about the rotation axis when it passes through the upside-down (inverted) orientation?**

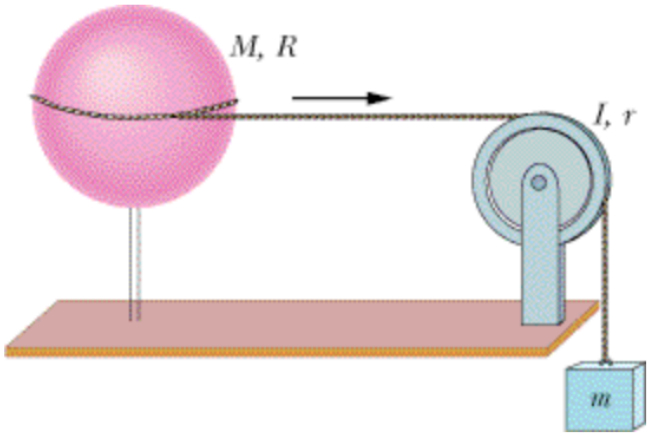


5. **In the figure below, two blocks, of mass m_1 = 240 [g] and m_2 = 640 [g], are connected by a massless cord that is wrapped around a uniform disk of mass M = 500 [g] and radius R = 12 [cm]. The disk can rotate without friction about a fixed horizontal axis through its center; the cord cannot slip on the disk. The system is released from rest.**

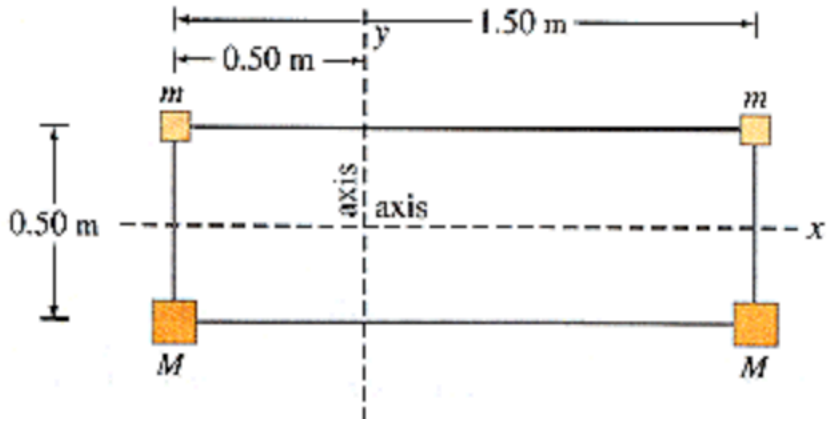


a. **Find the magnitude of the acceleration of the blocks.**
b. **Find the tension T_1 in the cord at the left.**
c. **Find the tension T_2 in the cord at the right.**

6. **A uniform spherical shell of mass M = 3.6 [kg] and radius R = 8.7 [cm] can rotate about a vertical axis on frictionless bearings (see figure below). A massless cord passes around the equator of the shell, over a pulley of rotational inertia I = 3.0 × 10^{-3} [kg m^2] and radius r = 5.0 [cm], and is attached to a small object of mass m = 0.60 [kg]. There is no friction on the pulley's axle; the cord does not slip on the pulley. What is the speed of the object after it has fallen 83 [cm] after being released from rest? Use the Conservation of Energy Bucket Model.**



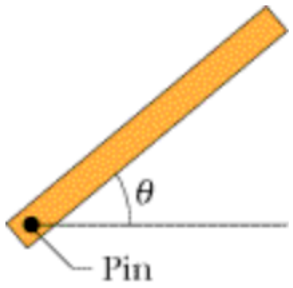
7. **The figure below shows a satellite assembly with m = 1.2 [kg] and M = 2.9 [kg].**



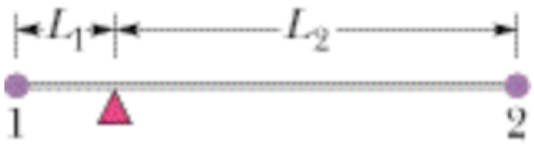
a. **Calculate the rotational inertia of the array of point objects shown in the figure about the vertical axis.**

b. **Calculate the rotational inertia of the array of point objects shown in the figure about the horizontal axis.**

8. **The thin uniform rod in the figure below has length 1.0 [m] and can pivot about a horizontal, frictionless pin through one end. It is released from rest at angle θ = 40° above the horizontal. Use the principle of conservation of energy to determine the angular speed of the rod as it passes through the horizontal position.**



9. **The figure below shows particles 1 and 2, each of mass m, attached to the ends of a rigid massless rod of length $L_1 + L_2$, with $L_1 = 23$ [cm] and $L_2 = 82$ [cm]. The rod is held horizontally on the fulcrum and then released.**



a. **What is the magnitude of the initial acceleration of particle 1?**
b. **What is the magnitude of the initial acceleration of particle 2?**

HW Set 5 Answers

1. 24 [N]

2. 0.121 [m/s]

3. 5.24 [m/s]

4. 13 [rad/s]

5a. 3.47 [m/s^2]
5b. 3.18 [N]
5c. 4.05 [N]

6. 1.52 [m/s]

7. 4.35 [rad/s^2]

8a. 5.13 [$kg\ m^2$]
8b. 0.513 [$kg\ m^2$]

9a. 1.83 [m/s^2]
9b. 6.54 [m/s^2]