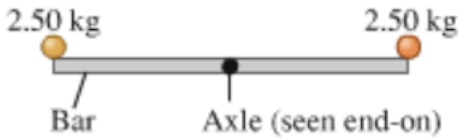
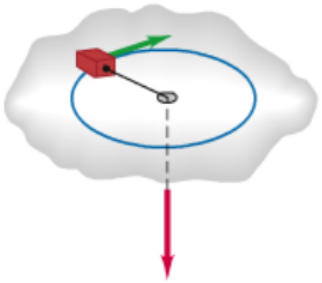
Physics 1A: Physics for Scientists and Engineers: Mechanics **Winter 2015**

Discussion 8: Week 10

Exercise 1 A thin, uniform, 3.80-kg bar, 80.0 cm long, has a very small 2.50-kg balls glued on at either end. It is supported horizontally by a thin, horizontal, frictionless axle passing through its center and perpendicular to the bar. Suddenly the right-hand ball becomes detached and falls off, but the other ball remains glued to the bar. (a) Find the angular acceleration of the bar just after the ball falls off. (b) Will the angular acceleration remain constant as the bar continues to swing? If not, will it increase or decrease? (c) Find the angular velocity of the bar just as it swings through its vertical position. (Moment of inertia of a rod rotating about its center is $I = \frac{1}{12}ML^2$)



Exercise 2 A small block with mass 0.250 kg is attached to a string passing through a hole in a frictionless, horizontal surface. The block is originally revolving in a circle with a radius of 0.800 m about the hole with a tangential speed of 4.00 m/s. The string is then pulled slowly from below, shortening the radius of the circle in which the block revolves. The breaking strength of the string is 30.0 N. What is the radius of the circle when the string breaks?



Exercise 3 A uniform solid cylinder with mass M and radius 2R rests on a horizontal tabletop. A string is attached by a yoke to a frictionless axle through the center of the cylinder so that the cylinder can rotate about the axle. The string runs over a disk-shaped pulley with mass M and radius R that is mounted on a frictionless axle through its center. A block of mass M is suspended from the free end of the string. The string doesnt slip over the pulley surface, and the cylinder rolls without slipping on the tabletop. Find the magnitude of the acceleration of the block after the system is released from rest. (Moment of inertia of a cylinder is $I = \frac{1}{2}MR^2$)