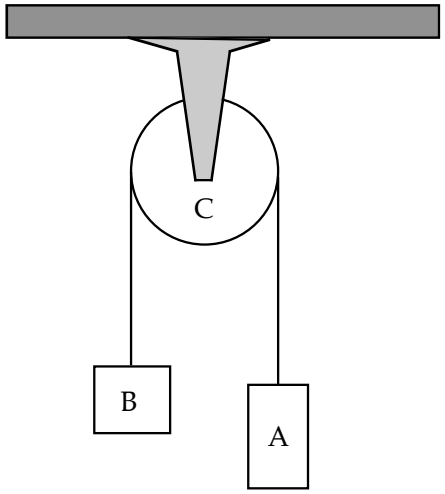
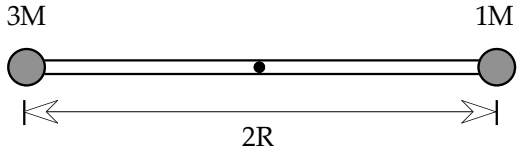
1. A solid disk is rolling without slipping on a level surface with a constant speed of 4.00 m/sec. How far can it roll up a 30.0° ramp before it stops?

2. The figure below represents and Atwood machine. Find the linear accelerations of blocks A and B, the angular acceleration of wheel C, and the tension in each side of the cord if there is no slipping between the cord and the surface of the wheel. Let the masses of the blocks A and B be 4.00 kg and 2.00 kg, respectively; the moment of inertia of the wheel about its axis be 0.300 kg · m^2; and the radius of the wheel be 0.120 m.



3.



Two point masses (of mass 3M and M, respectively) are superglued to the ends of a massless rod of length 2R. The rod can spin without friction around a fixed axis through its center.

a. Find the initial angular acceleration, α_0.

b. Find the linear velocity of the 3M mass at the bottom. (Careful . . . α is not constant; kinematics do not apply!)

c. At the bottom, a force must be exerted on 3M in order to keep it moving in a circle.
   i) What is the source of the force?
   ii) What is the magnitude of the force?
   iii) Explain why the magnitude of this force is not equal to the centripetal force. (Hint: Draw a FBD.)

Answers:

1. 2.4 m along the incline.
2. T_A = 37.0 N; T_B = 21.5 N; a = 0.745 m/s^2; α = 6.21 rad/s^2
3. a. $\alpha_0 = g/2R$
   b. $v = (gR)^{0.5}$ (but this is not critical speed…it just so happens to be the same relationship!)
   c. i. Force of the bar (F_{BAR}) pulling up on the mass.
      ii. $F_{BAR} = 6Mg$
      iii. $F_{BAR} = F_C + (3M)g$