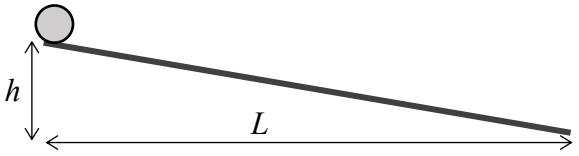
PHYS 1210 Worksheet 8. Rotational kinetic energy

1. Round objects are released from rest at the top of a ramp of length $L = 5.00$ meters, whose top is elevated a height $h = 1.00$ meters above its base. The objects roll without slipping down the ramp. The objects all have the same mass $m = 2.00$ kilograms and the same outer radius $r = 4.00$ centimeters (0.0400 meters). The round objects are

   a. A cylindrical shell, $I = mr^2$
   b. A solid cylinder, $I = \frac{1}{2}\, mr^2$
   c. A spherical shell, $I = 2/3\, mr^2$
   d. A solid sphere, $I = 2/5\, mr^2$



   A. What are their *total kinetic energies* at the bottom of the ramp?

   B. As the objects roll down the ramp, what *fraction* of their total kinetic energy is rotational?

   C. What is the *speed* of each object at the bottom of the ramp?

   D. If a 2.00-kilogram block were released at the top of the ramp to slide down the ramp without friction, what would *its* speed be at the bottom of the ramp?

   E. We haven't yet learned how to find a rolling object's *acceleration* down the ramp, but you can probably guess that it is constant. Use constant acceleration kinematics to find the acceleration of each object.

2. (This problem is adapted from problem 10.73 in your textbook.) A solid sphere starts from rest on a sloped track, a height h above a level section of the track. The sphere rolls without slipping down the sloped portion, then along the level section. After the level section, the track slopes upward *without friction*. How high up the frictionless slope does the sphere ascend?