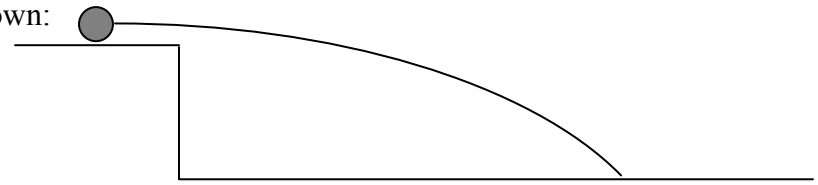
AP Physics C
Review Chapter 6 Energy Considerations

1. A 15 kg crate is moved along a horizontal floor by a warehouse worker who's pulling on it with a cope that makes a 30° angle with the horizontal. The tension in the rope is 200 N and the crate slides a distance of 10 m. Assume the coefficient of kinetic friction is 0.4.
   a. How much work is done on the crate by the worker?
   b. How much work is done by the normal force?
   c. How much work is done by friction?

2. The force exerted by a spring when it's displaced by x from its natural length us given by the equation $F(x)=-kx$, where k is a positive constant. What is the work done by a spring as it pushes out from $x = -x_2$ to $x = -x_1$ (where $x_2 > x_1$)?

3. A block of mass m = 5 kg slides down a frictionless ramp. The ramp has a vertical height of 1 meter and makes a 30° angle to the floor. When the block reaches the bottom of the ramp, it starts sliding along the floor. However, the floor isn't frictionless. In fact, the floor's coefficient of kinetic friction is 0.2.
   a. How much work does the floor do on the block as the block slows down and eventually comes to rest?
   b. How far along the floor, does the block slide before coming to rest?
   c. How would your answers to parts (a) and (b) be different if the floor's coefficient of friction were u=.4 instead of u=.2?

4. A ball rolls off a cliff as shown:



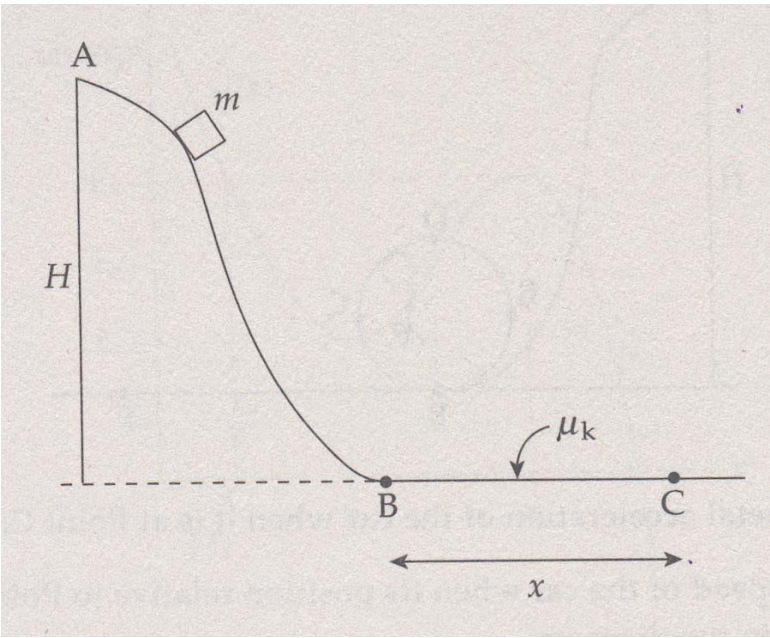
   The ball's speed as it leaves the cliff is 20 m/s. The distance from the top of the cliff to the ground is 40 meters.

   a. How fast is the ball moving just as it hits the ground?
      HINT: You can solve this part quickly using energy considerations.
   b. In what direction is the ball moving just as it hits the ground?

5. As a rock of mass 4 kg drops from the edge of a 40-meter high cliff, it experiences air resistance, whose average strength during the descent is 20 N. At what speed will the rock hit the ground?

6. A force of 200 N is required to keep an object sliding at a constant speed of 2 m/s across a rough floor. How much power is being expended to maintain this motion?

7. A box of mass m is released from rest at Point A, the top of a long, frictionless slide. Point A is at height H above the level of Points B and C. Although the slide is frictionless, the horizontal surface from Point B to C is not. The coefficient of kinetic friction between the box and this surface is μ_k , and the horizontal distance between Points B and C is x.



a. Find the speed of the box when its height above Point B is ½ H.

b. Find the speed of the box when it reaches Point B.

c. Determine the value of μ_k so that the box comes to rest at Point C.

d. Now assume that Points B and C were not on the same horizontal level. In particular, assume that the surface from B to C had a uniform upward slope so that Point C were still at a horizontal distance of x from B but now at a vertical height of y above B. Answer the question posed in part (c).

e. If the slide were not frictionless, determine the work done by friction as the box moved from Point A to Point B if the speed of the box as it reached Point B were half the speed calculated in part (b).

8. A 55 kg skier starts from rest at the top of a 20° incline and skis in a straight line to the bottom of the slope, a distance (measured along the slope) of 400 m. If the coefficient of friction between the skis and the snow is 0.2,

a. Calculate the skier's speed at the bottom of the run.

b. How much work is done by gravity on the skier?

c. If it takes the skier 35 s to make the run, how much power is expended by gravity?