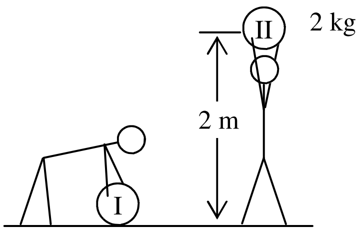
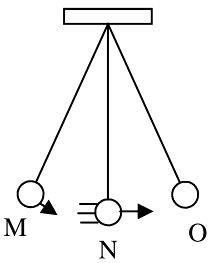
PreAP Energy 5

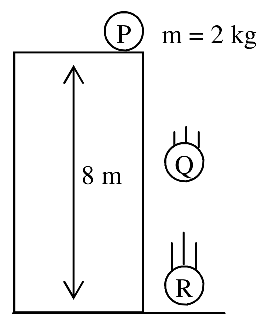


1. Once again, Slim Jim helps us by lifting an object. Thanks, Jim!
   Obviously the object is moving up so that d is a + value.
   A. * Since Jim's force is +, is this + or − W done by Jim?
   B. * Since gravity pulls down, is $W_{gravity}$ + or −?
   C. Is the change of potential energy (ΔPE or ΔU) + or − ?
   D. * So if $W_{gravity}$ were +, the ΔU would be: + or − ?
   E. Calculate the work done by gravity on the object.

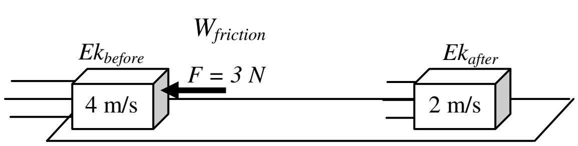
(College textbooks use U for PE, K for KE, and E for total energy.) Whenever there is potential energy, the ΔU always = −W done by the force that gives the potential energy. The force only does + W when it gives K. When an object falls, ΔU is −, ΔW is +, and ΔK is +. This is true for gravity and for springs. So, $\Delta U_{gravitational} = -W_{gravity}$ and $\Delta U_{elastic} = -W_{spring}$



2. Use the pendulum at the left to answer the following.
   A. What kind of energy does it have at M?
   B. What kind of energy does it have at N?
   C. If it has 100 J of energy at M, how much energy does it have at N?
   D. How does the total energy change as the pendulum swings?



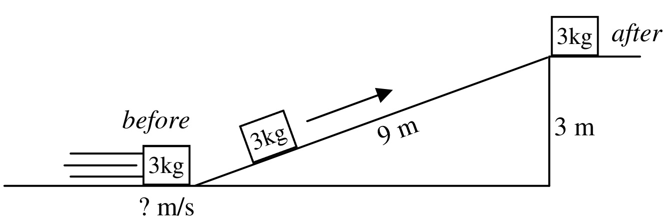
3. Use the diagram at the right to answer the following.
   A. Calculate the object's energy at the top.
   B. How much kinetic energy does it have at the bottom?
   C. How much potential energy does it have half way down?
   D. Calculate its velocity just before it hits the ground.

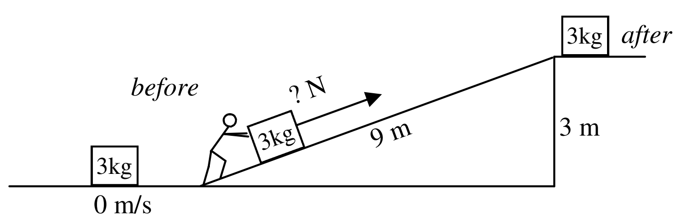


$\Sigma E_{before} \quad \pm W \quad = \quad \Sigma E_{after}$

4. * A 6 kg object is moving 4 m/s to the right. A 3N force slows the object down to 2 m/s.
   A. Write the Conservation of Energy formula under the diagram.
   B. Calculate the distance that the force acted on the object.

5. To simplify our discussion, let's assume the ramp is frictionless, but that Slim Jim can still apply a force.
   A. Calculate the energy of the object at the top of each ramp.
   B. In which example (left or right) is work done?

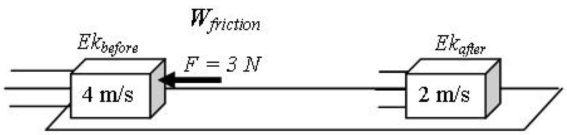




   C. *Use the same process as above to calculate the velocity of the object at the bottom of the left ramp.

   D. *Calculate the magnitude of Jim's force as he pushes

1A: + (adds E to the object)
1B: – (imagine an object rolling up a hill, it slows down because gravity does – W, slowing the object)
1D: – (so the object is losing PE and gaining KE)



$$\Sigma E_{\textbf{before}} \quad \pm W \quad = \quad \Sigma E_{\textbf{after}}$$

$$\frac{1}{2}mv^2 - Fd = \frac{1}{2}mv^2$$

$$\frac{1}{2}(6)4^2 - 3(d) = \frac{1}{2}6(2)^2$$

4. * A 6 kg object is moving 4 m/s to the right. A 3N force slows the object down to 2 m/s.
   A. Write the Conservation of Energy formula under the diagram.
   B. Calculate the distance that the force acted on the object.

$3(16) - 3d = 3(4)$ div by 3

$16 - d = 4$

$16 - 4 = 12\ m$

Q5C: 7.75 m/s Q5D: 10 N

Q7E: 130.6 N/m