1. The Panorama Tower in Miami is 868 feet tall.

A. If 1 meter = 3.28 feet, what is the height of the Panorama Tower in meters?

h_f = 868 feet

c = 3.28 feet

h_m = ?

$h_m = \frac{h_f}{c}$

$h_m = \frac{868}{3.28} = 264.6341$

h_m = 265 meters

B. A worker assigned to check the lights at the top of the Panorama Tower is standing on the roof. A quarter with a mass of 0.0057 kg is in her shirt pocket. What is the gravitational potential energy (GPE) of the quarter at the top of the tower?

m = 0.0057 kg

g = 9.80 m/s^2

h = 265 m

GPE = ?

GPE = mgh

GPE = (0.0057 kg)(9.80 m/s^2)(265 m)

GPE = 14.8 (kg)(m/s^2)(m)

GPE = 14.8 (kg)(m^2/s^2)

GPE = 14.8 J

C. What is the kinetic energy (KE) of the quarter in her shirt pocket at the top of the tower?

GPE = 14.8 J

m = 0.0057 kg

KE = ?

PE = KE

PE = $\frac{1}{2}mv^2$

14.8 J = $\frac{1}{2}$(0.0057 kg)v^2

v = $\sqrt{\frac{2(14.8\ J)}{0.0057\ kg}} = 72.06$

KE = $\frac{1}{2}(0.0057\ kg)(72.06\ m/s)^2$ = 14.799

KE = 14.80 J or 1.48 E1 J

2. Consider the concepts of kinetic energy (KE) and gravitational potential energy (GPE) as you complete these questions. A ball is held 1.4 meters above the floor. Use the terms KE of GPE as your answers.

   A. When the ball is held motionless above the floor, the ball possesses only ____ energy.

   gravitational potential (GPE)

   B. If the ball is dropped, its ____ energy decreases as it falls.

   gravitational potential (GPE)

   C. If the ball is dropped, its ____ energy increases as it falls.

   kinetic (KE)

   D. In fact, in the absence of air resistance, the amount of ____ when the ball is held motionless above the floor equals the amount of ____ at impact with the floor.

   gravitational potential energy (GPE) and kinetic energy (KE)

3. We will now use energy considerations to find the speed of a falling object at impact. Artiom is on the roof replacing some shingles when his 0.83 kg hammer slips out of his hands. The hammer falls 3.92 m to the ground. Neglecting air resistance, the total mechanical energy of the system will remain the same. The sum of the kinetic energy and the gravitational potential energy possessed by the hammer 3.92 m above the ground is equal to the sum of the kinetic energy and the gravitational potential energy of the hammer as it falls. Upon impact, all energy is in a kinetic form. The following equation can be used to represent the relationship:

   $GPE + KE_{(top)} = GPE + KE_{(at\ impact)}$

   Because the hammer is dropped from rest, the KE at the top is equal to zero.
   Because the hammer is at base level, the height of the hammer is equal to zero; therefore, the PE upon impact is zero.

   We may write our equation like this: $GPE_{(top)} = KE_{(at\ impact)}$

   This gives us the equation: $(mgh)_{(top)} = 1/2\ mv^2{}_{(at\ impact)}$

   What is the speed at which the hammer struck the ground?

   m = 0.83 kg

   h = 3.92 m

   $mgh = \frac{1}{2}mv^2$

   $gh = \frac{1}{2}v^2$

   $2gh = v^2 \rightarrow v = \sqrt{2gh}$

   $v = \sqrt{2(9.80)(3.92)} = 8.7653$

   $v = 8.77$ m/s

4. **A National Guard helicopter is helping to fight a wildfire by dumping water from a large external container. The container holds 2,500 liters (L) of water (density of water is 1 kg/L). If the water is released from a height of 75 m above the ground, what is the change in potential energy as it falls to the ground?**

   As the water is released and falls to the ground, the potential energy decreases since there is a decrease in its elevation/height above the base level (or ground).

   h = 75 m

   m = 2500 kg

   g = 9.80 m/s^2

   GPE = ?

   GPE = mgh

   GPE = (2500 kg)(9.80 m/s^2)(75 m) = 1837500

   GPE = 1800000 (kg)(m/s^2)(m)

   GPE = 1800000 (kg)(m^2/s^2)

   GPE = 1.8 E6 J