PRACTICE $F = mg$ (weight)

Now it is your turn to try calculating potential and kinetic energy. Don't forget to keep track of the units!

1. Determine the amount of potential energy of a 5.0-N book that is moved to three different shelves on a bookcase. The height of each shelf is 1.0 m, 1.5 m, and 2.0 m.
2. You are on in-line skates at the top of a small hill. Your potential energy is equal to 1,000. J. The last time you checked, your mass was 60.0 kg.
   a. What is your weight in newtons?
   b. What is the height of the hill?
   c. If you start rolling down this hill, your potential energy will be converted to kinetic energy. At the bottom of the hill, your kinetic energy will be equal to your potential energy at the top. Calculate your speed at the bottom of the hill.
3. A 1.0-kg ball is thrown into the air with an initial velocity of 30. m/s.
   a. How much kinetic energy does the ball have?
   b. How much potential energy does the ball have when it reaches the top of its ascent?
   c. How high into the air did the ball travel?
4. What is the kinetic energy of a 2,000.-kg boat moving at 5.0 m/s?
5. What is the velocity of an 500-kg elevator that has 4000 J of energy?
6. What is the mass of an object traveling at 30. m/s if it has 33,750 J of energy?

1) $GPE = mgh$ $(mg) = 5.0\,N \times 1.0\,m = 5.0\,J$
$5.0\,N \times 1.5\,m = 7.5\,J$
$5.0\,N = 2.0\,m = 10\,J$

2) $\frac{GPE}{mg} = \frac{mgh}{mg}$ $h = \frac{GPE}{mg}$

a) $m = 60.0\,kg$ $F = mg = 588N$
$g = 9.8\,\frac{m}{s^2}$

b) $\frac{1000J}{588N} = 1.7m$

c) $GPE = KE\left(\frac{1}{2}mv^2\right)$
$1000J = \frac{1}{2}\,60.0kg\,V^2$ $= \sqrt{\frac{2000J}{60.0kg}} = \sqrt{V^2}$ $V = 5.8\,\frac{m}{s}$

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3) a) $KE = \frac{1}{2}mv^2 = \frac{1}{2}(1.0kg)(30\frac{m}{s})^2 = 450J$

b) GPE at top = 450J

c) $h = \frac{GPE}{mg} = \frac{450J}{(1.0kg)(9.8\frac{m}{s^2})} = 46m$

4) $KE = \frac{1}{2}mv^2 = \frac{1}{2}(2000kg)(5\frac{m}{s})^2 = 25,000J$

5) $KE = \frac{1}{2}mv^2$

$\sqrt{\frac{2KE}{m}} = \sqrt{v^2} = \sqrt{\frac{8000J}{500kg}} = 4\frac{m}{s} = v$

6) $KE = \frac{1}{2}mv^2$

$\frac{2KE}{v^2} = m \qquad \frac{2(33,750J)}{(30\frac{m}{s})^2} = 75kg = m$