# 7.2 Conservation of Energy



READ

The law of conservation of energy tells us that energy can never be created or destroyed—it is just transformed from one form to another. The total energy after a transformation (from potential to kinetic energy, for example) is equal to the total energy before the transformation. We can use this law to solve real-world problems, as shown in the example below.

EXAMPLE

- A 0.50-kilogram ball is tossed upward with a kinetic energy of 100. joules. How high does the ball travel?

**1. Looking for:** The maximum height of the ball.

**2. Given:** The mass of the ball, 0.50 kg, and the kinetic energy at the start: 100. joules

**3. Relationships:** $E_K = {}^1/_2 mv^2$; $E_p = mgh$

**4. Solution:** The potential energy at the top of the ball's flight is equal to its kinetic energy at the start. Therefore, $E_p = mgh = 100.$ joules.

Substitute into the equation m = 0.50 kg and g = 9.8 m/s$^2$.

$100. = mgh = (0.50)(9.8)h = 4.9h$

Solve for $h$.

$100. = 4.9h$; $100. \div 4.9 = h$

$h = 20.$ m

PRACTICE

$h = \frac{\frac{1}{2}mv^2}{mg}$

1. A 3.0-kilogram toy dump truck moving with a speed of 2.0 m/s starts up a ramp. How high does the truck roll before it stops? h = 0.20m
2. A 2.0-kilogram ball rolling along a flat surface starts up a hill. If the ball reaches a height of 0.63 meters, what was its initial speed? V = 3.5m/s $V = \sqrt{2gh}$
3. A 500.-kilogram roller coaster starts from rest at the top of an 80.0-meter hill. What is its speed at the bottom of this hill? V = 39.6 m/s $V = \sqrt{2gh}$
4. Find the potential energy of this roller coaster when it is halfway down the hill. 196,000J
   GPE = mgh where h = 40.0 m
5. A 2.0-kilogram ball is tossed straight up with a kinetic energy of 196 joules. How high does it go?
   h = 10m $h = KE/mg$
6. A 50.-kilogram rock rolls off the edge of a cliff. If it is traveling at a speed of 24.2 m/s when it hits the ground, what is the height of the cliff? $h = \frac{1}{2}V^2/g$ h = 30m
7. Challenge! Make up your own energy conservation problem. Write the problem and the answer on separate index cards. Exchange problem cards with a partner. Solve the problems and then check each other's work using the answer cards. If your answers don't agree, work together to find the source of error.