

SECTION 1 — Potential Energy Only ($E_p = mgh$)

- 1) A 7.26 kg bowling ball is lifted 0.85 m above the ground. What is its gravitational potential energy?
- 2) A 0.015 kg rock is 40 m above the ground. What is its gravitational potential energy?
- 3) Two objects (Object A of mass m and Object B of mass $4m$) are lifted to the same height.
 - a) Compare their potential energies.
 - b) Which object must be lifted higher so both have the same PE? By what factor?
- 4) A construction worker lifts a 12 kg toolbox onto a platform 2.3 m high.
 - a) Find the potential energy gained by the toolbox.
- 5) A 6 kg toolbox is lifted to a platform and gains 270 J of gravitational potential energy. Solve for height.
- 6) A crate is lifted to a certain height and gains 520 J of gravitational potential energy. The crate has a mass of 8.0 kg. Solve for height:
- 7) An object is lifted to 5.0 m and gains 294 J of gravitational potential energy. Solve for the object's mass.

SECTION 2 — Kinetic Energy Only ($E_k = \frac{1}{2}mv^2$)

- 8) A 60.0 kg boy is skating at 4.0 m/s. What is his kinetic energy?
- 9) A 0.015 kg rock is falling at 24 m/s. What is its kinetic energy?
- 10) How much kinetic energy is required to accelerate a 1500 kg car:
 - a) From rest to 10 m/s.
 - b) From 10 m/s to 20 m/s.
 - c) From 20 m/s to 30 m/s.
- 11) Ryan and Alex have the same mass. Ryan runs at twice Alex's speed. How does Ryan's kinetic energy compare to Alex's?
- 12) A 3.0 kg medicine ball is thrown horizontally at 6.0 m/s. What is its kinetic energy?
- 13) A medicine ball has 54 J of kinetic energy when thrown. Its mass is 3.0 kg. Solve for its speed.
- 14) A cyclist has 1,250 J of kinetic energy while moving at 5.0 m/s. Solve for the cyclist's mass.
- 15) A car of mass m has 30,000 J of kinetic energy at a speed of 20 m/s. Solve for the car's mass.

SECTION 3 — Problems Involving BOTH E_p and E_k

- 16) A 10.0 kg watermelon is thrown straight up with a speed of 7.0 m/s.
- What is its initial kinetic energy?
 - Use kinematics to determine its maximum height.
 - What is the potential energy at this peak?
 - Compare the initial KE with the PE at the maximum height.
- 17) A 5.0 kg backpack is dropped from a height of 12 m.
- What is its initial potential energy?
 - Ignoring air resistance, what is its speed just before it hits the ground?
- 18) A 75 kg diver jumps from a 10 m platform with a horizontal speed of 3.0 m/s.
- What is the diver's PE at the top?
 - What is the diver's KE at the moment of takeoff?
 - What is the diver's total mechanical energy?
 - Just before hitting the water, what is the diver's speed?
- 19) A 2.0 kg object is launched upward with 80 J of kinetic energy.
- How high will it rise?
 - As the object travels upwards through the air, energy is converted from kinetic energy to potential energy. What is its speed as it reaches 2.0 m above the launch point?