Kinetic and Gravitational Potential

Energy Problems

An object positioned above the ground has **gravitational potential energy, Ep.** It can be calculated using the equation:

**EP = mgh**

Where m is the mass of the object (kg), g is the acceleration due to gravity (9.8m/s2 for objects near Earth) and h is the height (m).

An object that is moving has the ability to do work. The energy of moving objects is called **kinetic energy, Ek.** It is calculated using the following equation:

**EK = ½mv2**

Where m is the mass of the object (kg) and v is its speed (m/s).

1. Find the potential energy of a ball with a mass of 0.5 kg when held at the top of a 6 m ladder.
2. Calculate the gravitational potential energy of an 8 kg rock placed 8 m above the ground.
3. A crane lifts a 10 kg crate off the ground to a height of 2 m. How much potential energy does the crate have?
4. Tony stands o a diving board 11 m above the surface of the water. If he has 6468 J of energy, what is his mass?
5. A 2.5 kg textbook is on a desk that is 70 cm high. How much potential energy does the book have? (hint: remember to change cm into m)
6. Matthew has a mass of 65 kg and he is standing on an observation deck looking over the city. If he has 159.25 kJ of energy, how high is the observation deck? (hint: remember to change kJ into J)
7. Maggie is flying a plane at a height of 9500 m. Her mass is 55 kg.
   1. How much potential energy does she have in joules?
   2. How much potential energy does she have in kilojoules?
8. Tanya has potential energy of 4900 J standing on a diving board. If her mass is 50 kg, how high is the diving board?
9. Find the kinetic energy of a family car that has a mass of 980kg when travelling at a speed of 20m/s.
10. What is the kinetic energy of a 2 tonne truck travelling at a speed of 90 km/h? (Hint: remember to change mass into kg and speed into m/s)
11. Calculate the kinetic energy of a 50 g tennis ball travelling at 5 m/s.
12. Calculate the kinetic energy of a 156 g cricket ball travelling at 72 km/h.
13. Calculate the mass of a bird flying at 10 m/s with a kinetic energy of 50 J.
14. A skateboarder has 2025 J of kinetic energy. If his mass if 50 kg, at what speed is he travelling?
15. A person on a bridge drops a 3 kg stone into the water 5 m below. If the surface of the water is taken as the baseline, calculate:
    1. The initial gravitational potential energy of the rock.
    2. Its kinetic energy just prior to striking the water.
    3. Its speed just prior to striking the water.
16. A 2 kg bag of rice sits on a shelf 2 m above the floor.
    1. What is its potential energy?
    2. If the bag of rice fell, how much kinetic energy would the bag of rice have gained by the time it reaches the ground?
    3. What would be the velocity of the bag of rice when it hits the ground?
17. A helicopter is hovering 200 m off the ground when a loose object from inside the cabin falls out. Assuming the initial velocity of the object while in the cabin is 0 m/s and ignoring air resistance, calculate the velocity of the object just before it hits the ground.
18. In archery, the bow can store 50 J of elastic potential energy. If all of this is converted to the kinetic energy of the 0.25 kg arrow, find the arrow’s speed just after being fired.