

Unit 3 – Work, Energy & Power

Unit 3B – Energy

(A) Introduction – Definition of Energy

(B) Potential Energy

There are several forms or types of potential energy:

(1) **Gravitational potential energy** is

GPE is related to the mass of the object, the height of the object. These relationships are expressed by the following equation:

In the equation, **m** represents the _____ of the object, **h** represents the _____ of the object and **g** represents _____.

(2) **Elastic potential energy** is:

There is a special equation for springs which relates the amount of elastic potential energy to the amount of stretch (or compression) and the spring constant.

The equation is _____, where **k** refers to the _____ and **x** refers to the _____ from the spring's rest position.

(C) Check Your Understanding

1. Richard wants to know how much potential energy his cat has when it climbs to the top of the tree near his house. The tree is 15 meters high and the cat has a mass of 5 kilograms. How much potential energy does the cat have when the cat is at the top of the tree?
2. John has an object suspended in the air. It has a mass of 50 kilograms and is 50 meters above the ground. How much potential energy does the object have? How much work would the object do if it was dropped?
3. Mr S. dropped an object from 10 meters. He knows it did 50 joules of work. How much did it weigh?
4. A spring has a spring constant of 20 Nm and it gets compressed by 25 cm. How much potential energy is now stored in this spring?
5. A spring is stretched by 50 cm as 187.5 Joules of energy are applied onto the spring. Determine the spring constant of the spring.

(D) Kinetic Energy

Kinetic energy is _____. An object which has motion - whether it be vertical or horizontal motion - has kinetic energy.

The amount of kinetic energy which an object has depends upon two variables: the _____ of the object and the _____ of the object. The following equation is used to represent the kinetic energy (KE) of an object → _____ where **m** = _____ and **v** = _____.

(E) Check Your Understanding

Use your understanding of kinetic energy to answer the following questions.

1. Determine the kinetic energy of a 625-kg roller coaster car that is moving with a speed of 18.3 m/s.
2. If the roller coaster car in the above problem were moving with twice the speed, then what would be its new kinetic energy?
3. Missy Diwater, the former platform diver for the Ringling Brother's Circus, had a kinetic energy of 12 000 J just prior to hitting the bucket of water. If Missy's mass is 40 kg, then what is her speed?
4. A 900-kg compact car moving at 60 mi/hr has approximately 320 000 Joules of kinetic energy. Estimate its new kinetic energy if it is moving at 30 mi/hr.

KINETIC AND POTENTIAL ENERGY In Class WORKSHEET

Determine whether the the objects in the following problems have kinetic or potential energy. Then choose the correct formula to use: $E_K = 1/2 m v^2$ OR $E_P = m \times g \times h$

1. You serve a volleyball with a mass of 2.1 kg. The ball leaves your hand with a speed of 30 m/s. The ball has _____ energy. Calculate it.
2. A baby carriage is sitting at the top of a hill that is 21 m high. The carriage with the baby weighs 12 N. The carriage has _____ energy. Calculate it.
3. A car is traveling with a velocity of 40 m/s and has a mass of 1120 kg. The car has _____ energy. Calculate it.
4. A cinder block is sitting on a platform 20 m high. It weighs 79 N. The block has _____ energy. Calculate it.
5. There is a bell at the top of a tower that is 45 m high. The bell weighs 190 N. The bell has _____ energy. Calculate it.
6. A roller coaster is at the top of a 72 m hill and weighs 966 N. The coaster (at this moment) has _____ energy. Calculate it.