

Lesson 2

Potential and Kinetic Energy

Gravitational Potential Energy (E_g)

The type of energy possessed by an object because of its position (always with respect to a certain reference level).

$$E_g = mgh$$

The work done to lift an object to a certain height is equal to the object's potential energy at that height.

Example:

A 20.0 kg box of groceries is 0.50 m above a loading platform.

- a) Calculate the gravitational potential energy of the box relative to the platform.
- b) If the loading platform is 1.2 m above the ground, what is the potential energy of the box relative to the ground?

Kinetic Energy (E_k)

The energy of motion.

$$E_k = \frac{mv^2}{2}$$

Where

E_k = kinetic energy (J)

m = mass (kg)

Note that E_k also has units of Joules since objects can do work while moving.

Example:

What is the kinetic energy of a hammer of mass 3.0 kg while being swung at a speed of 4.0 m/s?

Example:

What is the speed of a 2.0 kg object that has a kinetic energy of 1.0×10^2 J?

69. Calculate the gravitational potential energy of
- a) a 2.0-kg physics textbook sitting on your desk 1.3 m above the floor.
 - b) a 50-g egg dropped from the top of a 3.0-m-high chicken coup.
 - c) a 200-kg air glider flying 469 m above the ground.
 - d) a 5000-kg car parked on the road.

47. What is the kinetic energy of a 60.0-g tennis ball that is travelling at
- a) 10.0 m/s?
 - b) 25.0 m/s?

53. At what speed must a 250.0-kg motorcycle be travelling to have a kinetic energy of
- a) 2.8×10^4 J?
 - b) 1.12×10^5 J?

Work-Energy Theorem

$$W = \Delta E_k$$

Example:

A car of mass 1.0×10^3 kg accelerates from 1.0 m/s to 4.0 m/s. How much work is done by the engine? If the car travelled 10.0 m, what was the force exerted on the car as a result of the actions of the engine?

Example:

A 50.0 g arrow is pulled back a distance of 80.0 cm in a bow. When the string is released, it exerts an average force of 60.0 N on the arrow. With what speed does the arrow leave the bow?

LAB: WORK-ENERGY THEOREM