What is Energy?

Energy – the ability to do work or cause change
- SI Unit: Joules (J)
- Whenever work is done, energy is transformed or transferred from one system to another

Energy can be split into two main categories

- Potential Energy – Stored energy that due to an objects position, shape, or condition.
- Kinetic Energy - Energy of an object due to its motion.

1

Common Forms of Energy

Potential Energy Examples:
- Stored Mechanical Energy
- Gravitational Energy
- Chemical Energy
- Nuclear Energy

Kinetic Energy Examples:
- Motion Energy
- Electrical energy
- Heat (thermal energy)
- Light (radiant energy)
- Sound

2

Mechanical Energy

Mechanical Energy – The amount of work an object can do from its potential and kinetic energies

Common forms of mechanical energy
- Elastic Potential Energy
  Stretched rubber band or compressed spring
- Gravitational Potential Energy
  Water at the top of a waterfall
  Hammer raised up in the air
- Kinetic Energy
  Hammer in motion, about to hit a nail

3

Mechanical Potential Energy

An object can store energy because of its position.

Elastic Potential Energy (PE) – Energy stored in an object that is compressed or stretched to change the distance between its parts.

Examples:
Archer pulls the bow back creating stored energy in the bow. When the bow is released, its stored energy is used and transferred to the arrow.

4

Gravitational Potential Energy

Gravitational Potential Energy (PE) – Potential energy due to an elevated position.

This is caused by gravity and is measured by the amount of work needed to lift the object to that point.

$PE_{gravity}$ = Work

Remember

W = Fd and $F_{gravity} = mg$

The distance is the height(h) of elevation

$$PE = mgh \qquad g = 9.8\ m/s^2$$

5

Potential Energy Example

A 3.0 kg mallet (A big hammer) is lifted to a height of 0.45 meters to drive in a railroad spike. What is the potential energy of the hammer while it is in the air?

$$PE = mgh \qquad g = 9.8\ m/s^2$$

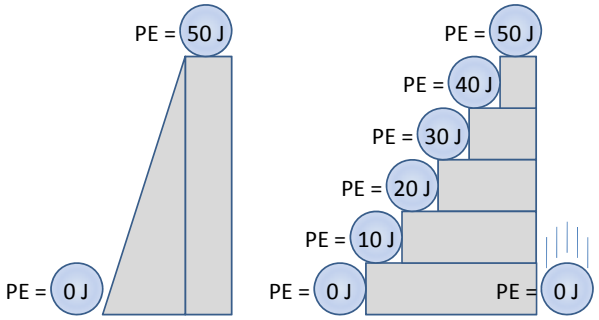
m = 3.0 kg h = 0.45 m

$PE = 3.0\ kg \cdot 9.8\ m/s^2 \cdot 0.45\ m = 13.2\ J$

6

Gravitational Potential Energy

PE is dependent on its relative height



7

Kinetic Energy

A moving object has the ability to do work.

Kinetic Energy(KE) – Energy of motion

The KE depends on an objects mass and speed
Both an increase of speed or mass will increase energy, but speed has a bigger impact on KE

$$KE = \frac{1}{2}mv^2$$

8

Kinetic Energy Example

Determine the kinetic energy of a 625 kg roller coaster car that is moving with a speed of 18.3 m/s.

$$KE = \frac{1}{2}mv^2$$

m = 625 kg v = 18.3 m/s

KE = ½ · 625 kg · (18.3 m/s)² = 105000 J

9

Conservation of Energy

Work-Energy Theorem

The change in Kinetic Energy is equal to the amount of work that can be done.

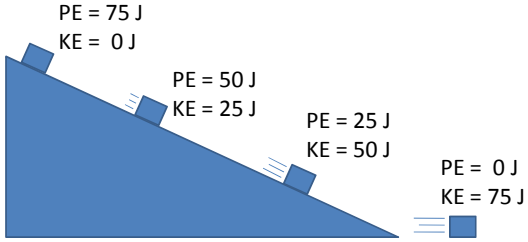
In most cases the moving object doing work will not lose mass (unless it breaks somehow).

$$Work = \frac{1}{2}m\left(v_{final}^{\ 2} - v_{initial}^{\ 2}\right)$$

10

Law of Conservation of Energy

Energy cannot be created or destroyed, it may be transformed from one form into another or transferred from one object to another, but the total amount of energy never changes



11