# ATOMIC ENERGY CENTRAL SCHOOL,ANUPURAM

## CH-6 Work Power and Energy(module2/6)


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# What is Kinetic Energy?

- The kinetic energy of an object is the energy that it possesses due to its motion. Kinetic energy definition is given as:

•The energy of an object because of its motion or the energy gained by an object from its state of rest to motion.

**How is kinetic energy different from potential energy?**

Kinetic energy is due to an object's motion whereas potential energy is due to an object's position or state. Velocity is an important factor while calculating an object's kinetic energy. However, velocity has nothing to do with an object's potential energy.

# Formula of Kinetic Energy

- Following is the formula of kinetic energy:

$$KE=1/2mv^2$$

Where, KE is the kinetic energy of the object

m is the mass of an object

v is the velocity of an object

Kinetic energy is an example of scalar quantity which means that the quantity has only magnitude and no direction.

Unit of Kinetic Energy

- The **SI unit of Kinetic energy** is Joule which is equal to 1 $kg.m^2.s^{-2}$.
- The **CGS unit of kinetic energy** is erg.

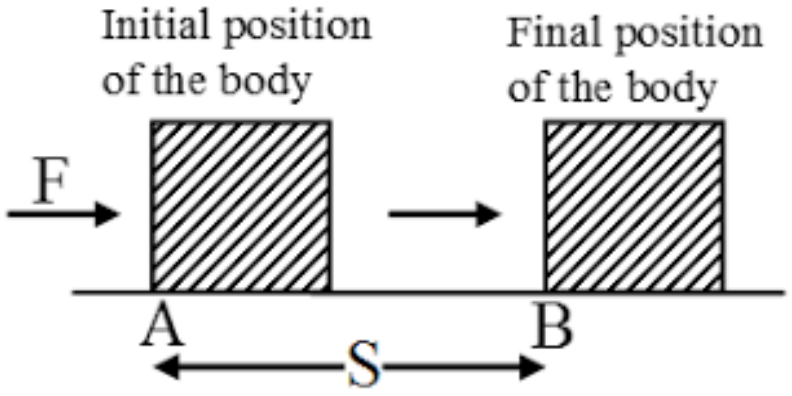
# Derivation for Kinetic Energy

$$W = Fs$$

$$v^2 - u^2 = 2as, s = \frac{v^2}{2a}$$

$$F = ma, W = ma \cdot \frac{v^2}{2a}$$

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




# Relation between K.E and Momentum

(considering the mass to be constant)

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

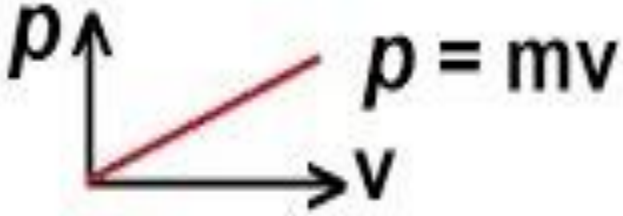
$$\Rightarrow E = \frac{m}{2m}mv^2$$

$$\Rightarrow E = \frac{1}{2m}(mv)^2$$

$$\Rightarrow E = \frac{p^2}{2m}$$ (this is valid when mass is constant)

# How is Momentum Different from Kinetic Energy?

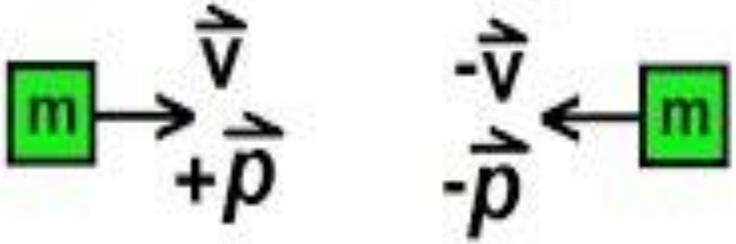
1) Momentum is a linear function of velocity




2) In a collision momentum is alway conserved

3) Momentum is a vector quantity

$\vec{p} = m\vec{v}$




1) K.E. is a quadratic function of v


2) In a collision K.E. is never conserved

3) K.E. is a scalar quantity (only positive)

# Work energy theorem

- According to this theorem, the net work done on a body is equal to change in Kinetic Energy of the body. This is known as Work-Energy Theorem. It can be represented as
- $K_f - K_i = W$
- Where $K_f$ = Final kinetic energy
- $K_i$ = Initial kinetic energy
- W = net work done

A constant force will produce constant acceleration. Let the acceleration be ‘a’.

From equation of motion,

$v^2 = u^2 + 2as$

$2as = v^2 – u^2$

Multiplying both side with mass ‘m’

$(ma).s = (mv^2–mu^2)/2$

$W=F.s = (mv^2–mu^2)/2$

Comparing the above equation we get,

Work done by force (F) = F.s

Where ‘s’ is the displacement of the body.