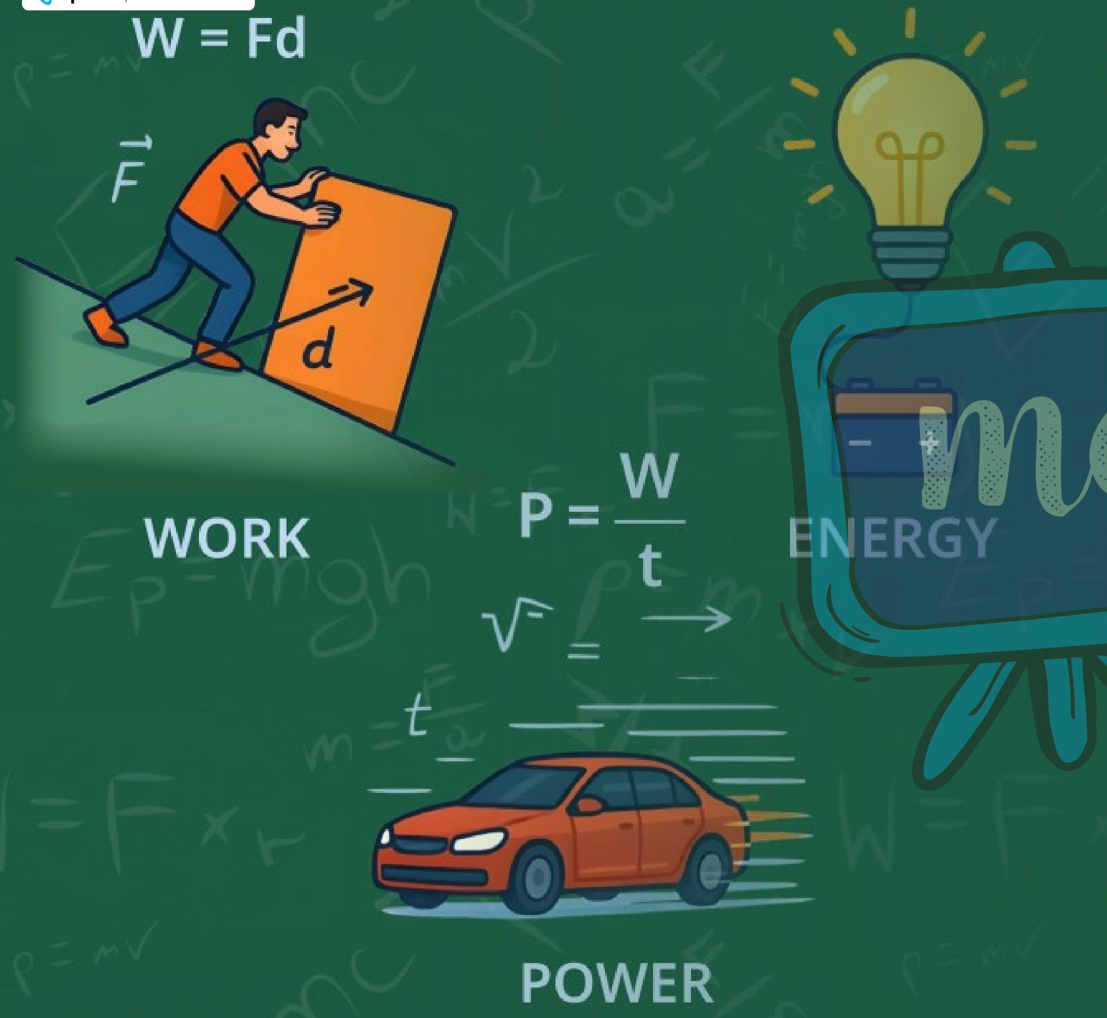
Under CSR Support by ipca | Foundation

missiongyan LET'S LEARN TOGETHER



CLASS – 11

PHYSICS

Chapter – 5

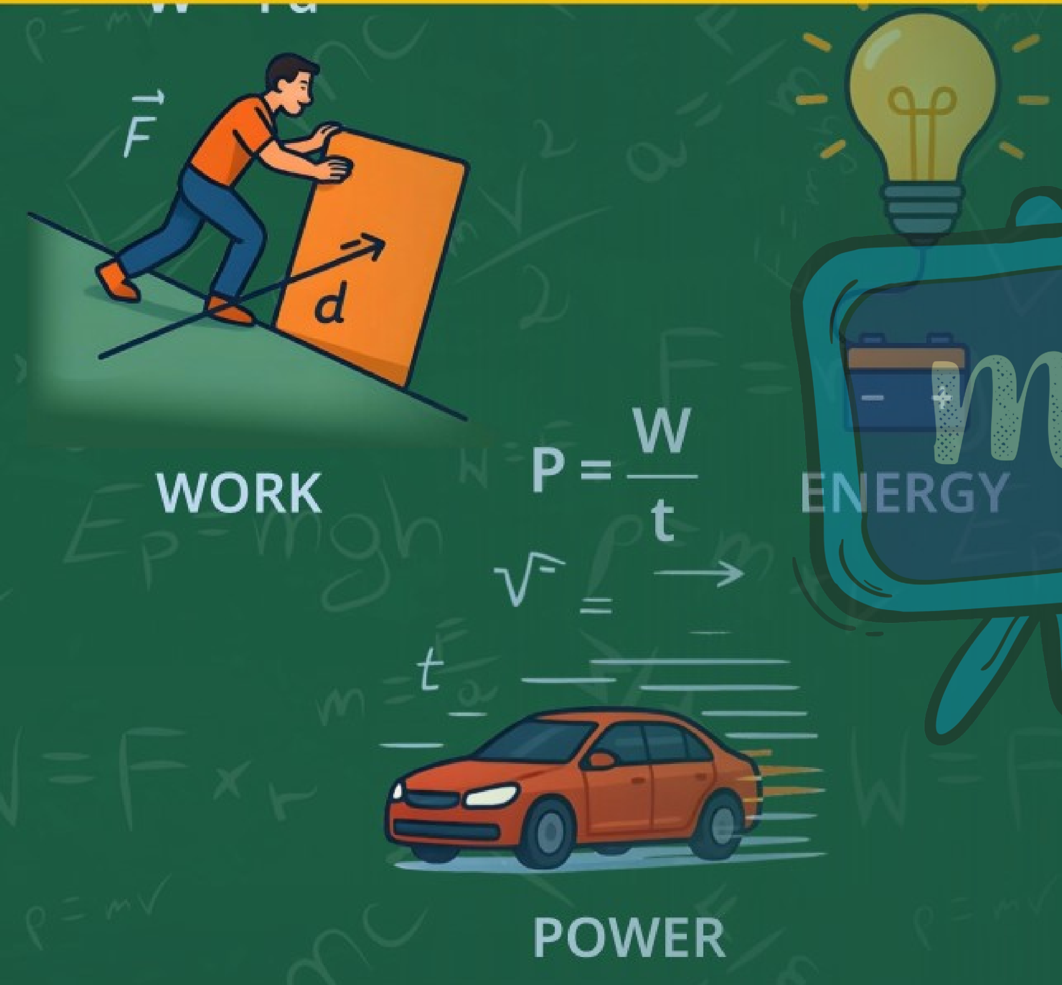
Work, Energy and Power

Part – 2

Energy

Alok Gaur

OVERVIEW



1. Work
2. Energy
3. Law of Conservation of Mechanical Energy and Power
4. Collision

ENERGY

Capacity of doing work

Energy is a body is defined as it's capacity to do work.

- The Energy of a body is measured by the amount of work the body can perform.
- Energy is Scalar Quantity.
- Unit : In M.K.S. = Joule

  In C.G.S. = Erg.

- Dimension : $[M^1L^2T^{-2}]$
- Energy has several forms : mechanical energy, sound energy, nuclear energy etc.

S.No.	Unit	Symbol	Value in S.I.
1.	erg	erg	10^{-7} J
2.	electron volt	ev	1.6×10^{-19}J
3.	calorie	cal	4.18 J
4.	Kilowatt Hours	kwh	3.6×10^6J

KINETIC ENERGY

The Energy possessed by a body by virtue of it's motion is called it's kinetic energy.

This is measured by workdone to move a body from rest.

Mechanical Energy

Mechanical Meaning

- Kinetic Energy
- Potential Energy

Example :

i. A bullet fired from a gun can pierce a target due to it's Kinetic Energy.

ii. The Kinetic Energy of air is used to run wind mills.

From Newton's Third Law

$$v^2 - u^2 = 2as$$

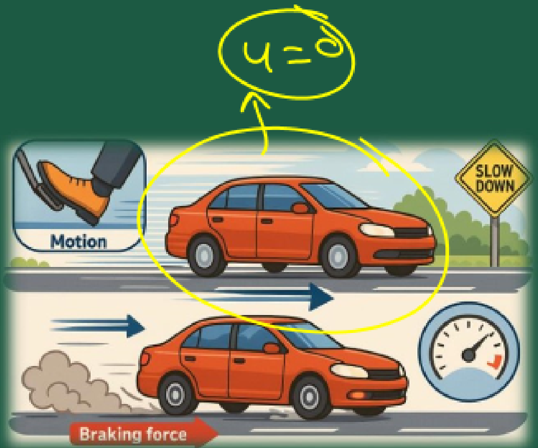
$$u = 0$$

$$v^2 = 2as$$

$$\because F = ma$$

$$a = \frac{F}{m}$$

$$v^2 = 2\frac{F}{m}s$$



$F = ma$

$u = 0$ → s → v

$W = F\,s$

$W = m a s$

by III k.E

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

$v^2 = 2as$

$s = \frac{v^2}{2a}$

$W = ma\left(\frac{v^2}{2a}\right)$

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

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

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

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

$$W = K.E.$$

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

- Kinetic Energy of a body is equal to one-half the product of the mass of the body and the square of it's velocity.

RELATION BETWEEN K.E. AND LINEAR MOMENTUM

$p = mv$

$K.E = \frac{1}{2} m v^2$

$= \frac{1}{2} \frac{m^2 v^2}{m}$

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

$K.E = \frac{p^2}{2m}$

$p = \sqrt{2mK.E}$

$P = mv$

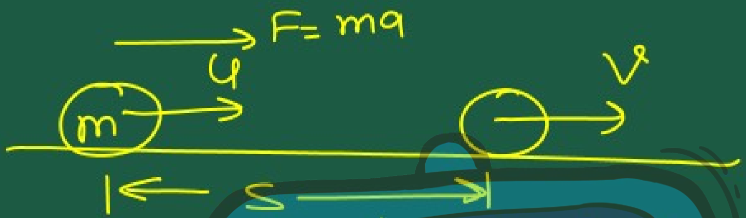
$K = \frac{1}{2} mv^2 = \frac{1}{2m}(m^2 - v^2) = \frac{1}{2m}(mv)^2$

$K = \frac{P^2}{2m}$

$P = \sqrt{2mk}$

WORK ENERGY THEOREM

It states that the work done by the net force acting on a body is equal to the change produced in the kinetic energy of the body.



$$W = F\,s$$

$$W = m\,a\,s$$

by III K.E

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

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

$$W = ma\left[\frac{v^2 - u^2}{2a}\right]$$

$$W = \frac{1}{2}mv^2 - \frac{1}{2}mu^2$$

$$W = K_f - K_i$$

$$W = \Delta K$$

From Newton's Third Law

$$v^2 - u^2 = 2as$$

$$v^2 = 2\frac{F}{m}s$$

$$\frac{1}{2}m(v^2 - u^2) = FS$$

$$W = \frac{1}{2}mv^2 - \frac{1}{2}mu^2$$

$$W = K_f - K_i$$

Change in K.E. of the body = Work done on the body by the next force

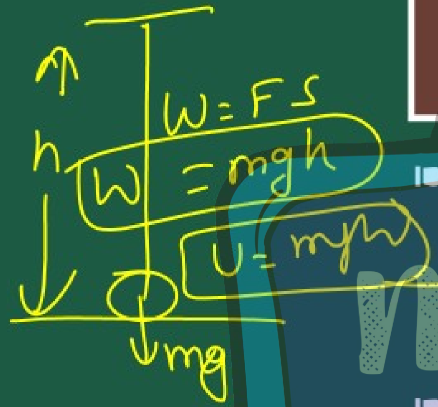
POTENTIAL ENERGY

Stored Energy

Potential energy is the energy stored in a body or a system by virtue of it's position in a field of force or by it's configuration.

Example : The potential energy of water stored to great heights in dams is used to run turbines for generating hydroelectricity.

DIFFERENT TYPES OF POTENTIAL ENERGY



- Gravitational Potential Energy

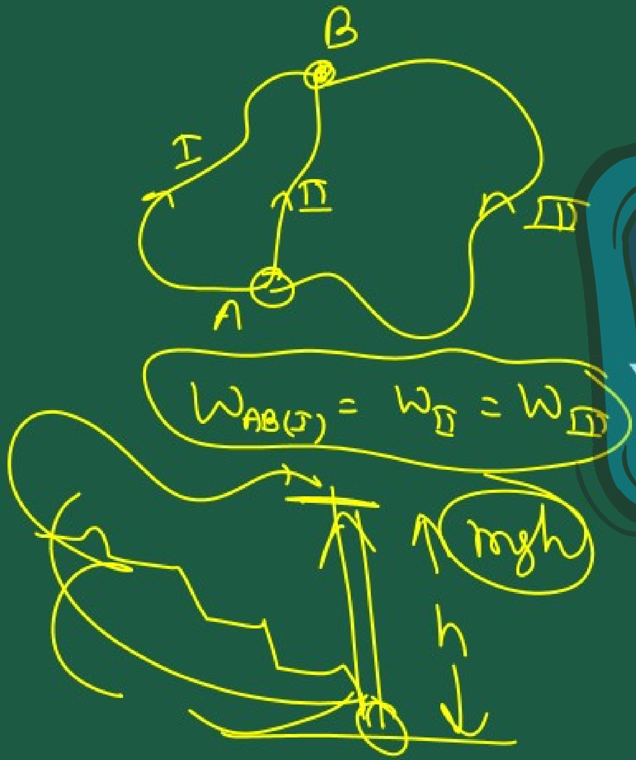
  $$U = mgh$$

- Elastic Potential Energy

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

- Electrostatic Potential Energy

  $$P.E. = \frac{KQ_1Q_2}{r}$$



FORCE

Conservative force

It is doesn't depend on path

Ex. Gravitational Force
Electrostatic Force

Non-Conservative force

It is depend on path

Ex. Force of Friction
and viscosity

POTENTIAL ENERGY IN RELATION TO CONSERVATIVE FORCE

$$W = \int_{x_1}^{x_2} F\,dx$$

$$\Delta U = -\int_{x_1}^{x_2} F\,dx$$

$$\Delta U = -W$$

$$W = \int_{x_i}^{x_f} F(x)dx$$

$$\Delta U = \int_{x_i}^{x_f} F(x)dx$$

difference the above equation we get

$$F = -\frac{du}{dx}$$

$$du = -F\,dx$$

$$U = -\int F\,dx$$

$$\frac{dU(x)}{dx} = -F(x)$$

$$F(x) = -\frac{dU}{dx}(x)$$

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

$a = g, s = h$

$v^2 = u^2 + 2gh$

$u = 0$

$v^2 = 2gh$

$$v = \sqrt{2gh}$$

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

$$K.E. = \frac{1}{2}m(\sqrt{2gh})^2$$

$$K.E. = mgh$$

K.E. = work done by the gravitational force

LEARNING OUTCOMES

To study for kinetic and potential energy

ASSESSMENT

1 Mechanical energy is ....

A. Equal to the rate of doing work

B. The sum of kinetic energy and the potential energy of an object

C. The energy released during mechanical work

D. The energy absorbed movement of a body.

ASSESSMENT

2 According to the work-energy theorem, total change in energy is equal to the–

A Total work done

B Half of the total work done

C Total work done added with frictional force

D Square of the total work done

$W = \Delta K$

ASSESSMENT

3 Work energy theorem is valid–

A Only in the presence of an external force

B Only in the presence of an internal force

C Only in the presence of an conservative force

D For all type forces