



মহাশিক্ষা বিভাগ (মামা)

DEPARTMENT OF EDUCATION (S)

Government of Manipur

**CLASS IX
PHYSICS**

CHAPTER 9 – WORK, ENERGY AND POWER

NOTES

Work: When an object moves under an applied force in the direction of it, then the force has done work on the object.

The work done by a force acting on an object is equal to the product of the force and displacement of the object in the direction of the force.

- Work done is mathematically equal to the product of the magnitude of the applied force (F) and the displacement (s). That is

$$W = Fs,$$

(9.1)

- Work done has only magnitude but no direction.
- The SI unit of work done is Nm or Joule (J).
- Work done is positive when the force is in the direction of the displacement.
- Work done is negative when the force is opposite to the direction of displacement.

Energy: Any object having capability to do work is said to possess energy. The object which does work lose energy whereas the object on which the work is done gain energy.

- The energy possessed by an object is measured in terms of its capacity for doing work.
- The SI unit of energy is Joule (J).

$$1\text{kJ} = 1000\text{ J}$$

$$1\text{MJ} = 10^6\text{ J}$$

- The various forms of energy are:

- ❖ Mechanical energy (kinetic energy and potential energy)
- ❖ Heat energy
- ❖ Chemical energy
- ❖ Electrical energy
- ❖ Light energy
- ❖ Sound energy



Kinetic energy: It is the energy possessed by an object due to its motion.

- The kinetic energy possessed by an object of mass m moving with a uniform velocity v at any instant of time is

$$E_k = \frac{1}{2} mv^2. \quad (9.2)$$

Potential Energy: The energy possessed by an object due to its position or configuration is called potential energy.

- The potential energy of an object increases when it is raised from a lower level to a higher level because of the work done on it against the gravity while it is being raised.
- The potential energy of an object of mass m at a height h is

$$E_p = mgh. \quad (9.3)$$

- Energy can be converted from one form to another.
- **Law of conservation of Energy:** It states that energy can never be created nor destroyed but can be transformed from one form to another. The total energy before and after the transformation remains the same.

Power: Power the rate of doing work or the rate of transfer of energy.

- **Mathematical form of power:** Power (P) is defined as the work done (W) or energy transferred per unit time (t). That is,

$$P = \frac{W}{t}. \quad (9.4)$$

- The SI unit of power is **Watt** having the symbol W in honor of James Watt.

$$1 \text{ kilowatt} = 1000 \text{ watt} = 1000 \text{ Js}^{-1}$$

$$1 \text{ megawatt} = 10^6 \text{ watt} = 10^6 \text{ Js}^{-1}$$



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- **Commercial unit of energy:** The commercial unit of energy is kilowatt hour represented as kWh.
1 kilowatt hour = 3.6×10^6 J
- The energy used by a machine or work done by a machine at the rate of kW in one hour is called **1kilowatt(kWh)**.



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