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## Work, Energy and Power

**Work** : If a body gets displaced when a force acts on it, work is said to be done. Work is measured by the product of force and displacement of the body along the direction of force.

If a body gets displaced by  $S$  when a force  $F$  acts on it, then the work  $W = FS \cos \theta$ ?

where  $\theta$  = angle between force and displacement.

If both force and displacement are in the same direction, then  $W = FS$

Work is a scalar quantity and its SI unit is joule.

**Energy** : Capacity of doing work by a body is called its energy.

---> Energy is a scalar quantity and its SI unit is joule.

---> Energy developed in a body due to work done on it is called mechanical energy. Mechanical energy is of two types :

**(i) Potential Energy (ii) Kinetic Energy**

**Potential Energy** : The capacity of doing work developed in a body due to its position or configuration is called its potential energy.

**Example** : (i) energy of stretched or compressed spring (ii) energy of water collected at a height (iii) energy of spring in a watch.

PE of a body in the gravitational field of earth is  $mgh$ .

where  $m$  = mass,  $g$  = acceleration due to gravity,  $h$  = height of the body from surface of the earth.

**Kinetic Energy** : Energy possess by a body due to its motion is called Kinetic Energy of the body. If a body of mass  $m$  is moving with speed  $v$ , then kinetic energy of the body is  $\frac{1}{2} mv^2$

Principle of Conservation of Energy.

Energy can neither be created nor can be destroyed. Only energy can be transformed from one form to another form. Whenever energy is utilized in one form, equal amount of energy is produced in other form. Hence total energy of the universe always remains the same. This is called the principle of

conservation of energy.

Some Equipments used to Transform Energy

### Relation between Momentum and Kinetic Energy

$K.E = p^2/2m$  where  $p = \text{momentum} = mv$

Clearly when momentum is doubled, kinetic energy becomes four times.

**Power** : Rate of doing work is called power.

If an agent does  $W$  work in time  $t$ , then power of agent =  $W/t$

SI unit of power is watt named as a respect to the scientist James Watt.

watt = joule / sec.

1 kW = 1000 watt

1 MW = 1000000 watt

Horse power is a practical unit of power. 1 H.P. = 746 watt.

1 watt second = 1 watt x 1 second = 1 joule.

1 watt hour (Wh) = 3600 joule

1 kilowatt hour (kWh) = 3.6 x 10<sup>6</sup> joule.

W, kW, MW & H.P. are units of power.

Ws, Wh, kWh are units of work and energy.

