Board – CBSE	Class –9th	Topic – Work and Energy

1. A force of 7 N acts on an object. The displacement is, say 8 m, in the direction of the force (Fig. 11.3). Let us take it that the force acts on the object through displacement. What is the work done in this case?

Ans.

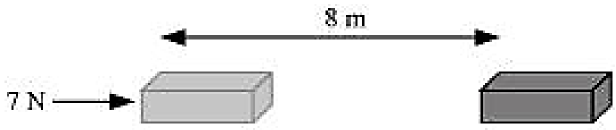

Fig 11.3

When a force F acts on an object to displace it through a distance S in its direction, then the work done W on the body by force is given by.

Work done = Force × Displacement

$W = F \times S$

Where,

F = 7 N

S = 8 m

Therefore, work done, $W = 7 \times 8$

= 56 Nm

= 56 J

2. When do we say that work is done?

Ans. Work is done whenever the given conditions are satisfied.

(i) A force acts on the body.

(ii) There is a displacement of the body caused by the applied force along the direction of the applied force.

3. Write an expression for the work done when a force is acting on an object in the direction of its displacement.

Ans. When a force F displaces a body through a distance S in the direction of the applied force, then the work done W on the body is given by the expression.

Work done = Force × Displacement

$W = F \times s$.

4. Define 1 J of work.

Ans. 1 J is the amount of work done by a force of 1 N on an object displaces it through a distance of 1 m in the direction of the applied force.

5. A pair of bullocks exerts a force of 140 N on a plough. The field being ploughed is 15 m long. How much work is done in ploughing the length of the field?

Ans. The expression gives work done by the bullocks.

Work done = Force × Displacement

$$W = F \times d$$

Where,

Applied force, F = 140 N

Displacement, d = 15 m

W = 140 × 15 = 2100 J

Hence, 2100 J of work is done in ploughing the length of the field.

6. What is the kinetic energy of an object?

Ans. Kinetic energy is the energy possessed by a body by its motion. Every moving object possesses kinetic energy. A body uses kinetic energy to do work. The hammer's kinetic energy is used in driving a nail into a log of wood, kinetic energy of air is used to run windmills, etc.

7. Write an expression for the kinetic energy of an object.

Ans. If a body of mass m is moving with a velocity v, then its kinetic energy E_K is given by the expression,

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

Its SI unit is Joule (J).

8. The kinetic energy of an object of mass, m moving with a velocity of 5 m s^{-1} is 25 J. What will be its kinetic energy when its velocity is doubled? What will be its kinetic energy when its velocity is increased three times?

Ans. Expression for kinetic energy is $E_K = \frac{1}{2}mv^2$

m = mass of the object

v = velocity of the object = 5 m s^{-1}

Given that kinetic energy, E_K = 25 J

(i) If the velocity of an object is doubled, then v = 5 × 2 = 10 m s^{-1}.

Therefore, its kinetic energy becomes 4 times its original value because it is proportional to the square of the velocity. Hence, kinetic energy = 25 × 4 = 100 J.

(ii) If velocity is increased three times, then its kinetic energy becomes 9 times its original value because it is proportional to the square of the velocity. Hence, kinetic energy = 25 × 9 = 225 J.

9. What is power?

Ans. Power is the rate of doing work or the rate of transfer of energy. If W is the amount of work done in time t, then power is given by the expression,

$$Power = \frac{Work}{Time} = \frac{Energy}{Time}$$

$$P = W/T$$

It is expressed in watt (W)

10. Define 1 watt of power.

Ans. A body is said to have the power of 1 watt if it does work at the rate of 1 joule in 1 s, i.e.,

$$1\,W = \frac{1\,J}{1\,S}$$

11. A lamp consumes 1000 J of electrical energy in 10 s. What is its power?

Ans. The expression gives power,

$$Power = \frac{Work\ done}{Time}$$

Work done = Energy consumed by the lamp = 1000 J

Time = 10 s

$$Power = \frac{1000}{10} = 100\,J\,s^{-1} = 100W$$

12. Define average power.

Ans. A body can do different amounts of work in different time intervals. Hence, it is better to define average power. Average power is obtained by dividing the total amount of work done in the total time taken to do this work.

$$Average\ Power = \frac{Total\ work\ done}{Total\ time\ taken}$$