SHORT QUESTIONS

4.1 A person holds a bag of groceries while standing still, taking to a friend. A car is stationery with its engine running. From the stand point of work, how are these two situations similar?

Ans. In both the situations there is no work done because both the bodies have zero displacement i.e.,

$$W = \vec{F} \cdot \vec{d}$$

$$= Fd \cos\theta \qquad \text{But} \qquad d = 0$$

$$W = F(0) \cos\theta$$

$$W = 0$$

Hence no work is done in both the cases.

4.2 Calculate the work done in kilo joules in lifting a mass of 10 kg (at a steady velocity) through a vertical height of 10m.

Ans. ***Data***

Mass = m = 10 kg

Vertical height = h = 10 m

To Find

Work done in KJ = ?

Solution

By formula:

$$\text{Work done} = W = mgh$$

$$= 10 \times 10 \times 9.8$$

$$= 980 \text{ J} = \frac{980}{1000} \text{ KJ}$$

Work done = 0.98 KJ

4.3 A force F acts through a distance L. The force is then increased to 3 F, and then acts through a further distance of 2L. Draw the work diagram to scale.

Ans. Work diagram is a force distance graph as shown in figure. A force F acts through a distance L then work done is FL. If the force is increased to 3F through a distance 2L then

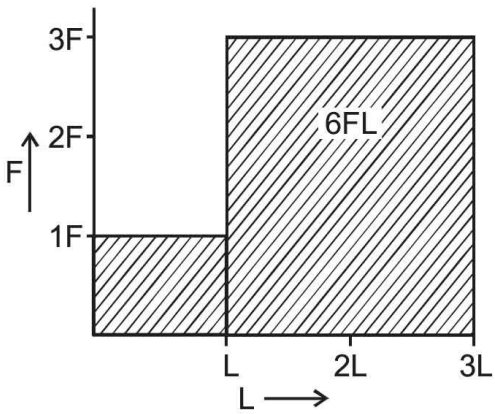
Work done = 3F . 2L

= 6FL

Hence the total:

Work done = FL + 6FL

= 7FL



4.4 In which case is more work done? When a 50 kg bag of books is lifted through 30 cm, or when a 50 kg create is pushed through 2m across the floor with a force of 50 N?

Ans. In 1st case when m = 50 kg

h = 50 cm = 0.5 m

Work done in this case is:

Work done = W_1 = mgh

= $50 \times 0.5 \times 9.8$

W_1 = 245 J

In 2nd case:

m = 50 kg

d = 2 m

F = 50 N

Work done in this case is:

W_2 = F . d

= 50×2

W_2 = 100 J

It is clear that more work is done in 1st case.

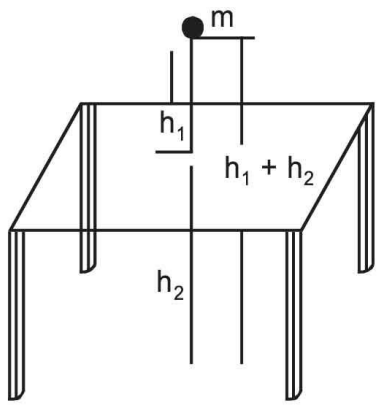
4.5 An object has 1 J of potential energy. Explain what does it mean?

Ans. As 1 J = 1 N × 1 m

When one Newton force is applied on a body in lifting it through a height of one metre. Then work done is stored in a body as P.E which is 1 Joule i.e., the body has the ability of doing 1 Joule of work.

4.6 A ball of mass m is held at a height h_1 above a table. The table top is at a height h_2 above the floor. One student says that the ball has potential energy mgh_1 but another says that it is $mg(h_1 + h_2)$. Who is correct?

Ans. The ball is at a height h_1 with respect to the table and the table is at height h_2 with respect to the ground, so the ball is at a height of $h_1 + h_2$ from the ground. Therefore the potential energy stored in the ball with respect to the top is mgh_1 and with respect to ground is $mg(h_1 + h_2)$. Hence both the students are correct because one student is telling with respect to the top and other is telling with respect to the ground.



4.7 When a rocket re-enters the atmosphere, its nose cone becomes very hot. Where does this heat energy come from?

Ans. When the rocket re-enters into the atmosphere then a part of its kinetic energy is used to do work against friction with air and dust particles present in atmosphere which will be appear in the form of heat therefore due to this reason nose cone of rocket become very hot.

4.8 What sort of energy is in the following:

(a) Compressed spring

(b) Water in a high dam

(c) A moving car

Ans. (a) A compressed spring has elastic potential energy.

(b) A water in a high dam has gravitational potential energy.

(c) A moving car has kinetic energy.

4.9 A girl drops a cup from a certain height, which breaks into pieces. What energy changes are involved?

Ans. At a certain height, a cup has gravitational potential energy. When it is dropped its gravitational potential energy decreases and kinetic energy increases. Just before striking the floor, kinetic energy is maximum. On striking, kinetic energy is changed into sound energy, heat energy and energy to break the cup if air friction is ignored. If air friction is present then some part of K.E is also used to overcome this friction.

4.10 A boy uses a catapult to throw a stone which accidentally smashes a green house window. List the possible energy changes.

Ans. Elastic potential energy stored in catapult, which is transferred to the stone as its kinetic energy. When the stone strikes the green house window, its kinetic energy changes into sound, heat and energy to break the glass window.