SHORT QUESTIONS

Q 4.1 A person holds a bag of groceries while standing still, talking to a friend. A car is stationary with its engine running. From the standpoint of work, how are these two situations similar?

Ans: In both cases, the displacement is zero and hence, no work is done. So these situation are similar.

Q 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 10 m.

Ans: In this case work done is stored in the body as its P.E. so

$$\text{Work} = \text{P.E} = mgh \quad \text{——} (1)$$
$$= 10\ kg \times 9.8\ ms^{-2} \times 10\ m$$
$$= 980\ J$$
$$= \boxed{0.98\ KJ}$$

Hence approx. 1KJ work is done.

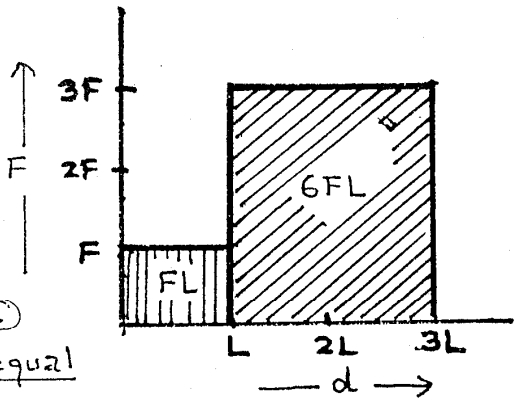
Q 4.3 A force "F" acts through a distance L. The force is then increased to 3F, and then acts through a further distance of 2L. Draw the work diagram to scale.

Ans: A force F acts through a distance L, then

work done = FL —— (1')

If the force is increased to 3F through a distance 2L, then work done

= 3F. 2L = 6FL —— (2')



The area under graph is equal to the total work done. So

Total work done = FL + 6FL = $\boxed{7FL\ (\text{units})}$

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

Ans: (a) $m = 50kg$, $h = 50cm = 0.5m$

In this case work done is stored as its P.E,

$$W_1 = P.E = mgh$$
$$= 50 \times 9.8 \times 0.5$$
$$= 245\ J \quad \text{——} ①$$

(b) $m = 50kg$, $d = 2m$, $F = 50N$

$$W_2 = F.d$$
$$= 50\ N \times 2m = 100\ J \quad \text{——} ② \qquad \because 1N \cdot m = 1J$$

So in Ist case work done is more.

Q 4.5 An object has 1J of P.E. Explain what does it mean?

Ans: An object has P.E when it is in a force field such as gravitational field or it is in a constrained state such as a compressed spring or extended spring.

(a) When an object is raised by doing 1J of work,

$$P.E = mgh = Wh = 1J \quad (1N \times 1m)$$

i.e; when one newton force is applied on a body and lift it up through a height of 1m, the work appears as its gravitational P.E. Then the work done is stored in the body is 1J.

(b) When a spring is compressed or extended by doing 1J work on it, the work is conserved in the spring as its elastic P.E.

Q 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 $P.E = mgh_1$ but another says that it is $mg(h_1 + h_2)$. Who is correct?

Ans. Both statements are correct. It is matter of

relative position for specifying the P.E of the ball. The P.E relative to the tabletop is mgh_1 and P.E relative to the ground is $mg(h_1+h_2)$.

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

Ans: When a rocket re-enters the atmosphere with high velocity, its nose becomes very hot due to air friction. The work done against the air friction is changed into heat.

Q 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) Elastic P.E is stored in a compressed spring.
(b) The water in a high dam has gravitational P.E due to its height w.r.t the basin.
(c) A moving car has K.E due to its motion.

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

Ans: The cup has gravitational P.E at a certain height. When it is dropped, its P.E decreases and K.E increases. Just before striking the floor, the whole of P.E is changed into K.E. On striking the ground, the K.E is changed into sound, heat and work to break the cup into pieces.

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

Ans: The elastic P.E of the catapult is transferred to stone as its K.E. When the stone strikes the green house window, the K.E of the stone is changed into sound, heat and work done in breaking the window glass.