Work, Energy and Power

Assertion Reason Questions

Two statements are given one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these question from the codes (a), (b), (c) and (d) as given below.

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false and R is also false.

1. Assertion (A): According to law of conser- vation of mechanical energy, change in potential energy is equal and opposite to the change in kinetic energy.
Reason (R): Mechanical energy is not a conserved quantity.

Ans. (c) A is true but R is false.
Explanation: Because mechanical energy is conserved in a process, the change in potential energy equals and opposes the change in kinetic energy.

2. Assertion (A): A person working on a horizontal road with a load on this head does not work.
Reason (R): No work is said to be done if the direction of force and displacement of load are perpendicular to each other.

Ans. (a) Both A and R are true and R is the correct explanation of A.
Explanation: The work done

$$W = \vec{F}.\vec{S}\cos\theta$$

When a person walks on a horizontal road with load on his head,
Then $\theta = 90°$,
Hence, $W = Fs \cos 90° = 0$
Thus, no work is done by a person.

3. Assertion (A): A spring has potential energy, both when it is compressed or stretched.
Reason (R): In compressing or stretching, work is done in the spring against the restoring force.

Ans. (a) Both A and R are true and R is the correct explanation of A.
Explanation: The work done on the spring against the restoring force is stored as potential energy in both conditions when it is compressed or stretched.

4. Assertion (A): Water at the foot of the waterfall is always at different temperatures from that at the top.
Reason (R): The potential energy of water at the top is converted into heat energy during falling.

Ans. (a) Both A and R are true and R is the correct explanation of A.
Explanation: When the water is at the top of the fall it has potential energy mgh (where m is the mass of the water and h is the height of the fall). On falling, this potential energy is converted into kinetic energy which further converts into heat energy and so the temperature of water increases.

5. Assertion (A): According to the principle of conservation of energy, all heat can be converted into mechanical energy.
Reason (R): Due to various losses, it is impossible to convert all heat into mechanical work.

Ans. (d) A is false and R is also false
Explanation: According to the law of conser- vation of energy, energy can neither be created nor it can be destroyed. Thus, it is physically possible to convert heat into mechanical work. But due to various energy losses, this cannot be achieved partially ever.

6. Assertion (A): In an elastic collision of two bodies, the momentum and energy of each body is conserved.
Reason (R): If two bodies stick to each other, after colliding the collision is said to be perfectly elastic.

Ans. (d) A is false and R is also false [Diksha]
Explanation: In an elastic collision, both the momentum and kinetic energy remains conserved. But this rule is not for individual bodies, but for the system of bodies before and after the collision. While collision in which there occurs some loss of kinetic energy is called inelastic collision. Collision in daily life and generally inelastic. The collision is said to be perfectly inelastic, if two bodies strike each other.

7. Assertion (A): In an elastic collision between the two bodies, the relative speed of the bodies after colli- sions is equal to the relative speed before the collision.
Reason (R): In a elastic collision the linear momentum of the system is conserved.

Ans. (b) Both A and R are true and R is not the correct explanation of A.
Explanation: In Collisions:
(1) Momentum is preserved in both elastic and inelastic collisions.
(2) Kinetic energy is preserved in elastic collisions as well.
Point 1 leads to Reason, which states that in an elastic collision, the system's linear momentum is conserved.
Point 2 leads to the Assertion, in an Elastic Collision between two bodies, the relative speed of the bodies after the collision is equal to the relative speed before the collision.

8. Assertion (A): A bullet is fired from a rifle. If the rifle recoils freely, the kinetic energy of the rifle is more than that of the bullet.
Reason (R): In the case of the rifle bullet system, the law of conser- vation of momentum violates.

Ans. (d) A is false and R is also false.
Explanation: Law of conservation of linear momentum is correct when no external force acts. When a bullet is fired from a rifle then both should pass equal momentum but different kinetic energy

$$E = \frac{P^2}{2m}$$

$\therefore$ Kinetic energy of the rifle is less than that of the bullet because $E \propto \frac{1}{m}$

9. Assertion (A): Total energy of the freely falling body is constant at each point.
Reason (R): Kinetic energy of freely falling body is minimum, when it reaches the ground.

Ans. (c) A is true but R is false.
Explanation: According to the law of conser- vation of energy, energy of a freely falling body remains conserved. Kinetic energy is maximum when body reaches at ground.

10. Assertion (A): The work done during a round trip is always zero.
Reason (R): No force is required to move a body in its round trip.

Ans. (d) A is false and R is also false.

Explanation: In a round trip, work done is zero only when the force is conservative in nature. Force is always required to move a body in a conservative, non-conservative field.