CLASS: IX
SUBJECT: PHYSICS: MOTION
WORK BOOK-2

Hints & Solutions

1. **(C)**

If an object is moving with a constant speed, its velocity is not changing, and therefore, its acceleration is zero.

2. **(C)**

Acceleration is a vector quantity as it has both magnitude and direction

3. **(B)**

The slope of a velocity-time graph represents acceleration. A steeper slope indicates a higher acceleration.

4. **(A)**

The area under a speed-time graph gives the distance traveled by the object.

5. **(A)**

Escape velocity of gas molecules is less than their root mean square velocity

6.
- Speed: Speed is the rate of change of distance with respect to time. It is a scalar quantity.
- Velocity: Velocity is the rate of change of displacement with respect to time. It is a vector quantity.
- Similarity: Both speed and velocity are measures of how fast an object is moving.
- Difference: Velocity has direction, while speed does not.

7.
- Speed (v) = 15 m/s, Distance (d) = 75 meters.
- Time (t) = Distance/Speed = 75/15 = 5 seconds.

8.
- Acceleration: Acceleration is the rate of change of velocity. It can be positive, negative, or zero. It is a vector quantity.
- Example: If a car starts from rest and reaches a speed of 20 m/s in 4 seconds, the acceleration can be calculated as follows:

$$a = \frac{20\,\text{m/s} - 0}{4\,\text{s}} = 5\,\text{m/s}^2$$

9. Given: Initial velocity (u) = 0m / s
Acceleration (a) = 4 m/s^2 Time (t) = 8 seconds.
- Use the first equation of motion: $v = u + at$.
- $v = 0 + \left(4\,\text{m/s}^2 \times 8\,\text{s}\right) = 32\,\text{m/s}$

10.
- The slope of a distance-time graph represents the speed of an object. The steeper the slope, the greater the speed
- Mathematically, the slope (m) is given by m

$$m = \frac{\text{Change in distance}}{\text{Change in time}}$$

- If the object is at rest, the distance-time graph will be a horizontal line (slope = 0).
  A straight, inclined line indicates constant speed.

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- Acceleration: Acceleration is the rate of change of velocity. It is a vector quantity.
- SI Unit: The SI unit of acceleration is m/s².
- Three Types of Acceleration:
  1.1. Positive Acceleration: When an object is speeding up, e.g., a car accelerating.
  1.2. Negative Acceleration (Retardation): When an object is slowing down, e.g., a car decelerating.
  1.3. Zero Acceleration: When an object is moving at a constant speed, e.g., a car moving with a constant velocity.

12.
- Given : initial velocity (u) = 0 m/s, Final velocity (v) = 30 m/s, time (t) = 10 seconds
- Use the equation $a = \frac{\Delta v}{\Delta t}$ to find acceleration.
- $a = \frac{30\,\text{m/s} - 0}{10\,\text{s}} = 3\,\text{m/s}^2$.
- Use the second equation of motion $s = ut + 1/2at^2$ to find the distance (s).

$$s = 0 \times 10 + \frac{1}{2} \times 3 \times 10^2 = 150 \text{ meters.}$$

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- Distance: Distance is the total path length traveled by an object. It is a scalar quantity and is always positive.
- Displacement: Displacement is the change in position of an object. It is a vector quantity and can be positive, negative, or zero.
- **Differences:**
  - 3.1. Direction: Distance is a scalar and has no direction. Displacement is a vector and has both magnitude and direction.
  - 3.2. Magnitude: Distance is always positive. Displacement can be positive, negative, or zero.

Examples:

- If a person walks around a circular track and returns to the starting point, the distance traveled is the total length of the track, but the displacement is zero.
- If a car moves 5 km east and then 3 km west, the distance is 8 km, but the displacement is 2 km west.

14. a. Total Distance:

- Calculate the area under the speed-time graph, which represents the total distance.
- Total Distance = Area of the shaded region.

b. Acceleration:

- Acceleration $(a) = \frac{\Delta v}{\Delta t}$
- Calculate the slope of the speed-time graph during the first 10 seconds

15. **Assertion is true.**

- Explanation: Acceleration is the rate of change of velocity. Even if the speed is constant, the direction might be changing, leading to non-zero acceleration.