Motion in a Straight Line

CHAPTER 3

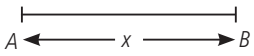
TRY YOURSELF

ANSWERS

1. The action or process of moving or being moved is called motion. Motion of train on a track is an example of motion.

2. Frame of reference is a system of graduated lines symbolically attached to a body that serve to describe position of points relative to the body.

3. If a body travels from point A to B and then returns to point A. In the whole journey, the body travels distance $2x$ but displacement of the body is zero. Hence if displacement is zero it does not necessarily mean that distance is also zero.



4. Path length is the total distance an object travels. For example, if a body covers half the circumference of a circle of radius r, the distance travelled is $d = \pi r$.

5. The distance and displacement of a moving object will have the same magnitude when the object moves along a straight line in the same fixed direction.

6. Given that, $r = 50$ m

$$\text{Average speed} = \frac{\text{Total distance covered}}{\text{Total time taken}}$$

$$= \frac{2\pi(50)\,\text{m}}{4 \times 60\,\text{s}} = 1.3\,\text{m/s}$$

7. Instantaneous speed is the speed of an object at given instant of time. Average speed is total distance travelled divided by elapsed time.

8. The speedometer of a car reveals information about the instantaneous speed of the car.

9. When an object is moving along a straight path, magnitude of average velocity is equal to the average speed.
Therefore, numerical ratio of average velocity to average speed is one.

10. Velocity is a vector quantity.

11. Speed is a scalar quantity whereas velocity is a vector quantity.

12. Instantaneous velocity.

13. A body is said to be in uniform motion if it covers equal distances in equal time intervals. For example, a car moving with a speed of 1 km/h, covers 1 km in one hour.

14. For stationary object, its position will not change with time. Thus, for a stationary object, position-time graph is a straight line parallel to time axis.

15. Acceleration is the rate of change of velocity. Its SI unit is m/s^2.

16. If a body moves with uniform retardation, the velocity-time graph is a straight line.

17. Let a be the uniform acceleration of the body. Then

$$x = \frac{1}{2}a(2)^2 = 2a \text{ and } x + y = \frac{1}{2}a(4)^2 = 4(2a) = 4x$$

$\therefore \quad y = 4x - x = 3x$

18. (i) $v = u + at$ (ii) $s = ut + \frac{1}{2}at^2$

(ii) $v^2 - u^2 = 2as$

19. Let t be the time taken by the ball to reach the highest point.

As, $v = u + at$

Here, $u = 30\ \text{m s}^{-1}$

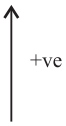
$v = 0$ (At highest point velocity is zero)

$a = -g = -10\ \text{m s}^{-2}$

$\therefore \quad 0 = 30 - 10t$ or $t = 3$ s

$\because$ Time taken by the ball to return to player's hand

$= 3\text{ s} + 3\text{ s} = 6\text{ s}$.



20. (a) $u = 0$, $a = 9\ \text{m/s}^2$, $x = 50$ m

From, $v^2 - u^2 = 2ax$

$v^2 = 2 \times 9 \times 50 = 900 \quad \Rightarrow \quad v = 30$ m/s

(b) From, $v = u + at$

$\therefore \quad 30 = 0 + 9t \quad \Rightarrow \quad t = 3.3$ s

21. Let d_s be the distance travelled by the vehicle before it stops.

Here, final velocity $v = 0$, initial velocity $= u$, $S = d_s$

Using equation of motion, $v^2 = u^2 + 2aS$

$\therefore \quad (0)^2 = u^2 + 2ad_s$

or $\quad d_s = -\frac{u^2}{2a} \Rightarrow d_s \propto u^2$

22. There is a small delay before you apply your brakes after you see the stop lights of a car just in front of you go on. This time is called your reaction time. For example, if a person is driving a car and suddenly an animal appears on the road, then the time elapsed before he applies the brakes of the car is the reaction time.

23. Relative velocity is the velocity with which one or more objects move in a frame which is non-stationary with respect to another observer.

24. When the two object are moving with same speed in the same direction (*i.e.*, equal velocities).

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