Class XI: Physics
Chapter 2: Motion in a Straight Line

Chapter Notes

Key Learnings:

1. For motion in a straight line, position to the right of the origin is taken as positive and to the left as negative.
2. A body in straight line motion can have the line of path as vertical, horizontal or slanted.
3. Path length is defined as the total length of the path traversed by an object.
4. Distance: Total path length covered during a given time interval.
5. Displacement: Shortest straight line distance between the initial and final position.
6. Path length is greater or equal to the magnitude of the displacement between the same points.
7. An object is said to be in uniform motion in a straight line if its displacement is equal in equal intervals of time. Otherwise the motion is said to be non-uniform.
8. Average speed: Total distance traveled divided by the total time taken.
9. Average velocity: Total displacement divided by total time taken.
10. The average speed of an object is greater or equal to the magnitude of the average velocity over a given time interval.
11. Slope of the x-t graph gives the velocity at a given instant.

12. Position time graph of a body in non uniform motion is curved.

13. Velocity time graph of a body in non uniform accelerated motion is curved.

14. Slope of v-t graph gives the acceleration at that instant.

15. The area between the v-t graph and the time axis gives the displacement

16. The steepness of the slope of position vs. time graph tells us the magnitude of the velocity & its sign indicates the direction of the velocity.

17. If the tangent to the position vs. time curve slopes upward to the right on the graph, the velocity is positive.

18. If the tangent to the position time graph slopes downward to the right, the velocity is negative.

19. For one-dimensional motion, the slope of the velocity vs. time graph at a time gives the acceleration of the object at that time.

Top formulae

1. Displacement: $\Delta x = x_2 = x_1$

2. Average velocity: $\bar{v} = \dfrac{\text{Displacement}}{\text{time interval}} = \dfrac{\Delta x}{\Delta t}$

3. Instantaneous velocity: $v = \lim\limits_{\Delta t \to 0} \bar{v} = \lim\limits_{\Delta t \to 0} \dfrac{\Delta x}{\Delta t} = \dfrac{dx}{dt}$

4. Average acceleration: $\bar{a} = \dfrac{\Delta v}{\Delta t}$

5. Instantaneous acceleration: $a = \lim\limits_{\Delta t \to 0} \bar{a} = \lim\limits_{\Delta t \to 0} \dfrac{\Delta v}{\Delta t} = \dfrac{dv}{dt}$

6. Kinematics' equations of motion:

$$v = v_0 + at$$

$$x = v_0 t + \frac{1}{2} a t^2$$

$$v^2 = v_0^2 + 2ax$$