Chapter- 03

Motion in a Straight Line

Very Short Answer Type Questions (1 mark)

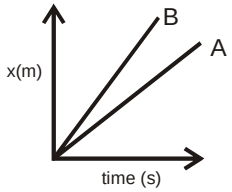
1. A body makes 5 complete revolutions in a circle of radius 1m. Find the distance and displacement of the body.
2. If the displacement of a body is zero, is the distance covered by it necessarily zero?
3. What is the significance of the slope of the x-t graph?
4. Under what condition will the distance and displacement of a moving object will have the same magnitude.?
5. If the position of a particle at instant t is given by $x=t^3$, find the acceleration of the particle.
6. Can a moving body have relative velocity zero with respect to another body? Give an example.
7. A ball dropped from height h reaches the ground in t secs. After what time the ball was passing through a point at height h/2?

Short Answer Type Questions (2 marks)

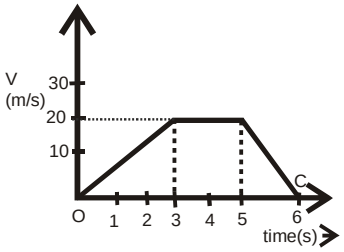
8. Given that $S = 5 - 7t - 6t^2$.
   a) Find instantaneous speed as a function of time.
   b) Find it's initial speed.
9. The displacement of the body is given by $x=1+2t+3t^2$. Where t represents time. Find the value of instantaneous acceleration.
10. A particle moves along the positive x-axis in such a way that coordinates vary in time. According to the expression $x=4+2t-3t^2$ where x is in meter and 't' in seconds.
    a) Find it's initial position and initial velocity of the particle.
    b) Determine at what time the particle reaches maximum co-ordinates.
    c) Calculate the position, velocity, and acceleration at t = 2 sec.
11. A car starts from rest and picks up speed till in 10 sec and thereafter move with uniform speed, till t = 18S, then the breaks are applied and the car stops and 20S after covering 296m. Draw position & time graph.

Short Answer Type Questions (3 marks)

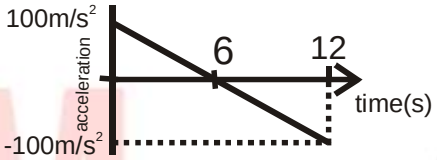
12. Draw a graph for position - time for motion with
    a) +ve acceleration
    b) -ve acceleration
    c) zero acceleration
13. Prove that the distance traveled by an object in n^{th} second is given by $S_{nth}=u+\frac{a}{2}(2n-1)$.
14. A body covers 12m in the third second of its motion and 20 m in 5th second. Calculate the velocity of the body after 10 seconds.
15. Mention of two bodies A and B are shown in the distance vs time graph which has more speed.



16. Interpret the following speed-time graph and find the acceleration and retardation required. Find the average speed from 0 to 6 sec.



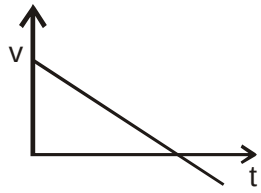
17. Shown in the acceleration time curve. What is the final velocity at t = 12s? If velocity at t = 0 in 200 m/s



18. A jet airplane traveling at the speed of 500 kmh^{-1} ejects its products of combustion at the speed of 1500 kmh^{-1} relative to the jet plane. What is the speed of the latter with respect to an observer on the ground?
19. A ball is dropped from a height of 90 m on a floor. At each collision with the floor, the ball loses one-tenth of its speed. Plot the speed-time graph of its motion between t=0 to 12s.

Long Answer Type Questions (5 marks)

20. Two train A and B of length 400m on each is moving on two parallel tracks with a uniform speed of 72 km/h in the same direction, with A ahead of B. The driver of B decided to overtake A and accelerates by 1 m/s^2. If after 50s, the guard of B just crosses the driver of A. Calculate the original distance between the two trains.
21. What type of motion does the following velocity-time curve represent?
22. Convert the velocity and time graph into



(i) $S \square t$ (ii) $\vec{a} \square t$ (iii) $\vec{S} \square t$ (iv) $v \square t$ (v) $\vec{a} \square \vec{v}$ (vi) $\vec{v} \square \vec{s}$ graph.

23. In which of the following examples of motion, can the body be considered approximately a point object:
    a) a railway carriage moving without jerks between two stations.
    b) a monkey sitting on top of a man, cycling smoothly on a circular track.
    c) a spinning cricket ball that turns sharply on hitting the ground.
    d) a tumbling beaker that has slipped off the edge of a table.
24. Two trains A and B of length 400 m each are moving on two parallel tracks with a uniform speed of 72 km h-1 in the same direction, with A ahead of B. The driver of B decides to

overtake A and accelerates by 1 ms^{-2}. If after 50 s, the guard of B just brushes past the driver of A, what was the original distance between them?

25. A balloon is ascending at a rate of 14 ms^{-1} at a height of 98 m. above the ground when a packet is dropped from the balloon. After how much time and with what velocity does it reach the ground?
26. Two stones are thrown up simultaneously from the edge of a cliff 22 m high with initial speeds of 15 ms^{-1} and 30 ms^{-1} verify that the graph shown in figure correctly represents the time variation of the relative position of the second stone with respect to first. Neglect air resistance and assume that the stones do not rebound after hitting the ground. Take g = 10ms^{-2}.
27. A car starting from rest, accelerates at the rate f through a distance s, then continues at a constant speed for some time, t and then decelerate at the rate f/2 to come to rest. If the total distance is 5s., then prove that $s = \frac{1}{2} ft^2$.
28. A body is projected vertically upwards from A, the top of a tower it reaches the ground in it t_1 second. If it is projected vertically downwards from A with the same velocity it reaches the ground in t_2 second. If it falls freely, from A, prove that it would reach the ground in $\sqrt{t_1 t_2}$ second.