1 PUC: CHAPTER- 03

MOTION IN A STRAIGHT LINE

1. A body is projected vertically upwards with a velocity u. It crosses a point in its journey at a height h twice, just after 1s and 7s. The value of u in ms^{-1} is ($g = 10ms^{-2}$)
(a) 50 (b) 40 (c) 30 (d) 20

2. A body dropped from a height h with initial velocity zero, strikes the ground with a velocity of 3 m/s. Another body of same mass is dropped from the height h with an initial velocity of 4 m/s. Find the velocity of second mass with which it strikes the ground.
(a) 3 m/s (b) 4 m/s (c) 5 m/s (d) 12 m/s

3. A stone projected upwards with a velocity u reaches two points P and Q separated by a distance h with velocities u/2 and u/3 respectively. The maximum height reached by it is
(a) $\frac{9h}{5}$ (b) $\frac{18h}{5}$ (c) $\frac{36h}{5}$ (d) $\frac{72h}{5}$

4. A ball is thrown vertically upwards from the ground. If T_1 and T_2 are the respective time taken in going up and coming down, and the air resistance is not ignored, then
(a) $T_1 > T_2$ (b) $T_1 = T_2$ (c) $T_1 < T_2$ (d) noting can be said

5. A particle moves along a straight line. Its position at any instant is given by $x = 32t - \frac{8t^3}{3}$ where x is in metres and t in second. Find the acceleration of the particle at the instant when particle is at rest.
(a) -16 ms^{-2} (b) -32 ms^{-2} (c) 32 ms^{-2} (d) 16 ms^{-2}

6. A stone is dropped from the top of a tower and one second later, a second stone is thrown vertically downward with a velocity 20 ms^{-1}. The second stone will overtake the first after travelling a distance of ($g=10$ ms^{-2})
(a) 13 m (b) 15 m (c) 11.25 m (d) 19.5 m

7. Two identical stones are shot upward one after another at an interval of 2s along the same vertical line with same initial velocity of 40 ms^{-1}. The height at which the stones collide is ($g = 10$ ms^{-2})
(a) 50 m (b) 75 m (c) 100 m (d) 125 m

8. A moving car possesses average velocities of 5 ms^{-1}, 10 ms^{-1} and 15 ms^{-1} in the first, second and third seconds, respectively. What is the total distance covered by the car in these 3s?
(a) 15 m (b) 30 m (c) 55 m (d) 10 m

9. Two trains, each travelling with a speed of 37.5 kmh^{-1}, are approaching each other on the same straight track. A bird that can fly at a constant speed of 60 kmh^{-1} flies off from one train when they are 90 km apart and heads directly for the other train. On reaching the other train, it flies back to the first and so on. Total distance covered by the bird is
(a) 90 km (b) 54 km (c) 36 km (d) 72 km

10. A train is moving at constant speed V when its driver observes another train in front of him on the same track and moving in the same direction with constant speed v. If the distance between the trains is x, then what should be the minimum retardation of the train so as to avoid collision?
(a) $\frac{(V+v)^2}{x}$ (b) $\frac{(V-v)^2}{x}$ (c) $\frac{(V+v)^2}{2x}$ (d) $\frac{(V-v)^2}{2x}$

11. Two objects are moving along the same straight line. They cross a point A with an acceleration α, 2 α and velocity 2u, u at time t = 0. The distance moved by the object when one overtakes the other is
(a) $\frac{6u^2}{\alpha}$ (b) $\frac{2u^2}{\alpha}$ (c) $\frac{4u^2}{\alpha}$ (d) $\frac{8u^2}{\alpha}$

12. The distance travelled by a particle starting from rest and moving with acceleration $\frac{4}{3}ms^{-2}$, in the third second is
(a) $\frac{10}{3}$m (b) $\frac{19}{3}$m (c) 6 m (d) 4 m

13. A man is 45 m behind the bus when the bus starts accelerating from rest with acceleration 2.5 m/s^2. With what minimum velocity should the man start running to catch the bus
(a) 12 m/s (b) 14 m/s (c) 15 m/s (d) 16 m/s

14. The displacement x of a particle varies with time t, $x = ae^{-\alpha t} + be^{\beta t}$, where a, b, α and β are positive constants. The velocity of the particle will
a) go on decreasing with t b) be independent of α and β
c) drop to zero when $\alpha = \beta$ d) go on increasing with time

15. The velocity of a particle is $v = v_0 + gt + ft^2$. If its position is x = 0 at t = 0, then its displacement after time t = 1s is
(a) $v_0 + 2g + 3f$ (b) $v_0 + g/2 + f/3$ (c) $v_0 + g + f$ (d) $v_0 + g/2 + f$

16. The relation $3t = \sqrt{3x+6}$ describes the displacement of a particle in one direction where x is in metres and t in second. The displacement, when velocity is zero, is
(a) 24 m (b) 12 m (c) 5 m (d) Zero

17. P is the point of contact of a wheel and the ground. The radius of the wheel is 1 m. The wheel rolls on the ground without slipping. The displacement of point P when the wheel completes half rotation is

(a) 2 m (b) $\sqrt{\pi^2+4}$ m (c) π m (d) $\sqrt{\pi^2+2}$ m

18. Two trains A and B 100 km apart are travelling towards each other on different tracks with starting speed of 50 kmph for both. The train A accelerates at 18 kmph^2 and the train B retard at the rate 18 kmph^2. The distance covered by the train A when they cross each other is

(a) 45 km (b) 59 km (c) 65 km (d) None

19. A particle's position as a function of time is described as $y(t) = 2t^2 + 3t + 4$ (in m). What is the average velocity of the particle from t = 0 to t = 3 s?

(a) 3 m/s (b) 6 m/s (c) 9 m/s (d) 12 m/s

20. A train of 150 m length is going towards north direction at a speed of 10 ms^{-1}. A parrot flies at the speed of 5 ms^{-1} towards south direction parallel to the railway track. The time taken by the parrot to cross the train is

(a) 12 s (b) 10 s (c) 15 s (d) 8 s

21. A juggler keeps on moving four balls in air throwing the balls vertically upwards after regular intervals. When one ball leaves his hand (speed = 20 ms^{-1}) the position of other balls (height in metre) will be (take g= 10 ms^{-2})

(a) 10, 20, 10 (b) 15, 20, 15 (c) 5, 15, 20 (d) 5, 10, 20

22. A ball is dropped from a bridge 122.5 m high. After the first ball has fallen for 2 s, a second ball is thrown straight down after it. What must the initial velocity of the second ball be, so that both the balls hit the surface of water at the same time? (g = 9.8 ms^{-2})

(a) 49 m/s (b) 55.5 m/s (c) 26.1 m/s (d) 9.8 m/s

23. A body of mass 3 kg falls from the multi storied building 100 m high and buries itself 2 m deep in the sand. The time of penetration will be: (g = 9.8 ms^{-2})

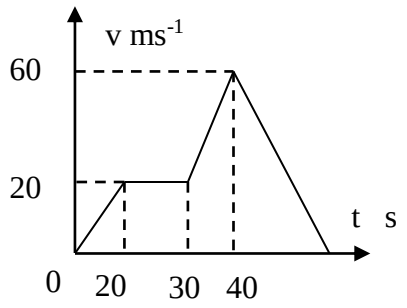
(a) 9 s (b) 0.9 s (c) 0.09 s (d) 10 s

24. The velocity-time graph of a body is given in figure. The maximum acceleration in ms^{-2} is

(a) 4

(b) 3

(c) 2

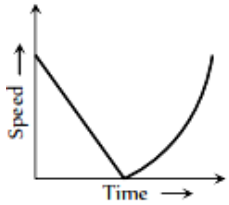


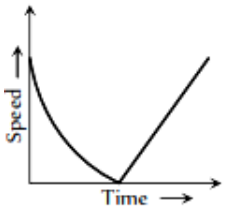
(d) 1

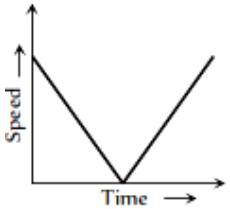
25. A body travels 200 cm in the first 2 s and 220 cm in the next 4 s with deceleration. The velocity of the body at the end of the 7^{th} second is
(a) 5 cms^{-1} (b) 10 cms^{-1} (c) 15 cms^{-1} (d) 20 cms^{-1}

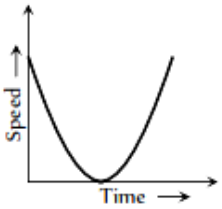
26. A body A starts from rest with an acceleration a_1. After 2 s, another body B starts from rest with an acceleration a_2. If they travel equal distances in the 5^{th} second, after the start of A, then the ratio $a_1 : a_2$ is equal to:
(a) 5:9 (b) 5:7 (c) 9:5 (d) 9:7

27. A ball is thrown vertically upwards. Which of the plots represents the speed-time graph of the ball during its flight if the air resistance is not ignored?

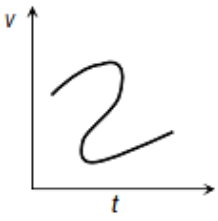
(a) 

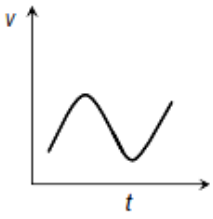
(b) 

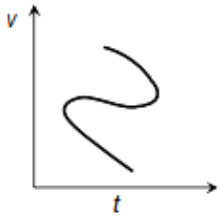
(c) 

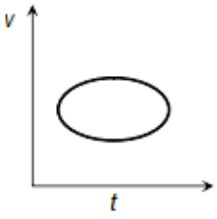
(d) 

28. Which of the following velocity-time graphs shows a realistic situation for a body in motion?

(a) 

(b) 

(c) 

(d) 

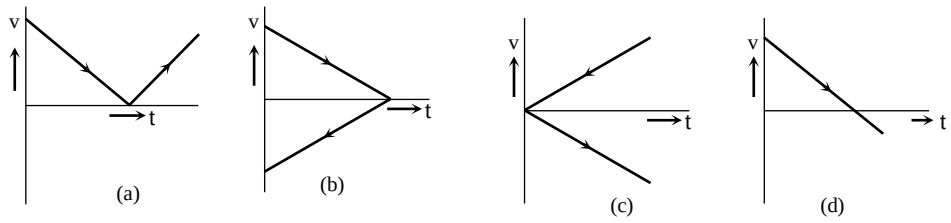
29. A particle is moving with a constant speed v in a circle. What is the magnitude of average velocity after half rotation?
(a) 2v (b) $2\frac{v}{\pi}$ (c) $\frac{v}{2}$ (d) $\frac{v}{2\pi}$

30. Two trains A and B, 100m and 60m long, are moving in opposite directions on parallel tracks. The velocity of the shorter train is 3 times that of the longer train. If the trains take 4s to cross each other, the velocities of the trains are
(a) V_A=10 ms^{-1}, V_B=30 ms^{-1} (b) V_A=2.5 ms^{-1}, V_B=7.5 ms^{-1}
(c) V_A=20 ms^{-1}, V_B=60 ms^{-1} (d) V_A=5 ms^{-1}, V_B=15 ms^{-1}

31. Two trains one travelling at 15 ms^{-1} and other at 20 ms^{-1} are headed towards one another along a straight track. Both the drives apply brakes simultaneously when they are 500 m apart. If each train has a retardation of 1 ms^{-2}, the separation after they stop is:
(a) 192.5 m (b) 225.5 m (c) 187.5 m (d) 155.5 m

32. B_1, B_2 and B_3 are three balloons ascending with the velocities v, 2v and 3v respectively. If a bomb dropped from each when they are at the same height, then
(a) Bomb from B_1 reaches ground first (b) Bomb from B_2 reaches ground first
(c) Bomb from B_3 reaches ground first (d) They reach ground simultaneously.

33. A ball is thrown vertically upwards. Which of the following graph/graphs represent velocity-time graph of the ball during its flight (air resistance is neglected)



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34. An object moving with a speed of 6.25 ms^{-1}, is decelerated at a rate given by $\frac{dv}{dt} = -2.5\sqrt{v}$, where v is the instantaneous speed. The time taken by the object, to come to rest, would be
(a) 1 s (b) 2 s (c) 4 s (d) 8 s

35. A particle moving with uniform acceleration has average velocities v_1, v_2 and v_3 over the successive intervals of time t_1, t_2 and t_3 respectively. The value of $(v_1 - v_2) / (v_2 - v_3)$ will be:
(a) $\frac{(t_1 - t_2)}{(t_2 - t_3)}$ (b) $\frac{(t_1 - t_2)}{(t_2 + t_3)}$ (c) $\frac{(t_1 + t_2)}{(t_2 - t_3)}$ (d) $\frac{(t_1 + t_2)}{(t_2 + t_3)}$

36. The relation between time t and distance x is: $t = \alpha x^2 + \beta x$, where α and β are constants. The retardation is
(a) $2\alpha v^3$ (b) $2\beta v^3$ (c) $2\alpha\beta v^3$ (d) $2\beta^2 v^3$

37. A train has a speed of 60 km/h, for the first one hour and 40 km/h for the next half an hour. Its average speed in km/h is
(a) 50 (b) 53. 33 (c) 48 (d) 70

38. The acceleration a of a particle starting from rest varies with time according to relation $a = \alpha t + \beta$. The velocity of the particle after a time t will be
(a) $\frac{\alpha t^2}{2} + \beta$ (b) $\frac{\alpha t^2}{2} + \beta t$ (c) $\alpha t^2 + \frac{1}{2}\beta t$ (d) $\frac{\left(\alpha t^2 + \beta\right)}{2}$

39. A point initially at rest moves along x-axis. Its acceleration varies with time as a = (6t + 5) m/s^2. If its starts from origin, the distance covered in 2 s is
(a) 20 m (b) 18 m (c) 16m (d) 25 m

40. The velocity time relation of an electron starting from rest is given by v = 2t (in ms^{-1}). The distance travelled in 3 s is
(a) 9 m (b) 16 m (c) 27 m (d) 36 m

41. A body is moving with uniform acceleration describes 40 m in the first 5 s and 65 m in next 5 s. Its initial velocity will be
(a) 4 m/s (b) 2.5 m/s (c) 5.5 m/s (d) 11 m/s

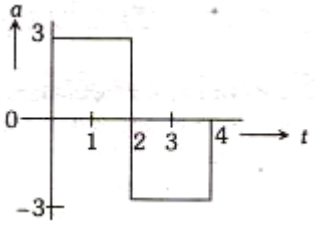
42. Two bodies of different masses m_a and m_b are dropped from two different heights a and b. The ratios of the time taken by the two bodies to cover these distances are
(a) a : b (b) b : a (c) $\sqrt{a} : \sqrt{b}$ (d) $a^2 : b^2$

43. Water drops fall at regular intervals from a tap which is 5 m above the ground. The third drop is leaving the tap at the instant the first drop touches the ground. How far above the ground is the second drop at that instant?
(a) 2.50 m (b) 3.75 m (c) 4.00 m (d) 1.25 m

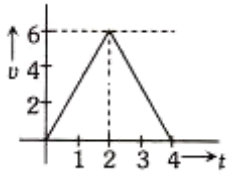
44. A balloon is rising vertically up with a velocity of 29 ms^{-1}. A stone is dropped from it and it reaches the ground in 10 s. The height of the balloon when the stone was dropped from it is (g = 9.8 ms^{-2})
(a) 100 m (b) 200 m (c) 400 m (d) 150 m

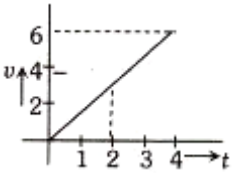
45. The acceleration of a particle is increasing linearly with time t as bt. The particle starts from the origin with an initial velocity v_0. The distance travelled by the particle in time t will be
(a) $v_0 t + \frac{1}{3}bt^2$ (b) $v_0 t + \frac{1}{3}bt^3$ (c) $v_0 t + \frac{1}{6}bt^3$ (d) $v_0 t + \frac{1}{2}bt^2$

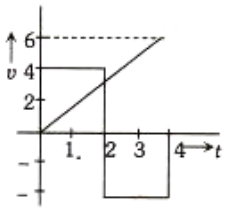
46. A particle starts from rest at $t = 0$ and undergoes an acceleration a in ms^{-2} with time 't' in seconds which is as shown.

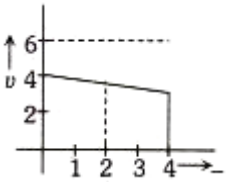


Which one of the following plot represents velocity V in ms^{-1} versus time 't' in seconds.

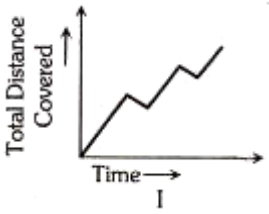
(a) 

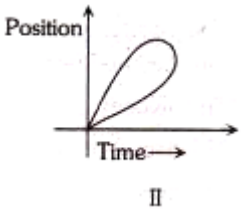
(b) 

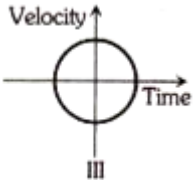
(c) 

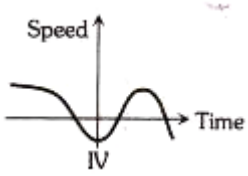
(d) 

47. Which of the following graphs cannot possibly represent one dimensional motion of a particle?









(a) I and II (b) II and III (c) II and IV (d) All four

48. Two identical balls are shot upward one after another at an interval of 2s along the same vertical line with same initial velocity of 40 ms^{-1}. The height at which the balls collide is
(a) 50 m (b) 75 m (c) 100 m (d) 125 m

49. The velocity υ and displacement r of a body are related as $\upsilon^2 = kr$, where k is a constant. What will be the velocity after 1 second? (Given that the displacement is zero at t = 0)
(a) $\sqrt{kr}$ (b) $kr^{3/2}$
(c) $\frac{k}{2}r^0$ (d) Data is not sufficient

50. A stone is dropped from the 25^{th} storey of a multi-storeyed building and it reaches the ground in 5s. In the first second, it passes through how many storeys of the building ($g = 10\ ms^{-2}$)
(a) 1 (b) 2 (c) 3 (d) None