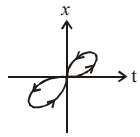
2

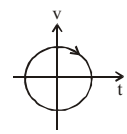
MOTION IN A STRAIGHT LINE

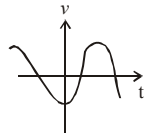
MCQs with One Correct Answer

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

2. Which of the following graph cannot possibly represent one dimensional motion of a particle?

(a) 

(b) 

(c) 

(d) All of the above

3. A body moving with a uniform acceleration crosses a distance of 65 m in the 5 th second and 105 m in 9th second. How far will it go in 20 s?
(a) 2040 m (b) 240 m
(c) 2400 m (d) 2004 m

4. When two bodies move uniformly towards each other, the distance decreases by 6 ms^{-1}. If both bodies move in the same directions with the same speed (as above), the distance between them increases by 4 ms^{-1}. Then the speed of the two bodies are
(a) 3 ms^{-1} and 3 ms^{-1}
(b) 4 ms^{-1} and 2 ms^{-1}
(c) 5 ms^{-1} and 1 ms^{-1}
(d) 7 ms^{-1} and 3 ms^{-1}

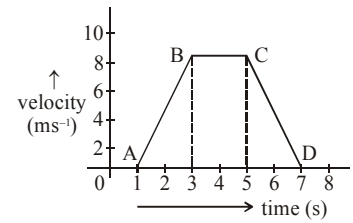
5. For the velocity time graph shown in the figure below the distance covered by the body in the last two seconds of its motion is what fraction of the total distance travelled by it in all the seven seconds?

(a) $\frac{1}{2}$

(b) $\frac{1}{4}$

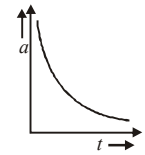
(c) $\frac{2}{3}$

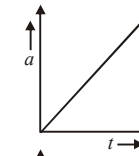
(d) $\frac{1}{3}$

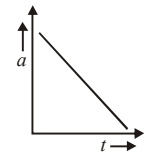


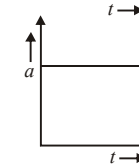
6. A particle moves for 20 seconds with velocity 3 m/s and then with velocity 4 m/s for another 20 seconds and finally moves with velocity 5 m/s for next 20 seconds. What is the average velocity of the particle ?
(a) 3 m/s (b) 4 m/s
(c) 5 m/s (d) Zero

7. The distance travelled by a body moving along a line in time t is proportional to t^3.
The acceleration-time (a, t) graph for the motion of the body will be

(a) 

(b) 

(c) 

(d) 

8. A goods train accelerating uniformly on a straight railway track, approaches an electric pole standing on the side of track. Its engine passes the pole with velocity u and the guard's room passes with velocity v. The middle wagon of the train passes the pole with a velocity.

(a) $\frac{u+v}{2}$ (b) $\frac{1}{2}\sqrt{u^2+v^2}$

(c) $\sqrt{uv}$ (d) $\sqrt{\left(\frac{u^2+v^2}{2}\right)}$

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

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

10. A car, starting from rest, accelerates at the rate f through a distance S, then continues at constant speed for time t and then decelerates at the rate $\frac{f}{2}$ to come to rest. If the total distance traversed is 15 S, then

(a) $S = \frac{1}{6}ft^2$ (b) $S = ft$

(c) $S = \frac{1}{4}ft^2$ (d) $S = \frac{1}{72}ft^2$

11. A particle located at $x = 0$ at time $t = 0$, starts moving along with the positive x-direction with a velocity 'v' that varies as $v = \alpha\sqrt{x}$. The displacement of the particle varies with time as
(a) t^2 (b) t (c) $t^{1/2}$ (d) t^3

12. A person climbs up a stalled escalator in 60 s. If standing on the same but escalator running with constant velocity he takes 40 s. How much time is taken by the person to walk up the moving escalator?
(a) 37 s (b) 27 s (c) 24 s (d) 45 s

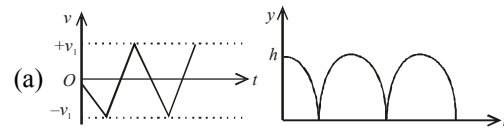
13. From a tower of height H, a particle is thrown vertically upwards with a speed u. The time taken by the particle, to hit the ground, is n times that taken by it to reach the highest point of its path. The relation between H, u and n is:

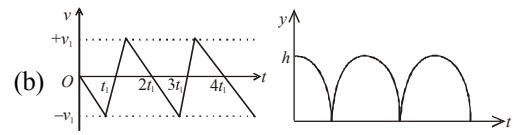
(a) $2gH = n^2u^2$ (b) $gH = (n-2)^2u^2d$
(c) $2gH = nu^2(n-2)$ (d) $gH = (n-2)u^2$

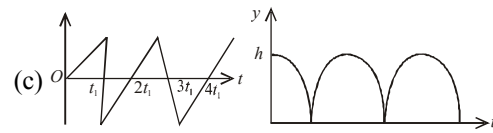
14. If a body looses half of its velocity on penetrating 3 cm in a wooden block, then how much will it penetrate more before coming to rest?

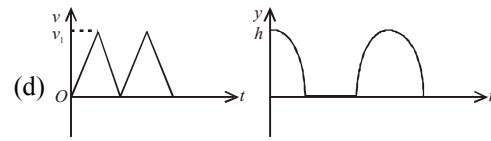
(a) 1 cm (b) 2 cm
(c) 3 cm (d) 4 cm.

15. Consider a rubber ball freely falling from a height $h = 4.9$ m onto a horizontal elastic plate. Assume that the duration of collision is negligible and the collision with the plate is totally elastic.
Then the velocity as a function of time and the height as a function of time will be :

(a) 

(b) 

(c) 

(d) 

16. The position of a particle as a function of time t, is given by
$x(t) = at + bt^2 - ct^3$
where, a, b and c are constants. When the particle attains zero acceleration, then its velocity will be:

(a) $a + \frac{b^2}{4c}$ (b) $a + \frac{b^2}{3c}$

(c) $a + \frac{b^2}{c}$ (d) $a + \frac{b^2}{2c}$

17. A car is standing 200 m behind a bus, which is also at rest. The two start moving at the same instant but with different forward accelerations. The bus has acceleration 2 m/s^2 and the car has acceleration 4 m/s^2. The car will catch up with the bus after a time of :

(a) $\sqrt{110}$ s (b) $\sqrt{120}$ s
(c) $10\sqrt{2}$ s (d) 15 s

18. A person standing on an open ground hears the sound of a jet aeroplane, coming from north at an angle 60º with ground level. But he finds the aeroplane right vertically above his position. If v is the speed of sound, speed of the plane is:

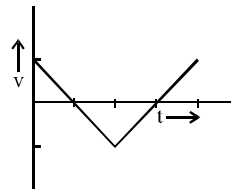
(a) $\frac{\sqrt{3}}{2}v$ (b) $\frac{2v}{\sqrt{3}}$

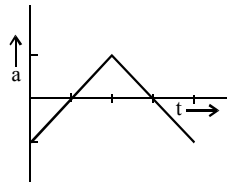
(c) v (d) $\frac{v}{2}$

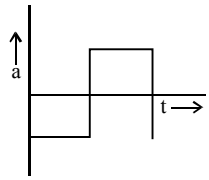
19. A passenger train of length 60 m travels at a speed of 80 km/hr. Another freight train of length 120 m travels at a speed of 30 km/h. The ratio of times taken by the passenger train to completely cross the freight train when: (i) they are moving in same direction, and (ii) in the opposite directions is:

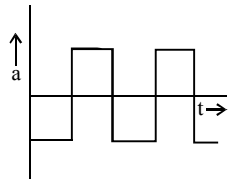
(a) $\frac{11}{5}$ (b) $\frac{5}{2}$ (c) $\frac{3}{2}$ (d) $\frac{25}{11}$

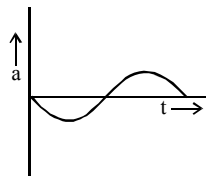
20. The graph shown in figure shows the velocity v versus time t for a body. Which of the graphs represents the corresponding acceleration versus time graphs?



(a)


(b)


(c)


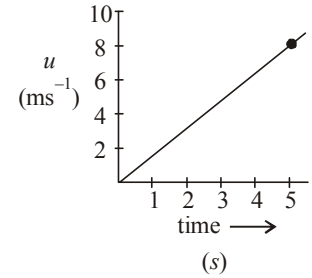
(d)


Numeric Value Answer

21. A parachutist after bailing out falls 50 m without friction. When parachute opens, it decelerates at 2 m/s^2 . He reaches the ground with a speed of 3 m/s. At what height (in m), did he bail out ?

22. An automobile travelling with a speed of 60 km/h, can brake to stop within a distance of 20m. If the car is going twice as fast i.e., 120 km/h, the stopping distance (in m) will be

23. The speed verses time graph for a particle is shown in the figure. The distance travelled (in m) by the particle during the time interval $t = 0$ to $t = 5$ s will be _____.



24. The distance x covered by a particle in one dimensional motion varies with time t as $x^2 = at^2 + 2bt + c$. If the acceleration of the particle depends on x as x^{-n}, where n is an integer, the value of n is _____.

25. A ball is dropped from the top of a 100 m high tower on a planet. In the last $\frac{1}{2}$ s before hitting the ground, it covers a distance of 19 m. Acceleration due to gravity (in ms^{-2}) near the surface on that planet is _____.

26. An object, moving with a speed of 6.25 m/s, is decelerated at a rate given by

$\frac{dv}{dt} = -2.5\sqrt{v}$ where v is the instantaneous speed. The time (in second) taken by the object, to come to rest, would be:

27. A cat, on seeing a rat at a distant of d = 5 m, starts with velocity u = 5 ms^{-1} and moves with acceleration $\alpha = 2.5$ ms^{-2} in order to catch it, while

the rate with acceleration β starts from rest. For what value of β will be the cat overtake the rat ? (in ms^{-2})

28. A particle is moving in a straight line with initial velocity and uniform acceleration a. If the sum of the distance travelled in t^{th} and $(t + 1)^{th}$ seconds is 100 cm, then its velocity after t seconds, in cm/s, is

29. A body is thrown vertically upwards with velocity u. The distance travelled by it in the fifth and the sixth seconds are equal. The velocity u (in m/s) is given by ($g = 9.8\ m/s^2$)

30. If you throw a ball vertically upward with an initial velocity of 50 m/s, approximately how long (in second) would it take for the ball to return to your hand? Assume air resistance is negligible.

ANSWER KEY																			
1	(d)	**4**	(c)	**7**	(b)	**10**	(d)	**13**	(c)	**16**	(b)	**19**	(a)	**22**	(80)	**25**	(8)	**28**	(50)
2	(d)	**5**	(b)	**8**	(d)	**11**	(a)	**14**	(a)	**17**	(c)	**20**	(b)	**23**	(20)	**26**	(2)	**29**	(49)
3	(c)	**6**	(b)	**9**	(b)	**12**	(c)	**15**	(b)	**18**	(d)	**21**	(293)	**24**	(3)	**27**	(5)	**30**	(10)