02 - DESCRIPTION OF MOTION IN ONE DIMENSION

(Answers at the end of all questions)

1) 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 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) $S = \frac{1}{72} ft^2$ [AIEEE 2005]

2) The relation between time t and distance x is $t = a x^2 + b x$ where a and b are constants. The acceleration is

(a) $2bv^3$ (b) $- 2abv^2$ (c) $2av^2$ (d) $- 2av^3$ [AIEEE 2005]

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

(a) 182 m (b) 91 m (c) 111 m (d) 293 m [AIEEE 2005]

(NOTE: Actually, frictional force in the upward direction is not constant but increases in proportion to the downward velocity. Hence, the downward deceleration of the parachutist keeps decreasing and he finally reaches a constant terminal velocity.)

4) A ball is released from the top of a tower of eight h metres. It takes T seconds to reach the ground. What s the position of the ball in T / 3 seconds ?

(a) h / 9 m from the ground (b) 7h / 9 m from the ground

(c) 8h / 9 m from the ground (d) 17h / 18 m from the ground [AIEEE 2004]

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

(a) 20 m (b) 40 m (c) 60 m (d) 80 m [AIEEE 2004]

6) A car moving with a speed of 50 km / hr can be stopped by brakes in 6 m. If the same car is moving with a speed of 100 km / hr, then minimum stopping distance is

(a) 6 m (b) 12 m (c) 18 m (d) 24 m [AIEEE 2003]

7) Two cars 1 and 2, starting from rest are moving with speeds v_1 and v_2 m /s ($v_1 > v_2$). Car 2 is ahead of car 1 by 's' metres when the driver of car 1 sees car 2. What minimum retardation should be given to car 1 to avoid collision ?

(a) $\frac{v_1 - v_2}{2}$ (b) $\frac{v_1 + v_2}{2}$ (c) $\frac{[v_1 + v_2]^2}{2s}$ (d) $\frac{[v_1 - v_2]^2}{2s}$ [AIEEE 2002]

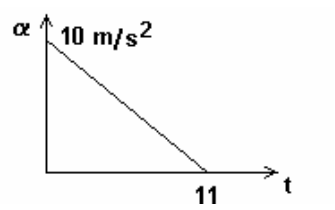
8) A car moves along a straight line whose motion is given by $s = 12t + 3t^2 - 2t^3$, where (s) is in metres and (t) is in seconds. The velocity of the car at start will be

(a) 7 m /s (b) 9 m /s (c) 12 m /s (d) 16 m /s [AIEEE 2002]

9) A particle starts from rest. Its acceleration (α) versus time (t) is as shown in the figure. The maximum speed of the particle will be

(a) 110 m /s (b) 55 m /s (c) 550 m /s (d) 660 m /s

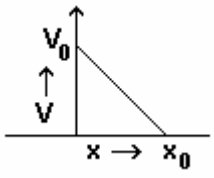
[IIT 2004]

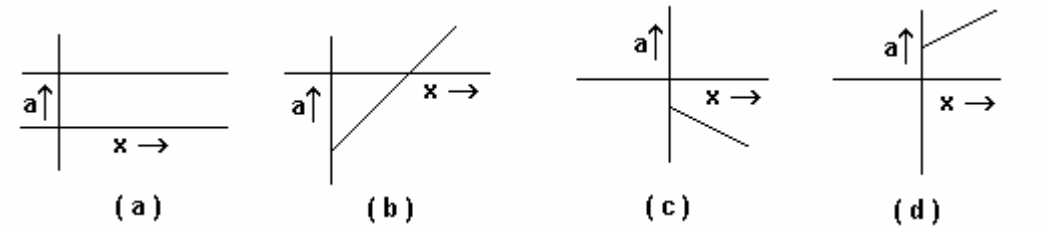


(Answers at the end of all questions)

10) If graph of velocity vs. distance is as shown, which of the following graphs correctly represents the variation of acceleration with displacement ?

[IIT 2005]





11) A particle of mass m moves on the x-axis as follows: it starts from rest at t = 0 from the point x = 0, and comes to rest at t = 1 at the point x = 1. No other information is available about its motion at intermediate times (0 < t < 1). If α denotes the instantaneous acceleration of the particle, then

(a) α cannot remain positive for all t in the interval $0 \le t \le 1$

(b) $|\alpha|$ cannot exceed 2 at any point in its path

(c) $|\alpha|$ must be ≥ 4 at some point or points in its path

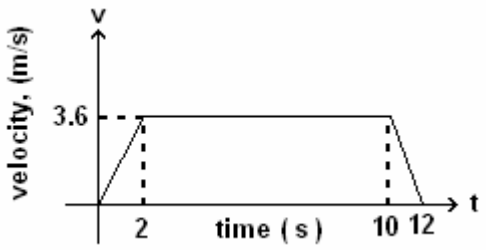
(d) α must change sign during the motion, but no other assertion can be made with the information given. [IIT 1993]

12) Four persons K, L, M and N are initially at the corners of a square of side of length d. If every person starts moving with velocity v such that K is always headed towards L, L towards M, M towards N and N towards K, then the four persons will meet after

(a) d/v s (b) $d\sqrt{2}/v$ s (c) $d/\sqrt{2}\,v$ s (d) d / 2v s [IIT 1984]

13) A lift is going up. The variation in the speed of the lift is as given in the graph.
What is the height to which the lift takes the passengers ?

(a) 3.6 m (b) 28.8 m
(c) 36 m
(d) cannot be calculated from the above graph



[IIT 1970]

14) In the above graph, what will be the average velocity of the lift ?
(a) 1 m/s (b) 2.88 m/s (c) 3.24 m/s (d) 3 m/s [IIT 1970]

15) In the graph of question 12), the average acceleration of the lift is
(a) 1.8 m/s^2 (b) - 1.8 m/s^2 (c) 0.3 m/s^2 (d) zero [IIT 1970]

(Answers at the end of all questions)

16) A car accelerates from rest at a constant velocity m for some time and then decelerates at a constant rate n to come to rest. If the total time of journey is t, then the maximum velocity acquired by the car is given by

(a) $\left(\frac{m+n}{mn}\right)t$ (b) $\left(\frac{mn}{m+n}\right)t$ (c) $\left(\frac{m^2 - n^2}{mn}\right)t$ (d) $\left(\frac{mn}{m-n}\right)t$

17) The coordinates of a moving particle at any time t are given by $x = at^2$ and $y = bt^2$. The speed of the particle at time t is given by

(a) $2t(a + b)$ (b) $\sqrt{a^2 + b^2}$ (c) $2t\sqrt{a^2 + b^2}$ (d) $2t\sqrt{a^2 - b^2}$

18) A stone thrown upwards with a velocity 10 m/s from the top of the tower reaches the ground with a velocity 20 m/s. The height of the tower, taking g = 10 m/s^2, is

(a) 10 m (b) 15 m (c) 20 m (d) 25 m

19) If 'a', 'b' and 'c' are the distances travelled by a particle during xth, yth and zth second from the start, then which of the following relations is valid ?

(a) $a(y - z) + b(z - x) + c(x - y) = 0$

(b) $a(x - y) + b(y - z) + c(z - x) = 0$

(c) $a(z - x) + b(x - y) + c(y - z) = 0$

(d) $ax + by + cz = 0$

20) The distance-time graph of a particle at time t makes an angle of 45° with the time axis. After 1 second, it makes an angle of 60° with the time axis. The acceleration of the particle is

(a) $\sqrt{3} - 1$ (b) $\sqrt{3} + 1$ (c) $\sqrt{3}$ (d) 1

21) A stone is dropped into a well in which the level of water is at a depth h below the top f the well. If v is the velocity of sound, then the time t after which the splash of sound is heard after dropping the ball is

(a) $\sqrt{\frac{2h}{g}} + \frac{h}{v}$ (b) $\frac{2h}{v}$ (c) $\sqrt{\frac{h}{2g}} + \frac{h}{v}$ (d) $\sqrt{\frac{h}{2g}} + \frac{2h}{v}$

22) The relation between time t and distance x is $t = ax^2 + bx$, where a and b are constants. If v represents the velocity, the retardation is

(a) $2av^2$ (b) $2bv^3$ (c) $2b^2v^3$ (d) $2ab\,v^3$ [NCERT 1982]

23) A particle moving with uniform acceleration has velocities u and v at points A and B in its path. The velocity of the body midway between A and B is

(a) $\frac{u+v}{2}$ (b) $\sqrt{\frac{u^2 + v^2}{2}}$ (c) $\sqrt{uv}$ (d) None of these

24) A particle moves with uniform acceleration and v_1, v_2 and v_3 denote the average velocities in three successive intervals of time t_1, t_2 and t_3. Then $\frac{v_1 - v_2}{v_2 - v_3}$ is equal to

(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) $\frac{t_1 - t_2}{t_1 - t_3}$

Answers

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
d	d	d	c	d	d	d	c	b	b	c	a	c	d	d	b	c	b	a	a

21	22	23	24
a	a	c	b