Roll No :
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School : ACHIEVERS FOUNDATION
Assessment : Motion in a Straight Line
Subject : physics
Class : XI

Time : 00
Marks: 72

1 An object while moving may not have **1**

(a) variable speed but constant velocity.
(b) variable velocity but constant speed.
(c) non-zero acceleration but constant speed.
(d) zero acceleration but constant velocity.

Ans :(a)

2 A particle moves along a straight line as **1**

$s = u(t-2) + a(t-2)2$

(a) the acceleration of the particle is 'a'.
(b) the initial velocity of the particle is 'v'.
(c) at t = 2s, the particle is at rest.
(d) the acceleration of the particle is '$2a$'.

Ans : (d)

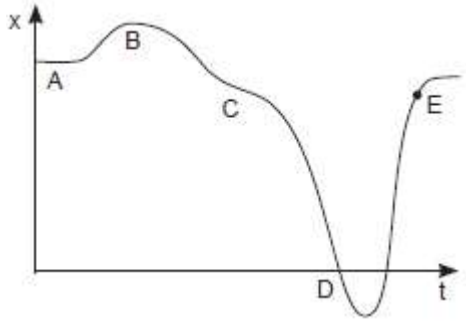
3 A vehicle travels half the distance L with speed V_1 and the other half with speed V_2, then its average speed is **1**

(a) $\frac{v_1 + v_2}{2}$ (b) $\frac{2v_1 + v_2}{v_1 + v_2}$

(c) $\frac{2v_1 v_2}{v_1 + v_2}$ (d) $\frac{L(v_1 + v_2)}{v_1 v_2}$

Ans : (c)

4 A graph of x versus t is shown in Fig. . Choose correct alternatives from below. [NCERT Exemplar] **1**



(a) The particle was released from rest at t = 0.

(b) At B, the acceleration a > 0.

(c) At C, the velocity and the acceleration vanish.

(d) The speed at D exceeds that at E.

Ans :(a, c, d)

5 A particle covers half of its total distance with speed v_1 and the rest half with speed v_2. Its average speed during the complete journey is **1**

(a) $\frac{v_1^2 v_2^2}{v_1^2 + v_2^2}$

(b) $\frac{v_1 + v_2}{2}$

(c) $\frac{v_1 v_2}{v_1 + v_2}$

(d) $\frac{2v_1 v_2}{v_1 + v_2}$

Ans :

(d) Let total distance = 2x

$$\text{Time } t_1 = \frac{x}{v_1} \text{ and } t_2 = \frac{x}{v_2}$$

$$\text{Average speed} = \frac{2x}{\frac{x}{v_1} + \frac{x}{v_2}} = \frac{2v_1 v_2}{v_1 + v_2}$$

6 A car travelling 500 km south-west depicts **1**

(a) distance

(b) speed

(c) displacement

(d) velocity

Ans :(c)

7 Which of the following is true for displacement? **1**

(a) It is always equal to distance travelled.

(b) It is straight line distance in a specific direction.

(c) It is the direction of motion from one point to another.

(d) It is the length of path covered by an object.

Ans :(b)

8 A stone is dropped from a certain height and at the same time another stone is thrown horizontally from the same height. Which one will reach the ground earlier? **1**

(a) First stone

(b) Second stone

(c) Simultaneously

(d) Not sure.

Ans :

(c) Since the initial vertical velocity of both the stones is zero and both are accelerated vertically downwards by equal acceleration, hence they reach earth simultaneously.

9 Distance travelled in the nth interval of time in uniform accelerated motion is _____. **1**

(a) $s_n = ut + \frac{1}{2}at(2n-1)$

(b) $s_n = ut + \frac{1}{2}at^2$

(c) $s_n = u + \frac{a}{2}(2n-1)$

(d) None of these

Ans :(c)

10 The distance covered by an object is directly proportional to square of time elapsed. Its acceleration is **1**

(a) constant

(b) increasing

(c) decreasing

(d) zero

Ans :(a)

11 The motion of a freely falling object is an example of **1**

(a) uniform motion

(b) uniformly accelerated motion

(c) non-uniformly accelerated motion

(d) zero acceleration

Ans : (b)

12 Wind is blowing west to east along two parallel tracks. Two trains moving with same speed in opposite directions when no wind is blowing. Now one train has speed double than other. The speed of each train is **1**

(a) equal to that of wind

(b) double that of wind

(c) three times that of wind

(d) half that of wind.

Ans :

(c) Let u and v be the speed of train and wind respectively. The speed of steam track of train moving in the direction of wind = u – v

The speed of steam track of train moving in the opposite direction of wind = u + v

As per question, (u + v) = 2(u – v) or u = 3v

13 A car (A) is moving with a speed of 80 km/h. Another car (B) is moving with 120 km/h in opposite direction. The relative speed of car (B) w.r.t. car (A) is **1**

(a) 80 km/h

(b) 120 km/h

(c) 200 km/h

(d) 40 km/h

Ans :(c) 200 km/h

$v_{BA} = v_B - v_A = 120 - (-80) = 200$ km/h

14 For the following question, two statements are given one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. **1**

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is NOT the correct explanation of A.

(c) A is true but R is false.

(d) A is false and R is also false.

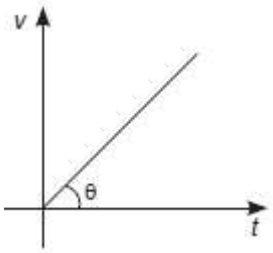
Assertion: For the uniform motion, the slope of the position-time graph will be constant.

Reason: The slope of the position-time graph represents velocity of the object and for uniform motion it is constant.

Ans :

(a) Both A and R are true and R is the correct explanation of A.

For uniform motion the position time graph is given by tan θ = Slope = Velocity = Constant



15 For the following question, two statements are given one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. **1**

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is NOT the correct explanation of A.
(c) A is true but R is false.
(d) A is false and R is also false.
Assertion: The total displacement of a student will be zero, if he rode a bicycle from point A to B and then came back to A.
Reason: Displacement is a scalar quantity.

Ans :
(c) A is true but R is false.
Displacement is a vector quantity and it will be zero if initial and final position is same.

16 For the following question, two statements are given one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. **1**
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is NOT the correct explanation of A.
(c) A is true but R is false.
(d) A is false and R is also false.
Assertion: In case of a body falling down freely near the surface of earth, displacement is directly proportional to square of time elapsed.
Reason: The freely falling body has constant acceleration.

Ans :(a) Both A and R are true and R is the correct explanation of A.

17 For the following question, two statements are given one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. **1**
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is NOT the correct explanation of A.
(c) A is true but R is false.
(d) A is false and R is also false.
Assertion: Two masses in ratio 1: 2 are thrown vertically up with same speed, reach the top simultaneously.
Reason: Acceleration due to gravity is directly proportional to the mass of a body.

Ans :(c) A is true but R is false.

18 For the following question, two statements are given one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. **1**

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is NOT the correct explanation of A.

(c) A is true but R is false.

(d) A is false and R is also false.

Assertion: An object while moving may not have variable speed but constant velocity.

Reason: The body may change its direction continuously during motion, even when its speed is constant.

Ans :(b) Both A and R are true but R is NOT the correct explanation of A

19 For the following question, two statements are given one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. **1**

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is NOT the correct explanation of A.

(c) A is true but R is false.

(d) A is false and R is also false.

Assertion: The position-time graph in uniformly accelerated motion is a parabola.

Reason: An object can have non-zero acceleration while maintaining constant speed.

Ans :(b) Both A and R are true but R is NOT the correct explanation of A

20 For the following question, two statements are given one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. **1**

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is NOT the correct explanation of A.

(c) A is true but R is false.

(d) A is false and R is also false.

Assertion: The area vector is associated with plane area drawn outward normal to the plane.

Reason: The area under velocity-time graph represents acceleration.

Ans :(c) A is true but R is false.

21 A monkey climbs up a slippery pole for 3 s and keeps on slipping for 3 s. At time t, its velocity is given by $v(t) = 2t(3 - t)$; $0 < t < 3$ and $v(t) = -(t - 3)(6 - t)$ for $3 < t < 6$ s (in m/s). It repeats this cycle till it reaches the height of 20 m. **1**

(i) At what time is its velocity maximum?

(a) 0.5 s

(b) 1 s

(c) 1.5 s

(d) 2 s

(ii) At what time is its average velocity maximum?

(a) $t = 0$ s

(b) $t = 2.25$ s

(c) $t = 4.5$ s

(d) $t = 7$ s

(iii) At what time is its acceleration is maximum in magnitude?

(a) $t = 0$ s

(b) $t = 3$ s

(c) Both (a) and (b)

(d) Never

(iv) How many cycles (counting fractions) are required to reach the top?

(a) 2 (b) 3

(c) 4 (d) 5

Or

(iv) The motion of the monkey over the pole is

(a) periodic

(b) non-periodic

(c) retarded

(d) accelerated

Ans :

As $v(t) = 2t(3 - t) = 6t - 2t^2$,

$$a(t) = \frac{dv(t)}{dt} = 6 - 4t$$

(*i*) (*c*) For maximum velocity $v(t)$, we have

$$\frac{d[v(t)]}{dt} = 0$$

$$\Rightarrow 6 - 4t = 0 \text{ or } t = \left(\frac{3}{2}\right)\text{s}$$

(*ii*) (*b*) $v(t) = 6t - 2t^2$

$$\frac{ds}{dt} = 6t - 2t^2$$

$$ds = (6t - 2t^2)\, dt$$

Distance travelled from $t = 0$ s to $t = 3$ s,

$$S_1 = \int_0^3 (6t - 2t^2)\, dt = \left(\frac{6t^2}{2} - \frac{2t^2}{3}\right)_0^3 = 9 \text{ m}$$

$$v_{av} = \frac{S_1}{t} = \frac{9}{3} = 3 \text{ m/s}$$

Thus, $3 = 6t - 2t^2$

or $2t^2 - 6t + 3 = 0$

$$t = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(3)(2)}}{2(2)} = \frac{9}{4} \text{ s}$$

(*iii*) (*c*) For maximum acceleration, periodic motion, $v = 0$

Thus, acceleration is maximum at $t = 0$ and $t = 3$ s.

(*iv*) (*d*) $S_1 = \int_0^3 (6t - 2t^2)\, dt$

$$= \left[\frac{6t^2}{2} - \frac{2t^2}{3}\right]_0^3 = \frac{6(3)^2}{2} = \frac{2(3)^3}{3} = 9\text{m}$$

$$S_2 = \int_3^6 (18 - 9t + t^2)\, dt$$

$$= \left(18t - \frac{9t^2}{2} + \frac{t^3}{3}\right)_3^6$$

$$= \left[18(6) - \frac{9(6)^2}{2} + \frac{(6)^3}{3}\right] - \left[18(3) - \frac{9(3)^2}{2} + \frac{(3)^2}{3}\right]$$

$$= -4.5 \text{ m}$$

Total distance $= S_1 + S_2 = 9 - 4.5 = 4.5$ m

Number of cycles $= \frac{20}{4.5} = 4.44 = 5$

Or

(*iv*) (*a*) periodic motion

22 State the condition when the magnitude of velocity and speed of an object are equal. **1**

Ans : When a body moves in a straight line.

23 Under what condition will the distance and displacement of a moving object have the same magnitude ? **1**

Ans : When the motion is in a straight line.

24 Is it possible to have negative value in speed and displacement ? **1**

Ans : Speed is always +ve. Displacement can have −ve, 0 or +ve values.

25 Which vector can be associated with a plane area ? And what is its direction ? **1**

Ans : Area vector, outward drawn Normal to the plane will be its direction.

26 What does the slope of velocity-time graph represent ? **1**

Ans : The slope of velocity-time graph represents acceleration.

27 What is the significance of the slope of $x-t$ graph. **1**

Ans :
Slope of $x - t$ graph provides velocity of motion. The nature of motion is identified by the shape of the graph.

28 Write two uses of $v - t$ graph ? **1**

Ans : (i) Slope of $v - t$ graph gives acceleration.
(ii) Area under $v - t$ graph gives displacement.

29 When a ball hits a wall with a velocity of 50 m/s and bounces back with the same speed, what is the change in velocity of the ball ? **1**

Ans : $\Delta p = -2\ mv = -100\ m$
$\therefore m\Delta v' = -100\ m \Rightarrow \Delta v' = -100\ m/s$

30 What is the ratio of SI to CGS unit of acceleration ? **1**

Ans : Ratio of SI to CGS unit of acceleration is 10^2.

31 Can the relative velocity of two bodies be greater than the absolute velocity of either ? **1**

Ans :

Yes. For example, when two bodies move in opposite direction then relative velocity of each is greater than the individual velocities.

32 When a body accelerates by αt, what is the velocity after time 't', when it starts from rest? **1**

Ans : $a = \alpha t$ *i.e.,* $\int dv = \alpha \int t\, dt$

$$v = \frac{\alpha t^2}{2}$$

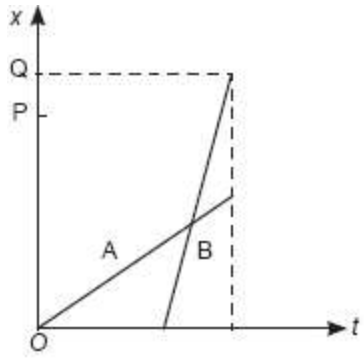
33 Write the expression for distance covered in nth second by a uniformly accelerated body. **1**

Ans :

If a is the uniform acceleration, then $s = u + \frac{a}{2}(2n-1)$,

where u is the initial velocity.

34 The position-time (x-t) graphs for two children A and B returning from their school O to their homes P and Q respectively are shown in figure. Choose the correct entries in the brackets below: **1**



(a) (A/B) lives closer to the school than (B/A).

(b) (A/B) starts from the school earlier than (B/A).

(c) (A/B) walks faster than (B/A).

(d) A and B reach home at the (same/different) time.

(e) (A/B) overtakes (B/A) on the road (once/twice).

Ans :

(a) Because OP < OQ, hence A lives closer to the school than B.

(b) When x = 0, t = 0, for A while t has some non-zero value for B. Therefore A starts from the school earlier than B.

(c) B walks faster, since the slope of B is more than the slope of A.

(d) A and B reach home at the same time.

(e) B overtakes A once during the journey.

35 The length covered by a body is found to be directly proportional to the square of time. What is the nature of acceleration ? **1**

Ans : $x \propto t^2 \therefore v \propto t'$ and $a \propto t^0$ (i.e.) acceleration is constant.

36 Give an example of a body possessing zero velocity and still accelerating. **1**

Ans :
A body thrown up vertically has zero velocity at the top-most point, but has acceleration of g.

37 Can a body have constant speed but a varying velocity ? **1**

Ans : Yes, it is possible only if direction changes.

38 Why does a parachute descend slowly ? **1**

Ans :
Due to increased surface area of a parachute, the air resistance is more, so it descends slowly.

39 What will happen to a hydrogen balloon released on the moon ? **1**

Ans : The balloon will fall with an acceleration of g/6 ms^{-2}.

40 What is the ratio of the time taken to go up and come down by a body thrown vertically up ? **1**

Ans : 1 : 1 in the absence of air resistance.

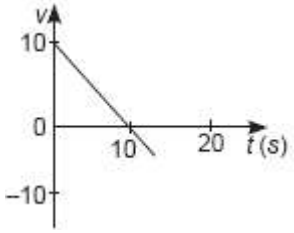
41 Two masses in the ratio 1 : 2 are thrown vertically up with the same speed. What is the effect on the time by the mass ? **1**

Ans : Mass does not influence time.

42 A mass is dropped from certain height. At the same time another equal mass is thrown with a horizontal velocity of u m/s. Which one of the two will reach the ground first? **1**

Ans : Both of them will reach the ground at the same time.

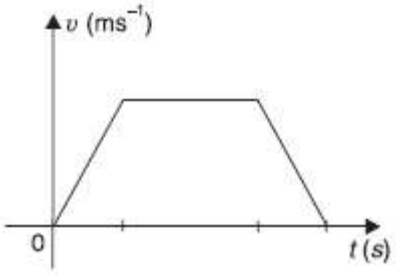
43 What can you say about the nature of acceleration, associated with a mass whose $v - t$ graph is shown ? **1**



Ans : Slope cover same magnitude. So acceleration is constant.

44 A car starts accelerating from rest for sometime, maintains the velocity for sometime and then comes to rest with uniform deceleration. Draw the $v - t$ graph. **1**

Ans :



45 Why is it not necessary for a body following another to stop, to avoid collision ? **1**

Ans : If the relative velocity becomes zero, the collision can be avoided.

46 If in case of a motion, displacement is directly proportional to the square of time elapsed, what do you think about its acceleration i.e., constant or variable ? Explain why ? **1**

Ans :

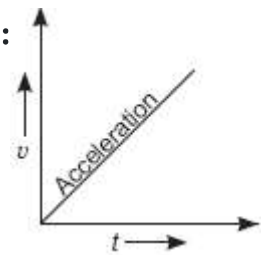
Acceleration is constant, since the equations of motion can be applied only then.

47 Why does the earth impart the same acceleration to all bodies ? **1**

Ans : Acceleration is force on unit mass. So, Earth does exert same acceleration.

48 Draw velocity-time graph for an object, starting from rest. Acceleration is constant and remains positive. **1**

Ans :



49 The position coordinate of a moving particle is given by $x = 6 + 18t + 9t^2$ (x in metres and t in seconds). What is its velocity at $t = 2$ sec. ? **1**

Ans : $x = 6 + 18t + 9t^2$, $v = 18 + 18t$

$v_{t=2} = 18 + 18 \times 2 = 54 \text{ ms}^{-1}$

50 A truck and a car with the same kinetic energy are brought to rest by the application of brakes which provide equal retarding forces. Which of them will come to rest in a shorter distance ? **1**

Ans : Both truck and car will stop at the same distance.

51 A ball is thrown straight up. What is its velocity and acceleration at the top ? **1**

Ans : $v = 0$, $a = g$.

52 A stone is dropped into well in which the level of water is at a distance h below the top of well. If v is the velocity of sound, the time T after which the splash is heard is given by **1**

(a) $T = \frac{2h}{v}$ (b) $T = \sqrt{\frac{2h}{g}} + \frac{h}{v}$

(c) $T = \sqrt{\frac{2h}{v}} + \frac{h}{g}$ (d) $T = \sqrt{\frac{h}{2g}} + \frac{2h}{v}$

Ans : (b)

$T = t_1 + t_2 = \sqrt{\frac{2h}{g}} + \frac{h}{v}$

53 The distance travelled by a body is directly proportional to the square of the time taken. Its acceleration **1**

(a) increases

(b) decreases

(c) becomes zero

(d) remains constant

Ans : (d)

54 Wind is blowing west to east along two parallel tracks. **1**

Two trains moving with same speed in opposite directions have the steam track of one double then other. The speed of each train is

(a) equal to that of wind

(b) double that of wind

(c) three times that of wind

(d) half that of wind.

Ans :

(c)

Let u and v be the speed of train and wind respectively.

The speed of steam track of train moving in the direction of wind = $u - v$

The speed of steam track of train moving in the opposite direction of wind = $u + v$

As per question, $(u + v) = 2(u - v)$ or $u = 3v$

55 A particle moving with a uniform acceleration travels 24 metre and 64 metre in first two consecutive intervals of 4 seconds each. Its initial velocity is **1**

(a) 1 m/s

(b) 2 m/s

(c) 5 m/s

(d) 10 m/s

Ans : (a)

$$24 = u \times 4 + \frac{1}{2}a \times 4^2$$

$$= 4u + 8a$$

or $$6 = u + 2a$$

$$(24 + 64) = u \times 8 + \frac{1}{2}a \times 8^2$$

$$= 8u + 32a$$

or $$11 = u + 4a$$

On solving (*i*) and (*ii*), we get $u = 1$ m/s

56 A ball is thrown up, it reaches a maximum height and then comes down. If $t_1 (t_2 > t_1)$ are the times that the ball takes to be at a particular height then the time taken by the ball to reach the highest point is **1**

(a) $(t_1 + t_2)$

(b) $(t_1 - t_2)$

(c) $(t_2 - t_1)/2$

(d) $(t_2 + t_1)/2$

Ans :

(d)

Let s be the height of a particular point where the ball crosses in time t_1 and t_2 seconds while going upwards and coming downwards. If u is the initial velocity of projection of ball, then

$$s = ut_1 - \frac{1}{2}gt_1^2 = ut_2 - \frac{1}{2}gt_2^2$$

or $$u(t_2 - t_1) = \frac{1}{2}g(t_2^2 - t_1)$$

or $$u = \frac{1}{2}g(t_2 + t_1)$$

If T is the time taken by ball to reach to its highest point then using the relation $v = u + at$, we have $0 = u + (-g)T$

or $$T = \frac{u}{g} = \frac{1}{2}\frac{g(t_2 + t_1)}{g} = \frac{1}{2}(t_2 + t_1)$$

57 A stone is dropped from a certain height and at the same time another stone is thrown horizontally from the same height which one will reach the ground earlier. **1**

(a) first stone

(b) second stone

(c) simultaneously

(d) not sure.

Ans :

Ans. (c)

Since the initial vertical velocity of both the stones is zero and both are accelerated vertically downwards by equal acceleration, hence they reach earth simultaneously.

58 A particle is forced to move on a straight line path. It returns to the starting point after 10 seconds. The total distance covered by the particle during this time is 20 m. Which of the following statements is false regarding the motion of the particles? **1**

(a) The average velocity of the particle is zero.

(b) The displacement of the particle is zero.

(c) The average speed of the particle is 2.0 ms^{-1}.

(d) The displacement of the particle is 20 m.

Ans : (d)

When a particle while moving returns to its initial position after a certain time, then its displacement in that time is zero. Its average velocity (= displacement/ time) is also zero.

But its Average speed = $\frac{\text{Total distance travelled}}{\text{Time taken}}$

$= \frac{20}{10} = 2.0 \text{ ms}^{-1}$

59 Select the correct statements for a particle going on a straight line: **1**

(a) If the position and velocity are in opposite directions, the particle is moving towards the origin.

(b) It the acceleration and velocity are in opposite directions, the particle is slowing down.

(c) If the velocity is zero for a time interval, the acceleration is zero at any moment within that time interval.

(d) If the velocity is zero at any instant, then the acceleration must also be zero at that instant.

Ans :(a, b, c)

60 **Acceleration of a particle which is at rest at $x = 0$ is $\vec{a} = (4 - 2x)\hat{i}$. Select the correct alternative(s).** **1**

(a) Maximum speed of the particle is 4 units.

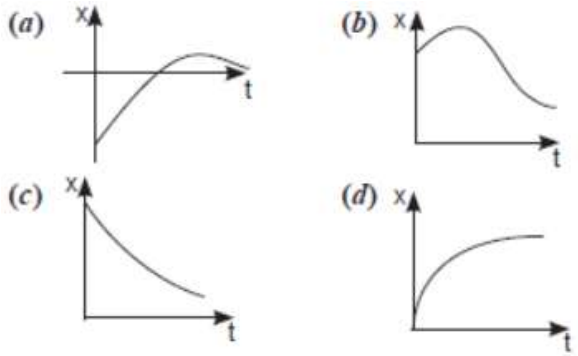
(b) Particle further comes to rest at x = 4.

(c) Particle oscillates about $x = 2$.

(d) Particle will continuously accelerate along the x-axis.

Ans :(b, c)

61 Among the four graphs, there is only one graph for which average velocity over the time interval (0, T) can vanish for a suitably chosen T. Which one is it? **1**



Ans :(b)

When (x-t) graph is convex upward, v is decreasing and when it is convex downward, v is increasing. Between these two regions, the average velocity can be zero.

62 A lift is coming from 8th floor and is just about to **1**

reach 4th floor. Taking ground floor as origin and positive direction upwards for all quantities, which one of the following is correct?

(a) $x < 0$, $v < 0$, $a > 0$

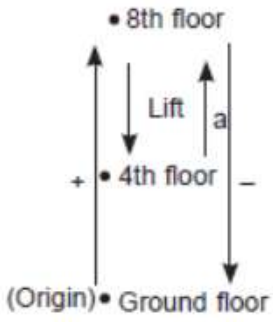
(b) $x > 0$, $v < 0$, $a < 0$

(c) $x > 0$, $v < 0$, $a > 0$

(d) $x > 0$, $v > 0$, $a < 0$

Ans : (a)

When the lift is about to reach the 4th floor, it is retarding, i.e., a is acting upward. i.e., $a > 0$, (fig). However, x and v being in the downward direction are negative, i.e., $x < 0$ $v < 0$.



63 In one dimensional motion, instantaneous speed v satisfies $0 \leq v < v_0$. **1**

(a) The displacement in time T must always take non-negative values.

(b) The displacement x in time T satisfies $-v_0T < x < v_0T$.

(c) The acceleration is always a non-negative number.

(d) The motion has no turning points.

Ans : (b)

Since maximum distance covered in time T is v_0T, displacement in time T can have both positive and negative values between $-v_0T$ and $-v_0T$.

64 The displacement of a particle is given by $x = (t-2)^2$ where x is in metres and t in seconds. The distance covered by the particle in first 4 seconds is **1**

(a) 4 m

(b) 8 m

(c) 12 m

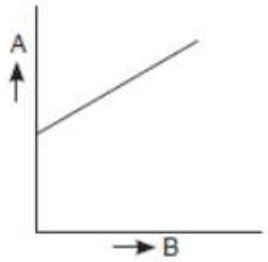
(d) 16 m

Ans : (b)

As $x = (t - 2)$, $x_4 - x_0 = (4 - 2)_2 - (0 - 2)_2$

$= 4 \text{ m} + 4 \text{ m} = 8 \text{ m}$

65 The variation of quantity A with quantity B, plotted in Fig. describes the motion of a particle in a straight line. Choose the correct statement(s). **1**



(a) Quantity B may represent time.

(b) Quantity A is velocity if motion is uniform.

(c) Quantity A is displacement if motion is uniform.

(d) Quantity A is velocity if motion is uniformly accelerated.

Ans :(a, b, c)

66 For the one-dimensional motion, described by **1**

$x = t - \sin t$

(a) $x(t) < 0$ for all $t > 0$.

(b) $v(t) > 0$ for all $t > 0$.

(c) $a(t) > 0$ for all $t > 0$.

(d) $v(t)$ lies between 0 and 2.

Ans :

(d) $v(t) = \frac{d}{dt}[t - \sin t] = 1 - \cos t$. When $t = 0°$, $v(t) = 0$

When $t = 180°$, $v(t) = 1 - \cos (180°) = 1 + 1 = 2$

67 A man throws ball into the air one after the other. Throwing one when other is at the highest point. How high the balls rise if he throws twice a second? **1**

(a) 2.45 m

(b) 1.225 m

(c) 19.6 m

(d) 4.9 m

Ans :(b)

The time taken by each ball to go from starting point to highest point, t = 1/2 sec, which is equal to time taken

by each ball to fall back to starting point (= 1/2 sec).

$$\therefore \quad s = \frac{1}{2} \times 9.8 \times \left(\frac{1}{2}\right)^2 = \frac{9.8}{8} \text{ m} = 1.225 \text{ m}$$

68 A balloon is going upwards with velocity 12 m/sec. It releases a packet when it is at a height 65 m from the ground. How much time the packet will take to reach the ground? (g = 10 m/s2) **1**

(a) 5 sec

(b) 6 sec

(c) 7 sec

(d) 8 sec

Ans : (a)

As $s = ut + \frac{1}{2}at^2$

$\therefore \quad 65 = -12t + \frac{1}{2} \times 10 \times t^2 = -12t + 5t^2$

or $5t^2 - 12t - 65 = 0$

On solving, $t = 10$ s or -26 s

69 The position of a particle moving in the X-Y plane at any time t is given by; $x = (3t^2 - 6t)$ meters; $y = (t^2 - 2t)$ meters. Select the correct statement. **1**

(a) acceleration is zero at $t = 0$

(b) velocity is zero at t = 0

(c) velocity is zero at t = 1 second

(d) velocity and acceleration of the particle are never zero.

Ans : (c)

$x = 3t^2 - 6t$, So $(\text{Velocity})_x = \frac{dx}{dt} = 6t - 6$

$(\text{Acceleration})_x = \frac{d^2y}{dt^2} = 6t$; $y = t^2 - 2t$;

so $(\text{Velocity})_y = \frac{dy}{dt} = 2t - 2$

$(\text{Acceleration})_y = \frac{d^2y}{dt^2} = 2$; At time $t = 1$,

$\frac{dx}{dt} = 6 \times 1 - 6 = 0$ and $\frac{dy}{dt} = 2 \times 1 - 2 = 0$

70 A stone is thrown with an initial speed of 4.9 m/s from a bridge in vertically upward direction. It falls down in **1**

water after 2 seconds. The height of the bridge is

(a) 4.9 m

(b) 9.8m

(c) 19.8 m

(d) 24.7 m

Ans : (b)

Taking vertical downward motion of stone, we have

$u = -4.9$ m/s, $a = 9.8$ m/s^2, $t = 2$s, $s = ?$

Now, $$s = ut + \frac{1}{2}at^2$$

$$= -4.9 \times 2 + \frac{1}{2} \times 9.8 \times 2^2 = 9.8 \text{ m}$$

71 A balloon starts rising from the ground with an acceleration of 1.25 m/s^2. After 8 seconds, a stone is released from the balloon. The stone will (use g = 10 m/s^2). **1**

(a) cover a distance of 40 m

(b) have displacement of 50 m

(c) reach the ground in 4 second

(d) begin to move downward after being released.

Ans : (c)

Taking upward motion of balloon for 8 seconds; we have

$u = 0$; $a = 1.25$ m/s^2; $t = 8$ s; $v = ?$; $s = ?$.

Here $v = u + at = 0 + 1.25 \times 8 = 10$ m/s

$$s = ut + \frac{1}{2}at^2$$

$$= 0 + \frac{1}{2} \times 1.25 \times 8^2 = 40 \text{ m}$$

Taking downward motion of released stone from balloon at height 40 m we have,

$u = -10$ m/s; $a = 10$ m/s^2; s = 40 m; $t = ?$

As, $$s = ut + \frac{1}{2}at^2$$

so, $$40 = -10t + \frac{1}{2} \times 10 \times t^2$$

or $t^2 - 2t - 8 = 0$. On solving $t = 4$s.

72 The displacement of a particle is represented by the **1**

following equation $s = 2t^3 + 7t^2 + 5t + 8$ where s is in metres and t in seconds. The acceleration of the particle at $t = 1$s is

(a) 18 m/s^2

(b) 32 m/s^2

(c) zero

(d) 14 m/s^2

Ans : (b)

$$s = 3t^3 + 7t^2 + 5t + 8;\ v = \frac{ds}{dt} = 9t^2 + 14t + 5$$

$$\text{Acceleration, } a = \frac{dv}{dt} = 18t + 14$$

$$\therefore \quad (a)_{t=1} = 18 \times 1 + 14 = 32 \text{ m/s}^2$$