Prachand NEET 2025

DPP 01

Physics

Motion in a straight line

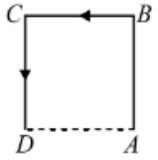
Q1 The displacement of a body is given by $s = \frac{1}{2}gt^2$, where g is acceleration due to gravity. Then what is velocity of the body at any time t ?

(A) $\frac{gt^3}{6}$
(B) $\frac{gt^2}{2}$
(C) gt
(D) $\frac{gt}{2}$

Q2 Which of the following statement is not true?

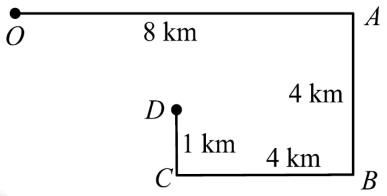
(A) If displacement covered of a particle is zero, then distance covered may or may not be zero.
(B) If the distance covered is zero, then the displacement must be zero.
(C) The numerical value of ratio of displacement to distance is equal to or less than one.
(D) The numerical value of the ratio of velocity to speed is always less than one.

Q3 A particle moves along the sides $\mathrm{AB}, \mathrm{BC}, \mathrm{CD}$ of a square of side $25\ \mathrm{m}$ with a speed of $15\ \mathrm{ms}^{-1}$. Its average velocity is:



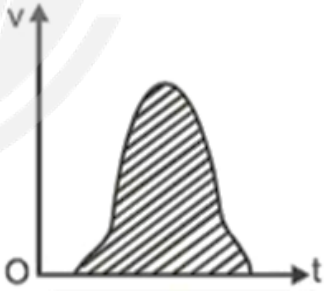
(A) $15\ \mathrm{ms}^{-1}$
(B) $10\ \mathrm{ms}^{-1}$
(C) $7.5\ \mathrm{ms}^{-1}$
(D) $5\ \mathrm{ms}^{-1}$

Q4 A car moves from O to D along the path $OABCD$ shown in figure. The distance travelled and net displacement respectively, is:



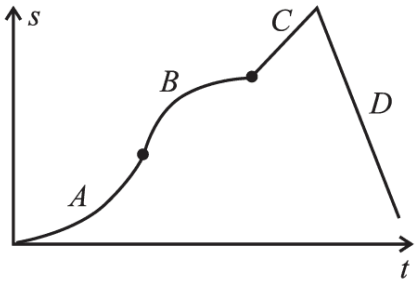
(A) $16\ \mathrm{km}, 1\ \mathrm{km}$
(B) $17\ \mathrm{km}, 5\ \mathrm{km}$
(C) $20\ \mathrm{km}, 4\ \mathrm{km}$
(D) $15\ \mathrm{km}, 3\ \mathrm{km}$

Q5 Figure below shows the velocity-time graph of a one dimensional motion. Which of the following characteristics of the particle is represented by the shaded area?



(A) Speed
(B) Displacement
(C) Acceleration
(D) Momentum

Q6 Displacement time graph of a particle moving in a straight line is shown in the figure below. Then,



(A) in region A, acceleration is negative.
(B) in region B, acceleration is negative.

(C) in region C, acceleration is non-zero.
(D) in region D, acceleration is non-zero.

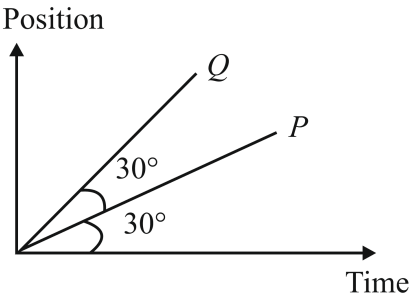
Q7 Object is moving with constant velocity, the speed of object:
(A) May be variable
(B) May be constant
(C) Must be variable
(D) Must be constant

Q8 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 metre and t in second. Find the instant when particle comes to rest and reverses its direction.
(A) 1 s
(B) 2 s
(C) 3 s
(D) 4 s

Q9 The initial velocity of a body having a uniform acceleration of $2\ \mathrm{m/sec^2}$ is $10\ \mathrm{m/sec}$. Its velocity after an interval of 4 sec is
(A) $12\ \mathrm{m/sec}$
(B) $14\ \mathrm{m/sec}$
(C) $16\ \mathrm{m/sec}$
(D) $18\ \mathrm{m/sec}$

Q10 A particle moves along a straight line OX. At a time t (in seconds), the distance x (in metres) of the particle from O is given by $x = 40 + 12t - t^3$. How long would the particle travel before coming to rest?
(A) 24 m (B) 16 m
(C) 56 m (D) 40 m

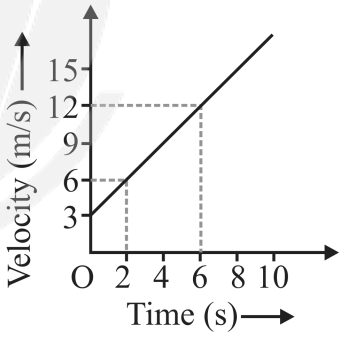
Q11 The position-time graph of two particles P and Q are as shown in figure. The ratio of their velocities $\frac{V_P}{V_Q}$ is



(A) $1:3$
(B) $\sqrt{3}:1$
(C) $3:1$
(D) $1:\sqrt{3}$

Q12 A particle starts moving from rest with uniform acceleration. It travels a distance x in first 2 seconds and distance y in the next 2 seconds. Then;
(A) y = 2x (B) y = 3x
(C) y = 4x (D) y = x

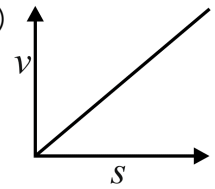
Q13 Calculate the acceleration using the graph shown below.

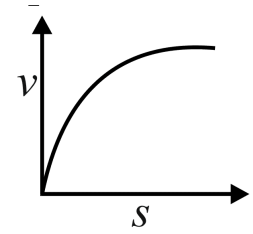


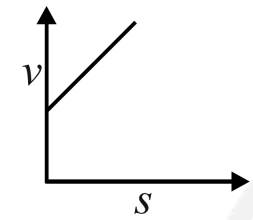
(A) $2\ \mathrm{m/s^2}$
(B) $5\ \mathrm{m/s^2}$
(C) $3\ \mathrm{m/s^2}$
(D) $1.5\ \mathrm{m/s^2}$

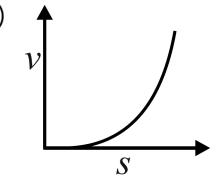
Q14 The time required to stop a car of mass 800 kg, moving at a speed of 20 $\mathrm{ms^{-1}}$ over a distance of 25 m is;
(A) 2 s (B) 2.5 s
(C) 4 s (D) 4.5 s

Q15 A particle starts from rest and move with constant acceleration. Its velocity-displacement curve is:

(A)


(B)


(C)


(D)


Q16 A person travelling on a straight line moves with a uniform velocity v_1 for some time and with uniform velocity v_2 for the next equal time. The average velocity v is given by:

(A) $v = \frac{v_1+v_2}{2}$

(B) $v = \sqrt{v_1 v_2}$

(C) $\frac{2}{v} = \frac{1}{v_1} + \frac{1}{v_2}$

(D) $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2}$

Q17 If the displacement of a particle varies with time as $\sqrt{x} = t + 7$, then-

(A) Velocity of the particle is inversely proportional to t

(B) Velocity of the particle is proportional to t^2

(C) Velocity of the particle is proportional to $\sqrt{t}$

(D) The particle moves with constant acceleration.

Q18 Initially a body is at rest. If its acceleration is $5\ \mathrm{ms}^{-2}$, then the distance travelled in the 18^{th} second is:

(A) $86.6\ \mathrm{m}$

(B) $87.5\ \mathrm{m}$

(C) $88.6\ \mathrm{m}$

(D) $89\ \mathrm{m}$

Q19 A particle is thrown vertically upward. Its velocity at half of the maximum height is $10\ \mathrm{m/s}$. The maximum height attained by it is

(A) $8\ \mathrm{m}$

(B) $20\ \mathrm{m}$

(C) $10\ \mathrm{m}$

(D) $16\ \mathrm{m}$

Q20 Which of the following is/are correct statements?

I. When a body reaches highest point in vertical motion, its velocity becomes zero but acceleration is non -zero.

II. Average velocity of an object is equal to the instantaneous velocity in uniform motion.

III. Average speed can be zero but average velocity can never be zero.

(A) I and II (B) II and III

(C) I and III (D) I, II and III

Q21 **Assertion:** Position-time graph of a stationary object is a straight line parallel to time axis.

Reason: For a stationary object, position does not change with time.

(A) Assertion is correct, reason is correct; reason is a correct explanation for assertion.

(B) Assertion is correct, reason is correct; reason is not a correct explanation for assertion

(C) Assertion is correct, reason is incorrect

(D) Assertion is incorrect, reason is correct.

Q22 A stone thrown upwards with a speed ' u ' from the top of the tower reaches the ground with a velocity ' $3u$ '. The height of the tower is:

(A) $\frac{4u^2}{g}$

(B) $\frac{4u^2}{2g}$

(C) $\frac{8u^2}{g}$

(D) $\frac{7u^2}{g}$

Q23 Two particles held at different heights a and b above the ground are allowed to fall from rest. The ratio of their velocities on reaching the ground is:

(A) $a : b$
(B) $\sqrt{a} : \sqrt{b}$
(C) $a^2 : b^2$
(D) $a^3 : b^3$

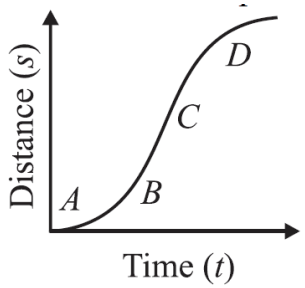
Q24 Position of a particle moving along x-axis is given by $x(\text{ in m}) = 2 + 8t - 4t^2$. The distance travelled by the particle from $t = 0$ to $t = 2$ s is;
(A) 0 m
(B) 8 m
(C) 12 m
(D) 16 m

Q25 The position of an object moving along X-axis is given by $\mathrm{x = a - bt^2}$, where $\mathrm{a = 8.5\ m,\ b = 2.5\ ms^{-2}}$ and t is measured in second. For the given situation, match the terms in Column I with the values of Column II and choose the correct option from the codes given below:

Column-I		Column-II	
I.	Velocity of object at $t = 2.0$ s	P.	-15 ms^{-1}
II.	Velocity of object at $t = 0$ s	Q.	-10 ms^{-1}
III.	Instantaneous speed of object at $t = 2.0$ s	R.	0 ms^{-1}
IV	Average velocity between $t = 2.0$ s and $t = 4.0$ s	S.	10 ms^{-1}

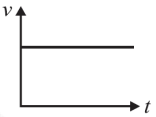
(A) I-P II-Q III-R IV-S
(B) I-Q II-R III-S IV-P
(C) I-S II-R III-Q IV-P
(D) I-R II-Q III-P IV-S

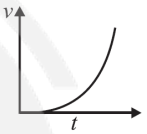
Q26 A particle shows distance-time curve as given in this figure. The maximum instantaneous velocity of the particle is around the point

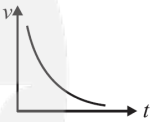


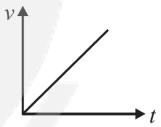
(A) A (B) B
(C) C (D) D

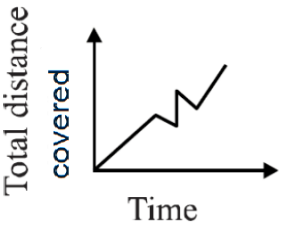
Q27 A scooter accelerates from rest for time t_1 at constant rate a_1 and then retards at constant rate a_2 for time t_2 and comes to rest. The correct value of $\frac{t_1}{t_2}$ will be:
(A) $\frac{a_1+a_2}{a_2}$
(B) $\frac{a_2}{a_1}$
(C) $\frac{a_1}{a_2}$
(D) $\frac{a_1+a_2}{a_1}$

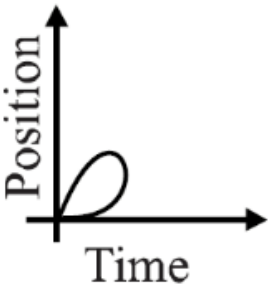
Q28 Which of the following velocity-time graphs represent uniform motion?
(A) 

(B) 

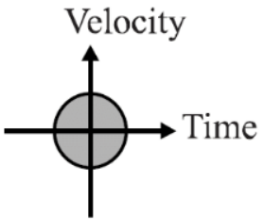
(C) 

(D) 

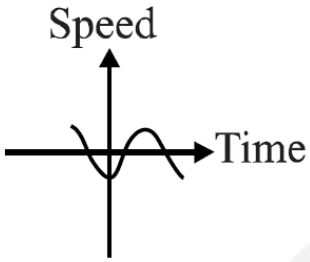
Q29 Which of the following graphs cannot possibly represent one-dimensional motion of a particle?
(I)


(II)


(III)

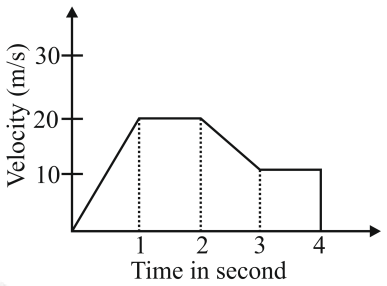


(IV)



(A) I and II (B) II and III
(C) II and IV (D) All of these

Q30 The variation of velocity of a particle with time moving along a straight line is illustrated in the following figure. The distance travelled by the particle in four seconds is:



(A) 60 m (B) 55 m
(C) 25 m (D) 30 m

Answer Key

Q1	(C)	Q16	(A)
Q2	(D)	Q17	(D)
Q3	(D)	Q18	(B)
Q4	(B)	Q19	(C)
Q5	(B)	Q20	(A)
Q6	(B)	Q21	(A)
Q7	(D)	Q22	(A)
Q8	(B)	Q23	(B)
Q9	(D)	Q24	(B)
Q10	(B)	Q25	(B)
Q11	(A)	Q26	(C)
Q12	(B)	Q27	(B)
Q13	(D)	Q28	(A)
Q14	(B)	Q29	(D)
Q15	(B)	Q30	(B)

Hints & Solutions

Note: scan the QR code to watch video solution

Q1 Text Solution:

(C)

Given $s = \frac{1}{2}gt^2$

$v = \frac{ds}{dt} = \frac{d}{dt}\left(\frac{1}{2}gt^2\right)$

$v = \frac{1}{2}g \cdot \frac{d}{dt}(t^2)$

$v = \frac{1}{2}g \cdot 2t$

$v = gt$

Video Solution:

Q2 Text Solution:

(D)

1. If the particle starts from some point A, and returns back to A after some time t, then displacement is zero, and distance is non zero.

2. If the distance covered is zero then the displacement must be zero.

3. $\frac{\text{Displacement}}{\text{Distance}} \geq 1$

4. The numerical value of the ratio of velocity to speed is not always less than one.

In uniform motion on a straight line, magnitude of speed and velocity are equal.

So, statement given in option D is incorrect.

Video Solution:

Q3 Text Solution:

(D)

Average velocity = $\frac{\text{Displacement}}{\text{Time}}$

Displacement, AD = 25 m

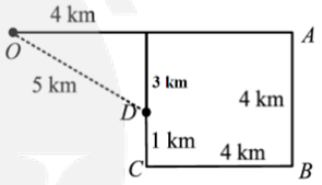
Total time taken, $t = \frac{\text{total distance}}{\text{average speed}} = \frac{75\ m}{15\ m/s} = 5\ s$

Average velocity=$\frac{25}{5} = 5\ m/s$

Video Solution:

Q4 Text Solution:

(B)



Displacement, OD = $\sqrt{4^2 + 3^2} = 5\ km$

Total distance travelled = OA +AB+BC+CD = 8+4+4+1 = 17 km

Video Solution:

Q5 Text Solution:

(B)

Area under velocity-time graph gives displacement.

Video Solution:

Q6 Text Solution:

(B)

- In region A, slope is increasing i.e velocity is increasing, acceleration is positive
- In region B, slope is decreasing, i.e velocity is decreasing, acceleration is negative
- In region C and D, slope is constant, i.e. velocity is constant, so acceleration is zero.

Video Solution:

Q7 Text Solution:

(D)

If object is moving with constant velocity, the speed of object must be constant.

Video Solution:

Q8 Text Solution:

(B)

$$x = 32t - \frac{8t^3}{3};$$
$$v = \frac{dx}{dt} = 32 - 8t^2$$

When particle comes to rest,

$v = 0$

$32 - 8t^2 = 0$

$\Rightarrow t^2 = 4$

$\Rightarrow t = 2\ s$

Video Solution:

Q9 Text Solution:

(D)

$$v = u + at$$
$$\Rightarrow v = 10 + 2(4)$$
$$= 18\ \text{ms}^{-1}$$

Video Solution:

Q10 Text Solution:

(B)

Given : $x = 40 + 12t - t^3$

$v = \frac{dx}{dt} = 0 + 12 - 3t^2$

Velocity becomes zero, when

$12 - 3t^2 = 0$

or $t = 2s$

At t =2 s, position of the object

$x = 40 + 12 \times 2 - 2^3 = 56\ m$

Initial position of the particle at t = 0, x =40 m

So the particle move a distance, x = 56 - 40 = 16 m

Video Solution:

Q11 Text Solution:

(A)

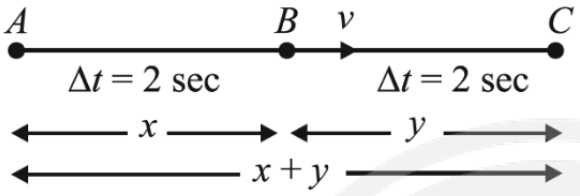
Slope of the graph will give us velocity

$\frac{V_P}{V_Q} = \frac{\tan\ \theta_P}{\tan\ \theta_Q} = \frac{\tan\ 30^\circ}{\tan\ 60^\circ} = \frac{1/\sqrt{3}}{\sqrt{3}} = \frac{1}{3}$

Video Solution:

Q12 **Text Solution:**

(B)



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

From $\mathrm{A} \rightarrow \mathrm{B}$

$x = \frac{1}{2}a(2)^2 = 2a$

From $\mathrm{A} \rightarrow \mathrm{C}$

$x + y = \frac{1}{2}a(4)^2 = 8a$

$\Rightarrow x + y = 8\left(\frac{x}{2}\right)$

$\Rightarrow x + y = 4x$

$\Rightarrow y = 3x$

Video Solution:

Q13 **Text Solution:**

(D)

Slope of the v-t graph gives acceleration .

Slope = $\frac{12-6}{6-2} = \frac{6}{4} = 1.5\ \mathrm{m/s^2}$

Video Solution:

Q14 **Text Solution:**

(B)

Using 3rd equation of motion,

$v^2 - u^2 = 2as$

$\Rightarrow (0)^2 - (20)^2 = 2a \times 25$

$\Rightarrow a = -8\ m/s^2$

Time taken to stop the car,

$t = \frac{v-u}{a} = \frac{0-20}{-8} = 2.5\ s$

Video Solution:

Q15 **Text Solution:**

(B)

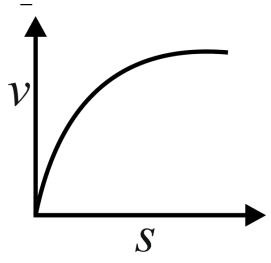
From, $v^2 - u^2 = 2as$

Given u = 0

So,

$$v^2 = 2as$$

Hence v-s graph will be parabola as shown below



Video Solution:

Q16 **Text Solution:**

(A)

Let the body covers x_1 distance in t/2 time with velocity v_1 and distance x_2 in next equal time t/2 with velocity v_2

$$\text{Average velocity } = \frac{x_1 + x_2}{t}$$
$$= \frac{v_1(t/2) + v_2(t/2)}{t} = \frac{v_1 + v_2}{2}$$

Video Solution:

Q17 **Text Solution:**

(D)

$$\sqrt{x} = t + 7$$
$$\Rightarrow x = (t+7)^2 = t^2 + 49 + 14t$$
$$\frac{dx}{dt} = 2t + 14$$
$$v = 2t + 14$$

Acceleration:

$$a = \frac{dv}{dt}$$
$$a = 2 \text{ ms}^{-2} \rightarrow \text{ constant}$$

Video Solution:

Q18 **Text Solution:**

(B)

Given, $u = 0$

$a = 5\ m/sec^2$

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

$= 0 + \frac{5}{2}(2 \times 18 - 1)$

$= \frac{5 \times 35}{2}$

$S_n = \frac{175}{2} = 87.5\ m$

Video Solution:

Q19 **Text Solution:**

(C)

Let maximum height be H

At half of the maximum height, u= 10 m/s, at maximum height, $v = 0$

From the formula, $v^2 - u^2 = 2as$

$$0 - 10^2 = 2 \times -10 \times \frac{H}{2}$$

$$H = \frac{100}{10} = 10 \text{ metre}$$

Video Solution:

Q20 **Text Solution:**

(A)

I. When a body reaches highest point in vertical motion, its velocity becomes zero but acceleration is equal to g i.e. non zero

II. In uniform motion, an object has a constant velocity. This means that the velocity is the same at every point, and all instantaneous velocities are equal to each other and to the average velocity.

III. Average velocity = $\frac{\text{Total Displacement}}{\text{time}}$

If net dispacement is zero, then average velocity is zero.

So, Only I and II are correct.

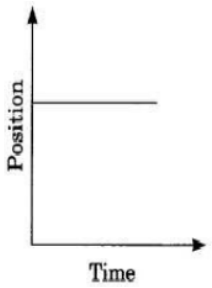
Video Solution:

Q21 **Text Solution:**

(A)

For a stationary object, the position of object will not change with respect to time.

So, Position-time graph for a stationary object is a straight line parallel to time axis.



Video Solution:

Q22 **Text Solution:**

(A)

$$v^2 = u^2 + 2gh$$

$$h = \frac{v^2 - u^2}{2g} = \frac{9u^2 - u^2}{2g} = \frac{4u^2}{g}$$

Video Solution:

Q23 **Text Solution:**

(B)

From, $v^2 - u^2 = 2as$

For particle 1, ${v_1}^2 - 0 = 2ga$

For particle 2, ${v_2}^2 - 0 = 2gb$

So, using the above equations

$\frac{{v_1}^2}{{v_2}^2} = \frac{a}{b}$

$\Rightarrow \frac{v_1}{v_2} = \sqrt{\frac{a}{b}}$

Video Solution:

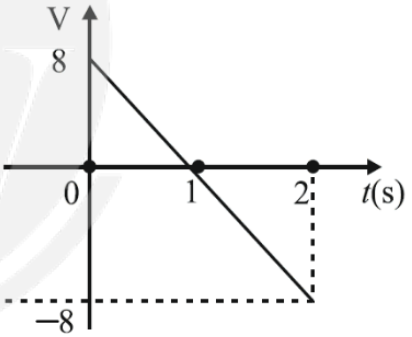
Q24 **Text Solution:**

(B)

$V = \frac{dx}{dt} = 8 - 8t$

At t = 1 s, its velocity is 0

If we plot the v-t graph,



Distance $=|$ Area $|$

$= \frac{1}{2} \times 1 \times 8 + \frac{1}{2} \times 1 \times 8 = 8\ m$

Video Solution:

Q25 **Text Solution:**

(B)

$x = a - bt^2$

$v = \frac{dx}{dt} = -2bt$

Velocity at t = 0, $v|_{t=0} = 0$

Velocity at t = 2 s,

$v|_{t=2} = -4b = -4(2.5) = -10$ m/s

Instantaneous speed at t = 2s,

$|v|_{t=2} = |-2bt|_{t=2} = 10$ m/s

Position at t = 2 s,

$x|_{t=2} = 8.5 - (2.5)4 = -1.5$ m

Position at t = 4 s,

$x|_{t=4} = 8.5 - (2.5)16 = -31.5$ m

Average velocity $= \frac{-31.5-(-1.5)}{4-2} = -\frac{30}{2} = -15\ \mathrm{m}/s$

Video Solution:

Q26 **Text Solution:**

(C)

Maximum instantaneous velocity will be at that point which has maximum slope.

As clear from the graph , at point' C ', it has maximum slope.

Video Solution:

Q27 **Text Solution:**

(B)

Using, $v = u + at$

During acceleration ,

$v_1 = 0 + a_1 t_1$

$a_1 = \frac{v_1}{t_1}$

During retardation ,

$0 = v_1 - a_2 t_2$

$\Rightarrow a_2 = \frac{v_1}{t_2}$

So,

$\frac{t_1}{t_2} = \frac{a_2}{a_1}$

Video Solution:

Q28 **Text Solution:**

(A)

Uniform motion means that the velocity of the body is constant with time i.e $v =$ constant. Only in graph given in option A, velocity is constant. So it represents uniform motion.

Video Solution:

Q29 **Text Solution:**

(D)

1. In graph I, distance is decreasing with time, which is not possible.
2. In the graph II, we can see that, there are two values of position shown for a particular time, which is not possible.
3. In the graph III, we can see that, there are two values of velocity shown for a particular time , which is not possible.
4. In the graph III, speed is shown as negative, and speed can never be negative, so this is also not possible.

Video Solution:

Q30 **Text Solution:**

(B)

$$\text{Distance} = \text{Area under } v-t \text{ graph}$$
$$= A_1 + A_2 + A_3 + A_4$$
$$= \frac{1}{2} \times 1 \times 20 + (20 \times 1) + \frac{1}{2}(20+10) \times 1 + (10 \times 1)$$
$$= 10 + 20 + 15 + 10 = 55 \text{ m}$$

Video Solution: