



NEET — JEE MAINS - ADVANCED

Chapter 2 : Motion in a Straight Line (50 Important MCQs)

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Notes

50 important MCQs from GSEB, CBSE, NEET and JEE exams · Answer key at the end

Section A — Multiple Choice Questions

Each question carries 1 mark. Choose the correct option.

Q.1 The velocity of a particle is given by $v = (3t^2 + 2t)$ m/s. Find its average velocity between $t = 0$ and $t = 3$ s and its acceleration at $t = 3$ s. The motion is one-dimensional.

- (A) 11 m/s, 10 m/s² (B) 12 m/s, 20 m/s² (C) 11 m/s, 20 m/s² (D) none of these

Q.2 The displacement of an object varies with time as $y = \left(\frac{3}{8}t^2 - 3t + 5\right)$ m. Find the instantaneous velocity at $t = 4$ s.

- (A) 45 m s⁻¹ (B) 12 m s⁻¹ (C) 3 m s⁻¹ (D) 0 m s⁻¹

Q.3 A ball thrown vertically upward returns to the same position in 2 s. The maximum height reached by the ball is (Take $g = 9.8$ m s⁻²)

- (A) 9.8 m (B) 14.7 m (C) 4.9 m (D) 19.6 m

Q.4 A car moving with constant acceleration has an initial velocity of 2 m s⁻¹ on a straight path. After 10 s, its velocity is 12 m s⁻¹. Find the distance covered in these 10 s.

- (A) 140 m (B) 50 m (C) 100 m (D) 70 m

Q.5 A car starting from rest moves with constant acceleration 3 m s⁻². Then it moves with constant deceleration 2 m s⁻² and finally stops. If the total time of the journey is 100 s, what was the maximum velocity of the car?

- (A) 100 m s⁻¹ (B) 80 m s⁻¹ (C) 140 m s⁻¹ (D) 120 m s⁻¹

Q.6 A car starting from rest moves with constant acceleration x , then with constant deceleration y , and stops. If the total time elapsed is t , the total distance travelled by the car is

- (A) $\left(\frac{xy}{x+y}\right)t$ (B) $\frac{1}{2}\left(\frac{xy}{x+y}\right)t^2$ (C) $2\left(\frac{xy}{x+y}\right)t^2$ (D) $\left(\frac{xy}{x+y}\right)t^2$

Q.7 A body initially at rest moves with uniform acceleration a . Its velocity after n seconds is v . The displacement of the body in the last 2 seconds is

- (A) $\frac{v(n+1)}{n}$ (B) $\frac{2v(n+1)}{n}$ (C) $\frac{v(n-1)}{n}$ (D) $\frac{2v(n-1)}{n}$

Q.8 The driver of the Shatabdi Express, running at 108 km/h, sights a goods train ahead of him at a distance of 50 m on the same track, moving in the same direction at 72 km/h. He applies brakes. To avoid an accident, what should be the magnitude of the deceleration produced by the brakes?

- (A) 5 m s⁻² (B) 1 m s⁻² (C) 3 m s⁻² (D) none of these

Q.9 If the velocity (in m s^{-1}) varies with time as $v = 5t$, find the distance travelled by the particle between $t = 2 \text{ s}$ and $t = 4 \text{ s}$.

- (A) 24 m (B) 30 m (C) 10 m (D) 20 m

Q.10 A ball thrown vertically upward reaches a maximum height of 20 m. At what height will its velocity be half of its initial velocity?

- (A) 15 m (B) 6 m (C) 12 m (D) 9 m

Q.11 An object is thrown vertically upward with velocity v_0 . The time to reach the maximum height is

- (A) $\frac{g}{v_0}$ (B) $\frac{v_0^2}{g}$ (C) $\frac{v_0}{g}$ (D) $\frac{v_0}{g^2}$

Q.12 The ratio of the distances travelled in the fourth and the third second by a particle starting from rest and moving on a straight path with constant acceleration is

- (A) $\frac{7}{5}$ (B) $\frac{7}{3}$ (C) $\frac{5}{7}$ (D) $\frac{3}{7}$

Q.13 For a given deceleration, if the initial velocity is increased three times, the braking (stopping) distance will become times.

- (A) two (B) three (C) nine (D) four

Q.14 A particle of unit mass undergoes one-dimensional motion such that its velocity varies as $v(x) = \beta x^{-2n}$, where β and n are constants and x is the position of the particle. The acceleration of the particle as a function of x is

- (A) $-2n\beta^2 x^{-4n-1}$ (B) $-2n\beta^2 x^{-2n+1}$
(C) $-2n\beta^2 e^{-4n+1}$ (D) $-2n\beta^2 x^{-2n-1}$

Q.15 A ball is thrown vertically downward with a velocity of 20 m/s from the top of a tower. It hits the ground with a velocity of 80 m/s. The height of the tower is ($g = 10 \text{ m/s}^2$)

- (A) 340 m (B) 320 m (C) 300 m (D) 360 m

Q.16 The ratio of the distances travelled by a freely falling body in the 1st, 2nd, 3rd and 4th second is

- (A) 1 : 3 : 5 : 7 (B) 1 : 1 : 1 : 1 (C) 1 : 2 : 3 : 4 (D) 1 : 4 : 9 : 16

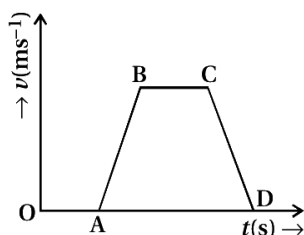
Q.17 A vehicle travels half the distance with speed v and the remaining distance with speed $2v$. Its average speed is

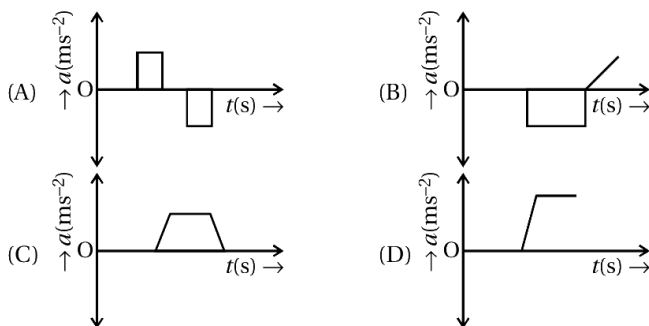
- (A) $\frac{3v}{4}$ (B) $\frac{v}{3}$ (C) $\frac{2v}{3}$ (D) $\frac{4v}{3}$

Q.18 A bullet fired with velocity u enters a rectangular wooden block along its length. After travelling 24 cm through the block, its velocity becomes $u/3$. It then penetrates further and comes to rest exactly at the other end of the block. The total length of the block is

- (A) 30 cm (B) 27 cm (C) 24 cm (D) 28 cm

Q.19 The velocity–time plot of the motion of a body is shown below. The acceleration–time graph that best suits this motion is:





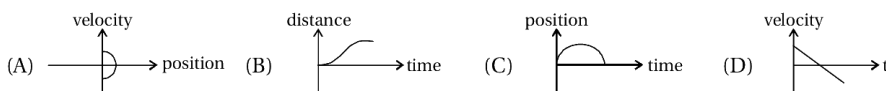
Q.20 A ball is dropped freely from the top of a tower of height 100 m and, at the same time, another ball is thrown upward from the ground with 50 m/s. When will they cross each other? ($g = 10 \text{ m/s}^2$)

- (A) 1 s (B) 2 s (C) 3 s (D) 4 s

Q.21 If the displacement at time t is $x = acost$, the acceleration is

- (A) $acost$ (B) $-acost$ (C) $asint$ (D) $-asint$

Q.22 The graphs below are meant to represent the same motion (a ball thrown up that returns). One of them is incorrect. Find it.



- (A) velocity–position (B) distance–time (C) position–time (D) velocity–time

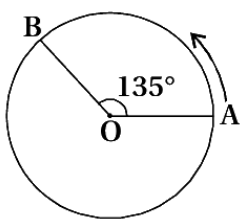
Q.23 A train passes a pole with uniform acceleration a . Its front end passes the pole with speed u and its back end with speed v . Find the speed of its middle point when it passes the pole.

- (A) $\frac{\sqrt{v^2+u^2}}{2}$ (B) $\sqrt{\frac{v^2+u^2}{2}}$ (C) $\sqrt{\frac{v^2-u^2}{2}}$ (D) $\frac{\sqrt{v^2-u^2}}{2}$

Q.24 A particle accelerates from rest with uniform acceleration α and then decelerates to rest with constant deceleration β . The total time is T . Find the total displacement.

- (A) $\alpha T^2 + \beta T^2$ (B) $\frac{\alpha T^2 + \beta T^2}{2}$ (C) $\frac{\alpha \beta T^2}{2(\alpha + \beta)}$ (D) $\frac{\alpha \beta T^2}{\alpha + \beta}$

Q.25 A person moves from A to B on a circular path as shown. If the distance travelled by him is 60 m, the magnitude of displacement would be (Given $\cos 135^\circ = -0.7$)



- (A) 42 m (B) 47 m (C) 19 m (D) 40 m

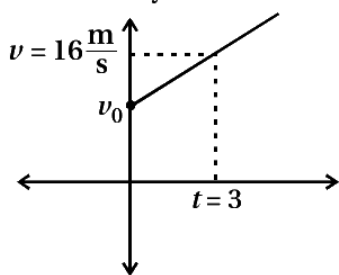
Q.26 A body starts from rest and moves with constant acceleration. It covers a displacement s_1 in the first $(p-1)$ seconds and s_2 in the first p seconds. The displacement $s_1 + s_2$ will be made in time

- (A) $(2p+1) \text{ s}$ (B) $\sqrt{2p^2 - 2p + 1} \text{ s}$
(C) $(2p-1) \text{ s}$ (D) $(2p^2 - 2p + 1) \text{ s}$

Q.27 The displacement of a particle is directly proportional to the square of time. Then its acceleration will be

- (A) zero (B) constant
(C) continuously decreasing (D) continuously increasing

Q.28 The graph shows the velocity–time graph of a particle having constant acceleration 2 m s^{-2} . Find its initial velocity.



- (A) 8 m/s (B) 10 m/s (C) 12 m/s (D) 14 m/s

Q.29 A body moves with uniform acceleration a . The change in velocity of the body in a time interval Δt is

- (A) $\frac{a}{\Delta t}$ (B) $a^2 \Delta t$ (C) $a \Delta t$ (D) $a \Delta t^2$

Q.30 An object is thrown down from a tower with velocity v_0 . When it reaches the ground, its velocity is $2v_0$. Calculate the height of the tower.

- (A) $\frac{3v_0^2}{2g}$ (B) $\frac{3v_0^2}{g}$ (C) $\frac{v_0^2}{2g}$ (D) $\frac{v_0}{2g}$

Q.31 A ball is allowed to fall freely from a height of 100 m . After 1 s of its motion, it has fallen 5 m . How far will it have fallen after 4 s ?

- (A) 80 m (B) 700 m (C) 750 m (D) 800 m

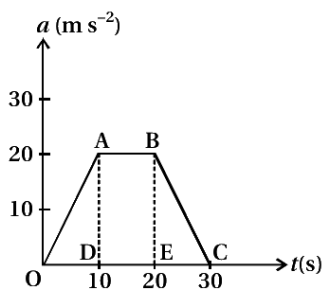
Q.32 The velocity–time relation of an electron moving from rest is $v = kt$, where $k = 2 \text{ m s}^{-2}$. The displacement of the electron in 3 seconds is

- (A) 9 m (B) 16 m (C) 27 m (D) 36 m

Q.33 A stone released with zero velocity from the top of a tower reaches the ground in 4 s . The height of the tower is m ($g = 10 \text{ m s}^{-2}$).

- (A) 160 (B) 80 (C) 40 (D) 20

Q.34 The acceleration–time graph of a rectilinear motion is shown. The average acceleration of the particle in the first 20 seconds is



- (A) 45 m s^{-2} (B) 40 m s^{-2} (C) 15 m s^{-2} (D) 20 m s^{-2}

Q.35 The displacement–time relation of a particle is $x = \frac{k}{b^2} (1 - e^{-bt})$, where b is a constant. The acceleration of the particle will be

- (A) ke^{-bt} (B) $-ke^{-bt}$ (C) $\frac{k}{b^2} e^{-bt}$ (D) $-\frac{k}{b^2} e^{-bt}$

Q.36 The displacement of a particle at time t is given by $S = 15t - 0.4t^2$. At what time is its velocity 7 m s^{-1} ?

- (A) 20 s (B) 15 s (C) 10 s (D) 5 s

Q.37 A ball A is thrown vertically upward with velocity v_0 . At the same instant, another ball B is allowed to fall freely from height h . The velocity of A with respect to B at time t is

- (A) v_0 (B) $v_0 - 2gt$ (C) $v_0 - gt$ (D) $\sqrt{v_0^2 - 2gh}$

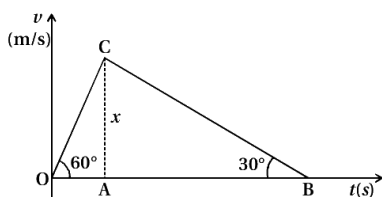
Q.38 The displacement of an object is related to time as $x = at + bt^2 - ct^3$, where a , b and c are constants. The velocity of the object when its acceleration is zero is

- (A) $a + \frac{b^2}{c}$ (B) $a + \frac{b^2}{2c}$ (C) $a + \frac{b^2}{3c}$ (D) $a + \frac{b^2}{4c}$

Q.39 The displacement of a particle is given by $y(t) = a + bt + ct^2 - dt^4$. The initial velocity and initial acceleration of the particle are and respectively.

- (A) $b, -4d$ (B) $-b, 2c$ (C) $b, 2c$ (D) $2c, -4d$

Q.40 The velocity–time graph of a body is shown. What will be the ratio of the magnitudes of the average accelerations during the intervals OA and AB?



- (A) 1 (B) $\frac{1}{2}$ (C) $\frac{1}{3}$ (D) 3

Q.41 Acceleration is

- (A) change in velocity magnitude (B) change in direction of motion
(C) rate of change of velocity (D) change in velocity

Q.42 Acceleration is the first derivative of with respect to time.

- (A) mass (B) force (C) velocity (D) displacement

Q.43 A car starting from rest accelerates uniformly at 2 m s^{-2} . The distance it covers in the 5th second is

- (A) 9 m (B) 10 m (C) 25 m (D) 5 m

Q.44 A train 100 m long, moving at 36 km/h, crosses a bridge 150 m long. The time taken is

- (A) 10 s (B) 15 s (C) 25 s (D) 40 s

Q.45 A stone dropped from the top of a tower covers 25 m in the last second of its fall. The height of the tower is ($g = 10 \text{ m s}^{-2}$)

- (A) 25 m (B) 45 m (C) 80 m (D) 125 m

Q.46 Two cars move in the same direction on a straight road at 72 km/h and 54 km/h. If the faster car is 100 m behind the slower one, the time it takes to catch up is

- (A) 5 s (B) 10 s (C) 20 s (D) 40 s

Q.47 A body starts from rest with uniform acceleration. The ratio of the distances covered in the first 2 s and the next 2 s is

- (A) 1 : 2 (B) 1 : 3 (C) 1 : 4 (D) 2 : 3

Q.48 The velocity of a particle varies with its position as $v^2 = 16 + 4x$ (SI units). The acceleration of the particle is

- (A) 1 m s^{-2} (B) 2 m s^{-2} (C) 4 m s^{-2} (D) 8 m s^{-2}

Q.49 The area under the acceleration–time graph of a particle gives its

- (A) displacement (B) change in velocity
(C) distance travelled (D) change in acceleration



Q.50 A body is dropped from a height of 20 m. With what speed does it hit the ground? ($g = 10 \text{ m s}^{-2}$)

(A) 10 m/s

(B) 20 m/s

(C) 40 m/s

(D) 200 m/s

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	11	C	21	B	31	A	41	C
2	D	12	A	22	B	32	A	42	C
3	C	13	C	23	B	33	B	43	A
4	D	14	A	24	C	34	C	44	C
5	D	15	C	25	B	35	B	45	B
6	B	16	A	26	B	36	C	46	C
7	D	17	D	27	B	37	A	47	B
8	B	18	B	28	B	38	C	48	B
9	B	19	A	29	C	39	C	49	B
10	A	20	B	30	A	40	D	50	B