Chapter 03

Kinematics

NEET-FLASHBACK

Q.1 A car runs at a constant speed on a circular track of radius 100 m, taking 62.8 s for every circular lap. The average velocity and average speed for each circular lap respectively is **[AIPMT 2006]**

(1) 0, 0 (2) 0, 10 m/s
(3) 10 m/s, 10 m/s (4) 10 m/s, 0

Q.2 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? **[AIPMT 2006]**

(1) 24 m (2) 40 m (3) 56 m (4) 16 m

Q.3 Two bodies, A (of mass 1 kg) and B(of mass 3 kg), are dropped from heights of 16 m and 25 m respectively. The ratio of the time taken by them to reach the ground is: **[AIPMT 2006]**

(1) $\frac{5}{4}$ (2) $\frac{12}{5}$ (3) $\frac{5}{12}$ (4) $\frac{4}{5}$

Q.4 For angles of projection of a projectile $(45° - \theta)$ and $(45° + \theta)$, the horizontal ranges described by the projectile are in the ratio of: **[AIPMT 2006]**

(1) 1 : 1 (2) 2 : 3 (3) 1 : 2 (4) 2 : 1

Q.5 A car moves from X to Y with a uniform speed v_u and returns to X with a uniform speed v_d. The average speed for this round trip is : **[AIPMT 2007]**

(1) $\frac{v_u + v_d}{2}$ (2) $\frac{2v_u v_d}{v_d + v_u}$

(3) $\sqrt{v_u v_d}$ (4) $\frac{v_u v_d}{v_d + v_u}$

Q.6 A particle is moving along x-axis has acceleration f, at time t, given by $f = f_o\left(1 - \frac{t}{T}\right)$, where f_o and T are constants. The particle at t = 0 has zero velocity. In the time interval between t = 0 and the instant when f = 0, the particle's velocity (v_x) is: - **[AIPMT-2007]**

(1) $\frac{1}{2}$ f_oT (2) f_oT (3) $\frac{1}{2}$ f_oT^2 (4) f_oT^2

Q.7 The position x of a particle with respect to time t along x-axis is given by $x = 9t^2 - t^3$ where x is in metres and t in seconds. What will be the position of this particle when it achieves maximum speed along the + x direction? **[AIPMT-2007]**

(1) 24 m (2) 32 m (3) 54 m (4) 81 m

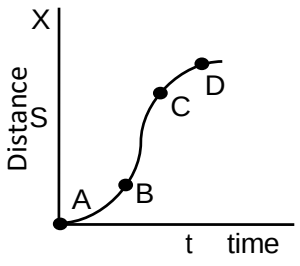
Q.8 The distance travelled by as particle starting from rest and moving with an acceleration $\frac{4}{3} m/s^2$, in the third second is: **[AIPMT 2007]**

(1) $\frac{10}{3}$m (2) $\frac{19}{3}$m (3) 6 m (4) 4 m

Q.9 A particle moves in a straight line with a constant acceleration. It changes its velocity from $10ms^{-1}$ to $20\ ms^{-1}$ while passing through a distance 135 m in t second. The value of t is :- **[AIPMT-2008]**

(1) 12 (2) 9 (3) 10 (4) 1.8

Q.10 A particle shows distance-time curve as given in this figure. The maximum instantaneous speed of the particle is around the point:- **[AIPMT-2008]**



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

Q.11 A particle of mass m is projected with velocity v making an angle 45° with the horizontal. When the particle lands on the level ground the magnitude of the change in its momentum will be: **[AIPMT 2008]**

(1) $mv\sqrt{2}$ (2) Zero (3) 2mv (4) $\frac{mv}{\sqrt{2}}$

Q.12 A body starting from rest is moving under a constant acceleration up to 20 sec. If it moves S_1 distance in first 10 sec., and S_2 distance in next 10 sec, then S_2 will be equal to: **[AIPMT 2009]**

(1) S_1 (2) $2S_1$ (3) $3S_1$ (4) $4S_1$

Q.13 A bus is moving with a speed of 10 ms^{-1} on a straight road. A scooterist wishes to overtake the bus in 100 s. If the bus is at a distance of 1 km from the scooterist, with what speed should the scooterist chase the bus: - **[AIPMT-2009]**

(1) 10 ms^{-1} (2) 20 ms^{-1} (3) 40 ms^{-1} (4) 25 ms^{-1}

Q.14 A particle moves a distance x in time t according to equation $x = (t + 5)^{-1}$. The acceleration of particle is proportional to: – **[AIPMT-2010]**

(1) $(velocity)^{2/3}$ (2) $(velocity)^{3/2}$

(3) $(distance)^2$ (4) $(distance)^{-2}$

Q.15 A ball is dropped from a high rise platform at t = 0 starting from rest. After 6 seconds another ball is thrown downwards from the same platform with a speed v. The two balls meet at t = 18 s. What is the value of v ? (take g = 10 m/s^2) **[AIPMT (Pre) 2010]**

(1) 60 m/s (2) 75 m/s (3) 55 m/s (4) 40 m/s

Q.16 A particle has initial velocity $(3\hat{i}+4\hat{j})$ and has acceleration $(0.4\hat{i}+0.3\hat{j})$. Its speed after 10s is : **[AIPMT (Pre) 2010]**

(1) 10 units (2) 7 units

(3) $7\sqrt{2}$ units (4) 8.5 units

Q.17 The speed of a projectile at its maximum height is half of its initial speed. The angle of projection is: **[AIPMT (Pre) 2010]**

(1) 15° (2) 30° (3) 45° (4) 60°

Q.18 A boy standing at the top of a tower of 20 m height drops a stone. Assuming g = 10 m/s^2, the velocity with which it hits the ground is: **[AIPMT (Pre) 2011]**

(1) 10.0 m/s (2) 20.0 m/s

(3) 40.0 m/s (4) 5.0 m/s

Q.19 A body is moving with velocity 30 m/s towards east. After 10 seconds its velocity becomes 40 m/s towards north. The average acceleration of the body is :- **[AIPMT (Pre) 2010]**

(1) 1 m/s^2 (2) 7 m/s^2

(3) $\sqrt{7}$ m/s^2 (4) 5 m/s^2

Q.20 A missile is fired for maximum range with an initial velocity of 20 m/s. If g = 10 m/s^2, the range of the missile is :- **[AIPMT (Pre) 2010]**

(1) 40 m (2) 50 m (3) 60 m (4) 20 m

Q.21 A particle covers half of its total distance with speed v_1 and the rest half distance with speed v_2. Its average speed during the complete journey is **[AIPMT (Mains) 2011]**

(1) $\frac{v_1v_2}{v_1+v_2}$ (2) $\frac{2v_1v_2}{v_1+v_2}$

(3) $\frac{v_1^2v_2^2}{v_1^2+v_2^2}$ (4) $\frac{v_1v_2}{2}$

Q.22 A projectile is fired at an angle of 45° with the horizontal. Elevation angle of the projectile at its highest point as seen from the point of projection, is: **[AIPMT (Mains) 2011]**

(1) 45° (2) 60°

(3) $\tan^{-1}\frac{1}{2}$ (4) $\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$

Q.23 The motion of a particle along a straight line is described by equation $x = 8 + 12t - t^3$ where x is in metre and t in second. The retardation of the particle when its velocity becomes zero is :- **[AIPMT (Pre) 2012]**

(1) 6 ms^{-2} (2) 12 ms^{-2}

(3) 24 ms^{-2} (4) zero

Q.24 The horizontal range and the maximum height of a projectile are equal. The angle of projection of the projectile is :- **[AIPMT (Pre) 2012]**

(1) $\theta = \tan^{-1}(2)$ (2) $\theta = 45°$

(3) $\theta = \tan^{-1}\left(\frac{1}{4}\right)$ (4) $\theta = \tan^{-1}(4)$

Q.25 A particle has initial velocity $\left(2\hat{i}+3\hat{j}\right)$ and acceleration $\left(0.3\hat{i}+0.2\hat{j}\right)$. The magnitude of velocity after 10 seconds will be:

[AIPMT (Pre) 2012]

(1) 5 units (2) 9 units

(3) $9\sqrt{2}$ units (4) $5\sqrt{2}$ units

Q.26 A stone is dropped from a height h. It hits the ground with a certain momentum P. If the same stone is dropped from a height 100% more than the previous height, the momentum when it hits the ground will change by :

[AIPMT (Mains) 2012]

(1) 200% (2) 100% (3) 68% (4) 41%

Q.27 A stone falls freely under gravity. It covers distances h_1, h_2 and h_3 in the first 5 seconds, the next 5 seconds and the next 5 seconds respectively. the relation between h_1, h_2 and h_3 is:

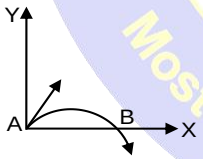
[AIPMT 2013]

(1) $h_1 = h_2 = h_3$ (2) $h_1 = 2h_2 = 3h_3$

(3) $h_1 = \frac{h_2}{3} = \frac{h_3}{5}$ (4) $h_2 = 3h_1 = h_3 = 3h_2$

Q.28 The velocity of a projectile at the initial point A is $\left(2\hat{i}+3\hat{j}\right)$ m/s. It's velocity (in m/s) at point B is

[AIPMT 2013]



(1) $2\hat{i}+3\hat{j}$ (2) $-2\hat{i}-3\hat{j}$

(3) $-2\hat{i}+3\hat{j}$ (4) $2\hat{i}-3\hat{j}$

Q.29 A projectile is fired from the surface of the earth with a velocity of 5 ms^{-1} and angle θ with the horizontal. Another projectile fired from another planet with a velocity of 3 ms^{-1} at the same angle follows a trajectory which is identical with the trajectory of the projectile fired from the earth. The value of the acceleration due to gravity on the planet is (in ms^{-2}) is : (given g = 9.8 m/s^2) **[AIPMT 2013]**

(1) 3.5 (2) 5.9 (3) 16.3 (4) 110.8

Q.30 A particle is moving such that its position coordinate (x, y) are **[AIPMT 2013]**

(2m, 3m) at time t = 0

(6m, 7m) at time t = 2 s and

(13m, 14m) at time t = 5s.

Average velocity vector from t = 0 to t = 5s is :

(1) $\frac{1}{5}\left(13\hat{i}+14\hat{j}\right)$ (2) $\frac{7}{3}\left(\hat{i}+\hat{j}\right)$

(3) $2\left(\hat{i}+\hat{j}\right)$ (4) $\frac{11}{5}\left(\hat{i}+\hat{j}\right)$

Q.31 A particle of unit mass undergoes one-dimensional motion such that its velocity varies according to $v(x) = \beta x^{-2n}$ 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 given by : **[AIPMT 2015]**

(1) $-2n\beta^2x^{-4n-1}$ (2) $-2\beta^2x^{-2n+1}$

(3) $-2n\beta^2e^{-4n+1}$ (4) $-2n\beta^2x^{-2n-1}$

Q.32 A ship A is moving Westwards with a speed of 10 km h^{-1} and a ship B, 100 km South of A, is moving Northwards with a speed of 10 km h^{-1}. The time after which the distance between them becomes shortest, is: **[AIPMT 2015]**

(1) 5 h (2) $5\sqrt{2}$ h (3) $10\sqrt{2}$ h (4) 0 h

Q.33 Two particles A and B, move with constant velocities $\vec{v}_1$ and $\vec{v}_2$. At the initial moment their position vectors are $\vec{r}_1$ and $\vec{r}_2$ respectively. The condition for particle A and B for their collision is:

[AIPMT 2015]

(1) $\vec{r}_1-\vec{r}_2=\vec{v}_1-\vec{v}_2$ (2) $\frac{\vec{r}_1-\vec{r}_2}{|\vec{r}_1-\vec{r}_2|}=\frac{\vec{v}_2-\vec{v}_1}{|\vec{v}_2-\vec{v}_1|}$

(3) $\vec{r}_1\cdot\vec{v}_1=\vec{r}_2\cdot\vec{v}_2$ (4) $\vec{r}_1\times\vec{v}_1=\vec{r}_2\times\vec{v}_2$

Q.34 If the velocity of a particle is $v = At + Bt^2$, where A and B are constants, then the distance travelled by it between 1s and 2s is: **[NEET-I-2016]**

(1) $\frac{3}{2}A+4B$ (2) 3A + 7B

(3) $\frac{3}{2}A+\frac{7}{3}B$ (4) $\frac{A}{2}+\frac{B}{3}$

Q.35 Two cars P and Q start from a point at the same time in a straight line and their positions are represented by $x_p(t) = at + bt^2$ and $x_Q(t) = ft - t^2$.

At what time do the cars have the same velocity? **[NEET-II-2016]**

(1) $\frac{a+f}{2(1+b)}$ (2) $\frac{f-a}{2(1+b)}$

(3) $\frac{a-f}{1+b}$ (4) $\frac{a+f}{2(b-1)}$

Q.36 Preeti reached the metro station and found that the escalator was not working. She walked up the stationary escalator in time t_1. On other days, if she remain stationary on the moving escalator, then the escalator takes her up in time t_2. The time taken by her to walk up on the moving escalator will be: **[NEET (UG) 2017]**

(1) $\frac{t_1t_2}{t_2-t_1}$ (2) $\frac{t_1t_2}{t_2+t_1}$ (3) t_1-t_2 (4) $\frac{t_1+t_2}{2}$

Q.37 The x and y coordinates of the particle at any time are $x = 5t - 2t^2$ and $y = 10t$ respectively, where x and y are in meters and t in seconds. The acceleration of the particle at t = 2s is : **[NEET (UG) 2017]**

(1) 5 m/s^2 (2) – 4 m/s^2

(3) – 8 m/s^2 (4) 0

Q.38 The speed of a swimmer in still water is 20 m/s. The speed of river water is 10 m/s and is flowing due east. If he is standing on the south bank and wishes to cross the river along the shortest path, the angle at which he should make his strokes w.r.t. north is given by: **[NEET (UG) 2019]**

(1) 30° west (2) 0°

(3) 60° west (4) 45° west

Q.39 When an object is shot from the bottom of a long smooth inclined plane kept at an angle 60° with horizontal, it can travel a distance x_1 along the plane. But when the inclination is decreased to 30° and the same object the shot with the same velocity, it can travel x_2 distance. Then x_1: x_2 will be: **[NEET (UG) 2019]**

(1) $1:\sqrt{2}$ (2) $\sqrt{2}:1$ (3) $1:\sqrt{3}$ (4) $1:2\sqrt{3}$

Q.40 A person standing on the floor of an elevator drops a coin. The coin reaches the floor in time t_1 if the elevator is at rest and in time t_2 if the elevator is moving uniformly. Then: – **[NEET (UG) 2019 (Odisha)]**

(1) $t_1 < t_2$ or $t_1 > t_2$ depending upon whether the lift is going up or down

(2) $t_1 < t_2$

(3) $t_1 > t_2$

(4) $t_1 = t_2$

Q.41 Two bullets are fired horizontally and simultaneously towards each other from roof tops of two buildings 100 m apart and of same height of 200 m with the same velocity of 25 m/s. When and where will the two bullets collide. (g = 10 m/s^2) **[NEET (UG) 2019 (Odisha)]**

(1) after 2s at a height 180 m

(2) after 2s at a height of 20 m

(3) after 4s at a height of 120 m

(4) they will not collide

Q.42 A person travelling in a straight line moves with a constant velocity v_1 for certain distance 'x' and with a constant velocity v_2 for next equal distance. The average velocity v is given by the relation: **[NEET (UG) 2019 (Odisha)]**

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

(3) $\frac{v}{2}=\frac{v_1+v_2}{2}$ (4) $v=\sqrt{v_1v_2}$

Q.43 A ball is thrown vertically downward with a velocity of 20 m/s from the top of a tower. It hits the ground after some time with a velocity of 80 m/s. The height of the tower is : (g = 10 m/s^2) **[NEET UG 2020]**

(1) 300 m (2) 360 m

(3) 340 m (4) 320 m

Q.44 A person sitting in the ground floor of a building notices through the window, of height 1.5 m, a ball dropped from the roof of the building crosses the window in 0.1 s. What is the velocity of the ball when it is at the topmost point of the window? (g = 10 m/s^2) **[NEET 2020]**

(1) 15.5 m/s (2) 14.5 m/s

(3) 4.5 m/s (4) 20 m/s

Q.45 A small block slides down on a smooth inclined plane, starting from rest at time t = 0. Let S_n be the distance travelled by the block in the interval t = n – 1 to t = n. Then, the ratio $\frac{S_n}{S_{n+1}}$ is:

[NEET (UG) 2021]

(1) $\frac{2n-1}{2n}$ (2) $\frac{2n-1}{2n+1}$

(3) $\frac{2n+1}{2n-1}$ (4) $\frac{2n}{2n-1}$

Q.46 A car starts from rest and accelerates at $5\ \text{m/s}^2$. At $t = 4$ s, a ball is dropped out of a window by a person sitting in the car. What is the velocity and acceleration of the ball at t = 6 s ? (Take $g = 10\ \text{m/s}^2$) **[NEET (UG) 2021]**

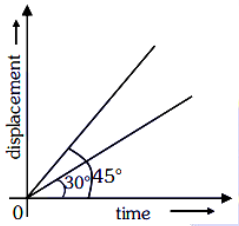
(1) $20\ \text{m/s}, 5\ \text{m/s}^2$

(2) $20\ \text{m/s}, 0$

(3) $20\sqrt{2}\ \text{m/s}, 0$

(4) $20\sqrt{2}\ \text{m/s}, 10\ \text{m/s}^2$

Q.47 The displacement-time graphs of two moving particles make angles of 30° and 45° with x-axis as shown in the figure. The ratio of their respective velocity is - **[NEET 2022]**



(1) $\sqrt{3}:1$ (2) 1 : 1

(3) 1 : 2 (4) $1:\sqrt{3}$

Q.48 The ratio of the distance travelled by a freely feeling body in the 1st, 2nd, 3rd and 4th second

[NEET 2022]

(1) 1 : 2 : 3 : 4 (2) 1 : 4 : 9 : 16

(3) 1 : 3 : 5 : 7 (4) 1 : 1 : 1 : 1

Q.49 A ball is projected with a velocity, 10 ms^{-1}, at an angle of 60° with the vertical direction. Its speed at the highest point of its trajectory will be –

[NEET 2022]

(1) Zero (2) $5\sqrt{3} ms^{-1}$

(3) 5 ms^{-1} (4) 10 ms^{-1}

Q.50 A bullet is fired from a gun at the speed of 280 m s^{-1} in the direction 30° above the horizontal. The maximum height attained by the bullet is (g = 9.8 m s–2 , sin30° = 0.5) **[NEET 2023]**

(1) 2000 m (2) 1000 m (3) 3000 m (4) 2800 m

Q.51 A vehicle travels half the distance with speed v and the remaining distance with speed 2v. Its average speed is **[NEET 2023]**

(1) $\frac{2v}{3}$ (2) $\frac{4v}{3}$ (3) $\frac{3v}{3}$ (4) $\frac{v}{3}$

Q.52 A horizontal bridge is built across a river. A student standing on the bridge throws a small ball vertically upwards with a velocity 4 m s^{-1} . The ball strikes the water surface after 4 s. The height of bridge above water surface is (Take g = 10 m s^{-2})

[NEET 2023]

(1) 60 m (2) 64 m (3) 68 m (4) 56 m

Q.53 A bullet from a gun is fired on a rectangular wooden block with velocity u. When bullet travels 24 cm through the block along its length horizontally, velocity of bullet becomes $\frac{u}{3}$. Then it further penetrates into the block in the same direction before coming to rest exactly at the other end of the block. The total length of the block is **[NEET 2023]**

(1) 24 cm (2) 28 cm (3) 30 cm (4) 27 cm

ANSWER KEY

NEET-FLASHBACK

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	4	4	1	2	1	3	1	2	4	1	3	2	2	2
Que.	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Ans.	3	4	2	4	1	2	3	2	4	4	4	3	4	1	4
Que.	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
Ans.	1	1	2	3	2	2	2	1	3	4	1	2	1	2	2
Que.	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**							
Ans.	4	4	3	2	2	2	2	4							