Chapter 03

Kinematics

TOPIC WISE QUESTIONS

DISTANCE AND DISPLACEMENT

Q.1 An athlete completes one round of a circular track of radius R in 40 sec. What will be his displacement at the end of 2 min. 20 sec.

(1) Zero (2) 2R (3) $2\pi R$ (4) $7\pi R$

Q.2 Position of a particle moving along x–axis is given by $x = 2 + 8t - 4t^2$. The distance travelled by the particle from t = 0 to t = 2 is: –

(1) 0 (2) 8 (3) 12 (4) 16

Q.3 A body moves 6 m north, 8 m east and 10 m vertically upwards, what is its resultant displacement from initial position:

(1) $10\sqrt{2}$ m (2) 10 m

(3) $10/\sqrt{2}$ m (4) 10 × 2 m

Q.4 A person moves 30 m north and then 20 m towards east and finally $30\sqrt{2}$ m in south-west direction. The displacement of the person from the origin will be :

(1) 10 m along north (2) 10 m along south

(3) 10 m along west (4) Zero

Q.5 A wheel of radius 1 metre rolls forward half a revolution on a horizontal ground. The magnitude of the displacement of the point of the wheel initially in contact with the ground is:

(1) 2π (2) 3π (3) $\sqrt{\pi^2+4}$ (4) π

AVERAGE SPEED, AVERAGE VELOCITY AND ACCELERATION

Q.6 A person travels along a straight road for half the distance with velocity 10 m/s and the remaining half distance with velocity 20 m/s. The average velocity is given by :

(1) 15 m/s (2) $\frac{20}{3}$ m/s

(3) $\frac{80}{3}$ m/s (4) $\frac{40}{3}$ m/s

Q.7 A car moves for half of its time at 80 km/h and for rest half of time at 40 km/h. Total distance covered is 60 km. What is the average speed of the car :

(1) 60 km / h (2) 80 km / h

(3) 120 km / h (4) 180 km / h

Q.8 The ratio of the numerical values of the average velocity and average speed of a body is always:

(1) Unity (2) Unity or less

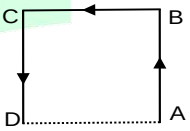
(3) Unity or more (4) Less than unity

Q.9 If a car covers $2/5^{th}$ of the total distance with v_1 speed and $3/5^{th}$ distance with v_2 then average speed is :

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

(3) $\frac{2v_1v_2}{v_1+v_2}$ (4) $\frac{5v_1v_2}{3v_1+2v_2}$

Q.10 A particle moves along the sides AB, BC, CD of a square of side 25m with a velocity of 15 ms^{-1}. Its average velocity is :



(1) 15 ms^{-1} (2) 10 ms^{-1}

(3) 7.5 ms^{-1} (4) 5ms^{-1}

Q.11 A car travels from A to B at a speed of 20 km/hr and returns at a speed of 30 km/hr. The average speed of the car for whole journey is :

(1) 25 km/hr

(2) 24 km/hr

(3) 50 km/hr

(4) 5 km/hr

Q.12 A particle is constrained to move on a straight line path. It returns to the starting point after 10 sec. The total distance covered by the particle during this time is 30 m. Which of the following statements about the motion of the particle is false:

(1) Displacement of the particle is zero

(2) Average speed of the particle is 3 m/s

(3) Displacement of the particle is 30 m

(4) Both (1) and (2)

Q.13 A particle moves along a semicircle of radius 10m in 5 seconds. The average velocity of the particle is:

(1) 2π ms^{-1} (2) 4π ms^{-1}

(3) 2 ms^{-1} (4) 4ms^{-1}

APPLICATION OF CALCULUS

Q.14 An electron starting from rest has a velocity that increases linearly with the time that is $v = kt$, where $k = 2m / sec^2$. The distance travelled in the first 3 seconds will be:

(1) 9 m (2) 16 m (3) 27 m (4) 36 m

Q.15 The velocity of a body depends on time according to the equation $u = 20 + 0.1\ t^2$. The body is undergoing:

(1) Uniform acceleration

(2) Uniform retardation

(3) Non–uniform acceleration

(4) Zero acceleration

Q.16 The acceleration 'a' in m/s^2 of a particle is given by $a = 3t^2 + 2t + 2$ where t is the time. If the particle starts out with a velocity u = 2m /s at t = 0, then the velocity at the end of 2 second is:

(1) 12 m/s (2) 18 m/s

(3) 27 m/s (4)36 m/s

Q.17 A particle moves along a straight line such that its displacement at any time t is given by $S = t^3 – 6t^2 + 3t + 4$ metres. The velocity when the acceleration is zero is:

(1) 3 ms^{-1} (2) –12 ms^{-1}

(3) 42 ms^{-1} (4) –9 ms^{-1}

Q.18 The displacement of a particle starting from rest (at t = 0) is given by $s = 6t^2 – t^3$. The time in seconds at which the particle will attain zero velocity again, is:

(1) 2 (2) 4 (3) 6 (4) 8

EQUATION OF MOTION

Q.19 A car starts from rest and moves with uniform acceleration 'a' on a straight road from time t = 0 to t = T. After that, a constant deceleration brings it to rest. In this process the average speed of the car is:

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

Q.20 A particle experiences a constant acceleration for 20 sec after starting from rest. If it travels a distance S_1 in the first 10 sec and a distance S_2 in the next 10 sec, then :

(1) $S_1 = S_2$ (2) $S_1 = S_2/3$

(3) $S_1 = S_2/2$ (4) $S_1 = S_2/4$

Q.21 A body starts from rest. What is the ratio of the distance travelled by the body during the 4th and 3rd second :

(1) 7/5 (2) 5/7 (3) 7/3 (4) 3/7

Q.22 A body travels for 15 sec starting from rest with constant acceleration. If it travels distance S_1, S_2 and S_3 in the first five seconds, second five seconds and next five seconds respectively the relation between S_1, S_2 and S_3 is :

(1) $S_1 = S_2 = S_3$ (2) $5S_1 = 3S_2 = S_3$

(3) $S_1 = \frac{1}{3}\ S_2 = \frac{1}{5}\ S_3$ (4) $S_1 = \frac{1}{5}\ S_2 = \frac{1}{3}\ S_3$

Q.23 A car moving with a speed of 50 km/hr, can be stopped by brakes after at least 6m. If the same car is moving at a speed of 100 km/hr, the minimum stopping distance is :

(1) 6 m (2) 12 m (3) 18 m (4) 24 m

Q.24 An object accelerates from rest to a velocity 27.5 m/s in 10 sec then find distance covered by object in next 10 sec :

(1) 550 m (2) 137.5 m

(3)412.5 m (4) 275 m**Q.25** A motor car moving with a uniform speed of 20 m/sec comes to stop on the application of brakes after travelling a distance of 10 m. Its acceleration is :

(1) 20 m / sec^2 (2) –20 m / sec^2
(3) –40 m / sec^2 (4) + 2m / sec^2

Q.26 A body of mass 10 kg is moving with a constant velocity of 10 m/s. When a constant force acts for 4 seconds on it, it moves with a velocity 2 m/sec in the opposite direction. The acceleration produced in it is:
(1) 3 m/sec^2 (2) –3 m/sec^2
(3) 0.3 m/sec^2 (4) –0.3 m/sec^2

Q.27 A car moving with a velocity of 10 m/s can be stopped by the application of a constant force F in a distance of 20 m. If the velocity of the car is 30 m/s, it can be stopped by this force in :
(1) $\frac{20}{3}$ m (2) 20 m (3) 60 m (4) 180m

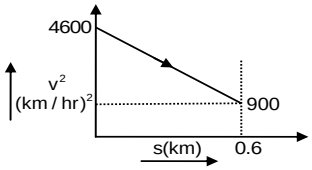
Q.28 If a train travelling at 72 kmph is to be brought to rest in a distance of 200 metres, then its retardation should be :
(1) 20 ms^{-2} (2) 10 ms^{-2}
(3) 2 ms^{-2} (4)1ms^{-2}

Q.29 The motion of a particle is described by the equation u = at. The distance travelled by the particle in the first 4 seconds:
(1) 4a (2) 12a (3) 6a (4) 8a

Q.30 A body is moving with uniform acceleration describes 40 m in the first 5 sec and 65 m in next 5 sec. Its initial velocity will be :
(1) 4 m/s (2) 2.5 m/s
(3) 5.5 m/s (4)11 m/s

Q.31 Speed of two identical cars are u and 4u at a specific instant. The ratio of the respective distances in which the two cars are stopped from that instant is (Breaks are indentical) :
(1) 1 : 1 (2) 1 : 4 (3) 1 : 8 (4) 1 : 16

Q.32 A graph between the square of the velocity of a particle and the distance (s) moved is shown in figure. The acceleration of the particle in kilometers per hour square is :–



(1) 2250.4 (2) 3083.33
(3) – 2250.4 (4) – 3083.33

Q.33 A car accelerates from rest at a constant rate of 2 m/s^2 for some time. Then, it retards at a constant rate of 4 m/s^2 and comes to rest. If it remains in motion for 3 second, then the maximum speed attained by the car is :–
(1) 2 m/s (2) 3 m/s (3) 4 m/s (4) 6 m/s

Q.34 A particle moving with a uniform acceleration travels 24 m and 64 m in the first two consecutive intervals of 4 sec each. Its initial velocity is :
(1) 1 m/sec (2) 10 m/sec
(3) 5 m/sec (4) 2 m/sec

Q.35 A particle travels 10m in first 5 sec and 10m in next 3 sec. Assuming constant acceleration what is the distance travelled in next 2 sec.
(1) 8.3 m (2) 9.3 m
(3) 10.3 m (4) None of above

Q.36 The engine of a motorcycle can produce a maximum acceleration 5 m/s^2. Its brakes can produce a maximum retardation 10 m/s^2. What is the minimum time in which it can cover a distance of 1.5 km:
(1) 10 sec (2) 15 sec
(3) 30 sec (4) 5 sec

MOTION UNDER GRAVITY

Q.37 A body falls freely from rest. It covers as much distance in the last second of its motion as covered in the first three seconds. The body has fallen for a time of:
(1) 3 s (2) 5 s (3) 7 s (4) 9 s

Q.38 A stone thrown upward with a speed u from the top of the tower reaches the ground with a velocity 3u. The height of the tower is:
(1) 3u^2 / g (2) 4u^2 / g (3) 6u^2 / g (4) 9u^2/ g

Q.39 A man in a balloon rising vertically with an acceleration of 4.9 m/sec^2 releases a ball 2 sec after the balloon is let go from the ground. The

greatest height above the ground reaches by the ball is ($g = 9.8$ m/sec^2)

(1) 14.7 m (2) 19.6 m
(3) 9.8 m (4) 24.5 m

Q.40 P, Q and R are three balloons ascending with velocities U, 4U and 8U respectively. If stones of the same mass be dropped from each, when they are at the same height, then :

(1) They reach the ground at the same time
(2) Stone from P reaches the ground first
(3) Stone from R reaches the ground first
(4) Stone from Q reaches the ground first

Q.41 A body is projected up with a speed 'u' and the time taken by it is T to reach the maximum height H. Pick out the correct statement :

(1) It reaches H/2 in T/2 sec.
(2) It acquires velocity u/2 in T/2 sec
(3) Its velocity is u/2 at H/2
(4) Same velocity at 2T

Q.42 A body thrown vertically upwards with an initial velocity u reaches maximum height in 6 seconds. The ratio of the distance travelled by the body in the first second and the seventh second is:

(1) 1 : 1 (2) 11 : 1 (3) 1 : 2 (4) 1 : 11

Q.43 A particle when thrown, moves such that it passes from same height at 2 and 10 s, the height is :

(1) g (2) 2g (3) 5g (4) 10 g

Q.44 Two balls A and B of same masses are thrown from the top of the building. A, thrown upward with velocity V and B, thrown downward with velocity V, then :

(1) Velocity of A is more than B at the ground
(2) Velocity of B is more than A at the ground
(3) Both A and B strike the ground with same velocity
(4) None of these

Q.45 A body falling from a high Minaret travels 40 meters in the last 2 seconds of its fall to ground. Height of Minaret in meters is ($g = 10$ m/s^2)

(1) 60 (2) 45 (3) 85 (4) 50

Q.46 A particle is dropped vertically from rest from a height. The time taken by it to fall through successive distance of 1 m each will then be:

(1) All equal, being equal to $\sqrt{2/g}$ second
(2) In the ratio of the square roots of the integers 1 : 2 : 3 .....
(3) In the ratio of the difference in the square roots of the integers i.e.
$\sqrt{1} : (\sqrt{2} - \sqrt{1}) : (\sqrt{3} - \sqrt{2}) : (\sqrt{4} - \sqrt{3})...$
(4) In the ratio of the reciprocal of the square roots of the integers i.e.,
$\frac{1}{\sqrt{1}} : \frac{1}{\sqrt{2}} : \frac{1}{\sqrt{3}} : \frac{1}{\sqrt{4}} ....$

Q.47 Two bodies of different masses m_a and m_b are dropped from two different heights a and b. The ratio of the time taken by the two to cover these distance are :

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

Q.48 A body is released from the top of a tower of height h. It takes t sec to reach the ground. Where will be the ball after time t/2 sec :

(1) At h/2 from the ground
(2) At h/4 from the ground
(3) Depends upon mass and volume of the body
(4) At 3h/4 from the ground

Q.49 A stone is dropped from a certain height which can reach the ground in 5 second. If the stone is stopped after 3 second of its fall and then allowed to fall again, then the time taken by the stone to reach the ground for the remaining distance is:

(1) 2 sec (2) 3 sec
(3) 4 sec (4) None of these

Q.50 A particle is dropped under gravity from rest from a height h ($g = 9.8$ m/s^2) and it travels a distance 9h/25 in the last second, the height h is:

(1) 100 m (2) 122.5 m
(3) 145 m (4) 167.5 m

Q.51 A balloon is at a height of 81 m and is ascending upwards with a velocity of 12 m/s. A body of 2 kg weight is dropped from it. If $g = 10$ m/s^2, the body will reach the surface of the earth in:

(1) 1.5 s (2) 4.025 s (3) 5.4 s (4) 6.75 s

Q.52 A ball is thrown vertically upwards from the top of a tower at 4.9 ms^{-1}. It strikes the pond near the base of the tower after 3 seconds. The height of the tower is:

(1) 73.5 m (2) 44.1 m
(3) 29.4 m (4) None of these

Q.53 A body starts to fall freely under gravity. The distance covered by it in first, second and third second are in ratio:

(1) 1 : 3 : 5 (2) 1 : 2 : 3
(3) 1 : 4 : 9 (4) 1 : 5 : 6

Q.54 A stone is shot straight upward with a speed of 20 m/sec from a tower 200 m high. The speed with which it strikes the ground is approximately:

(1) 60 m/sec (2) 65 m/sec
(3) 70 m/sec (4) 75 m/sec

Q.55 A body projected vertically upwards with a velocity u returns to the starting point in 4 seconds. If g = 10 m/sec^2, the value of u is :

(1) 5 m/sec (2) 10 m/sec
(3) 15 m/sec (4) 20 m/sec

Q.56 A body is thrown vertically up from the ground. It reaches a maximum height of 125m in 5 sec. After what time it will reach the ground from the maximum height position:

(1) 1.2 sec (2) 5 sec (3) 10 sec (4)25 sec

Q.57 A stone is dropped into a well in which the level of water is h below the top of the well. If v is velocity of sound, the time T after which the splash is heard is given by.

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

(3) $T=\sqrt{\frac{2h}{v}}+\frac{h}{g}$ (4) $T=\sqrt{\frac{h}{2g}}+\frac{2h}{v}$

Q.58 A body is falling from height 'h' it takes t_1 time to reach the ground. The time taken to cover the first half of height is :–

(1) $t_2=\frac{t_1}{\sqrt{2}}$ (2) $t_1=\frac{t_2}{\sqrt{2}}$

(3) $t_2=\sqrt{3}\,t_1$ (4) None of these

Q.59 Two balls are dropped from different heights at different instants. Second ball is dropped 2 sec. after the first ball. If both balls reach the ground simultaneously after 5 sec. of dropping the first ball, then the difference of initial heights of the two balls will be:– (g=9.8m/s^2)

(1) 58.8 m (2) 78.4 m
(3) 98.0 m (4) 117.6 m

Q.60 Drops of water falls from the roof of a building 9 m. high at regular intervals of time. When the first drop reaches the ground, at the same instant fourth drop starts to fall. What are the distances of the second and third drops from the roof :–

(1) 6 m and 2 m (2) 6 m and 3 m
(3) 1 m and 4 m (4) 4 m and 2 m

Q.61 With what velocity a ball be projected vertically upwards so that the distance covered by it in 5th second is twice the distance it covers in its 6th second (g = 10 m/s^2)

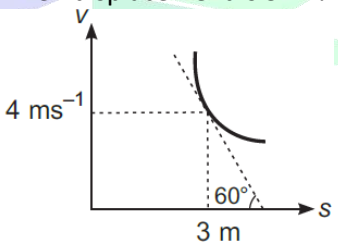
(1) 58.8 m/s (2) 49 m/s
(3) 65 m/s (4) 19.6 m/s

Q.62 A stone is dropped into water from a bridge 44.1 m above the water. Another stone is thrown vertically downward 1 sec later. Both strike the water simultaneously. What was the initial speed of the second stone :

(1) 12.45 m/s (2) 14.75 m/s
(3) 16.23 m/s (4) 17.15 m/s

GRAPH RELATED QUESTIONS

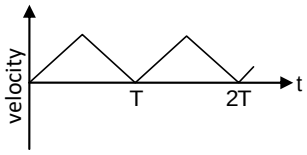
Q.63 A particle is moving along a straight line whose velocity-displacement graph is as shown in the figure. What is the magnitude of acceleration when displacement is 3 m ?

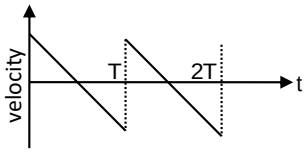


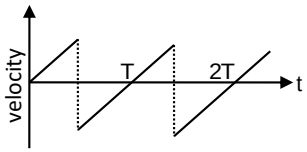
(1) $4\sqrt{3}ms^{-2}$ (2) $3\sqrt{3}ms^{-2}$

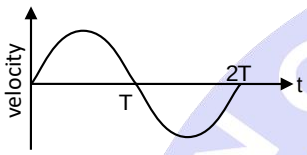
(3) $\sqrt{3}ms^{-2}$ (4) $\frac{4}{\sqrt{3}}ms^{-2}$

Q.64 A ball is dropped from the certain height on the surface of glass. It is collide elastically the comes back to initial position. If this process it repeated then the velocity time graph is :–
(Take downward direction as positive)

(1) 

(2) 

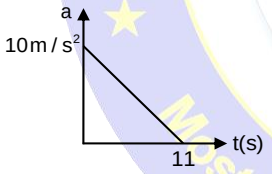
(3) 

(4) 

Q.65 The displacement–time graph for two particles A and B are straight lines inclined at angles of 30° and 60° with the time axis. The ratio of velocities of $V_A : V_B$ is :

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

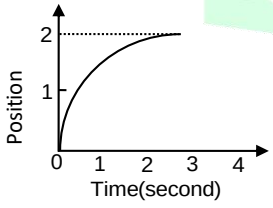
Q.66 A particle starts from rest. Its acceleration (a) versus time (t) is as shown in the figure. The maximum speed of the particle will be :



(1) 110 m/s (2) 55 m/s

(3) 550 m/s (4) 660 m/s

Q.67 The position of a particle as a function of time is shown in the figure. The figure shows that



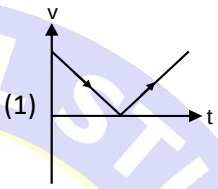
(1) The particle starts with certain velocity but the motion is retarded and finally the particle stops.

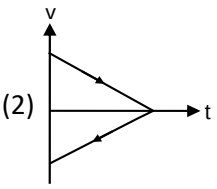
(2) The velocity of the particle is constant throughout.

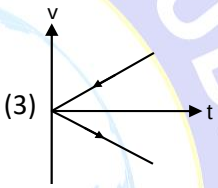
(3) Motion of the particle is uniform throughout.

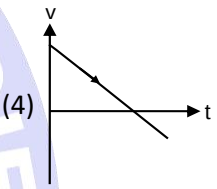
(4) The particle starts with constant velocity, then motion is accelerated and finally the particle moves with another constant velocity.

Q.68 A ball is thrown vertically upwards. Which of the following graph(s) represent velocity–time graph of the ball during its flight (air resistance is neglected)

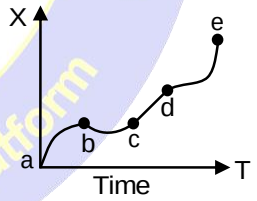
(1) 

(2) 

(3) 

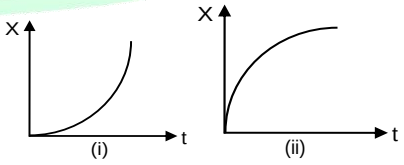
(4) 

Q.69 The displacement versus time graph for a body moving in a straight line is shown in figure. Which of the following regions represents the motion when no force is acting on the body :



(1) ab (2) bc (3) cd (4) de

Q.70 Figure (i) and (ii) below show the displacement–time graphs of two particles moving along the x–axis. We can say that :



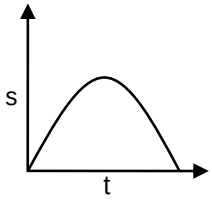
(1) Both the particles are having a uniformly accelerated motion.

(2) Both the particles are having a uniformly retarded motion.

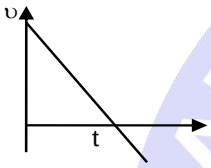
(3) Particle (i) is having a uniformly accelerated motion while particle (ii) is having a uniformly retarded motion.

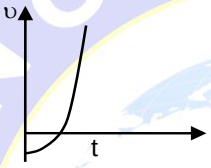
(4) Particle (i) is having a uniformly retarded motion while particle (ii) is having a uniformly accelerated motion.

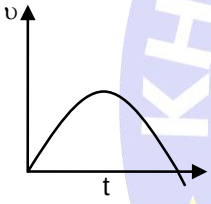
Q.71 The graph of displacement v/s time is,

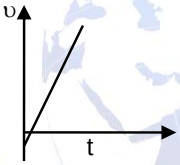


Its corresponding velocity–time graph will be :

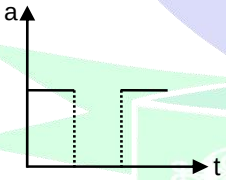
(1) 

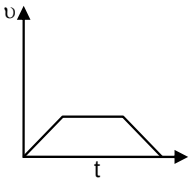
(2) 

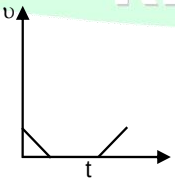
(3) 

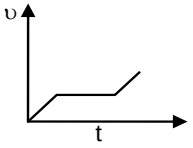
(4) 

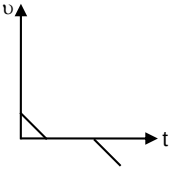
Q.72 An object starts from rest and acceleration–time graph of a body is shown. The corresponding velocity–time graph of the same body is:



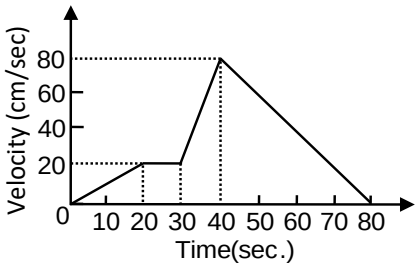
(1) 

(2) 

(3) 

(4) 

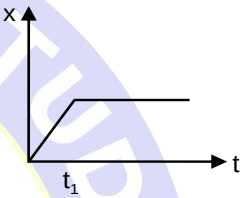
Q.73 The v – t graph of a moving object is given in figure. The maximum acceleration is



(1) 1cm/sec^2 (2) 2cm/sec^2

(3) 3cm/sec^2 (4) 6cm/sec^2

Q.74 The x–t graph shown in figure represents



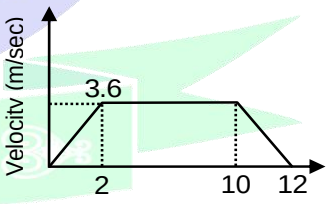
(1) Constant velocity

(2) Velocity of the body is continuously changing

(3) Instantaneous velocity

(4) The body travels with constant speed upto time t_1 and then stops

Q.75 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 :



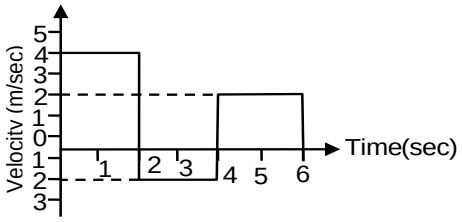
(1) 3.6 m

(2) 28.8 m

(3) 36.0 m

(4) Cannot be calculated from the above graph

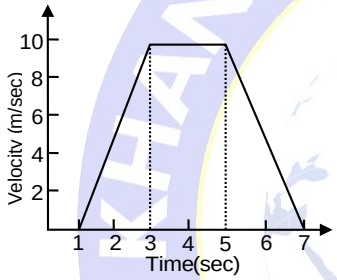
Q.76 The velocity–time graph of a body moving in a straight line is shown in the figure. The displacement and distance travelled by the body in 6 sec are respectively :



(1) 8 m, 16 m (2) 16 m, 8 m

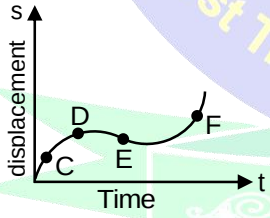
(3) 16 m, 16 m (4) 8 m, 8 m

Q.77 For the velocity–time graph shown in figure below the distance covered by the body in last two seconds of its motion is what fraction of the total distance covered by it in all the seven seconds.



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

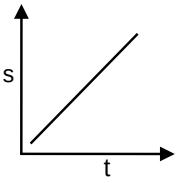
Q.78 The displacement–time graph of moving particle is shown below,

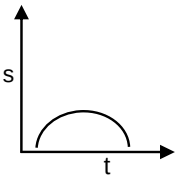


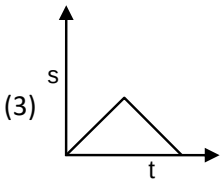
The instantaneous velocity of the particle is negative at the point :

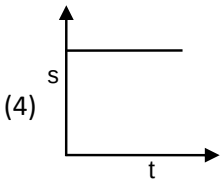
(1) D (2) F (3) C (4) E

Q.79 Which of the following graph represents uniform motion in given position time-graph :

(1) 

(2) 

(3) 

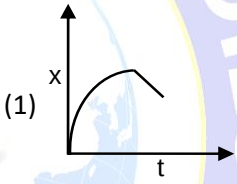
(4) 

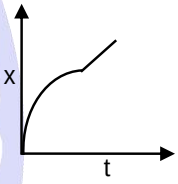
Q.80 A car, starting from rest, accelerates at the rate f through a distance S, then continues at constant speed for time t and then decelerates at the rate f/2 to come to rest. If the total distance traversed is 15 S, then :

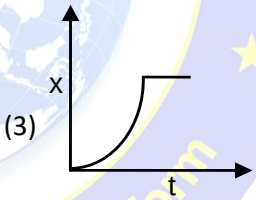
(1) $S = \frac{1}{2}$ ft^2 (2) $S = \frac{1}{4}$ ft^2

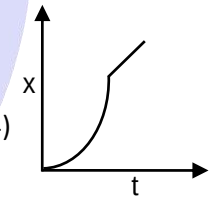
(3) $S = \frac{1}{72}$ ft^2 (4) $S = \frac{1}{6}$ ft^2

Q.81 A car starts from rest accelerates uniform by for 4 second and then moves with uniform velocity which of the x-t graph represent the motion of the car :–

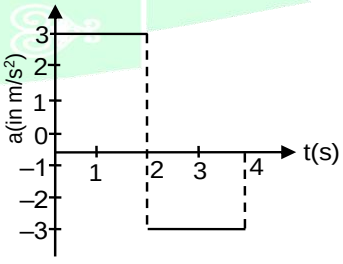
(1) 

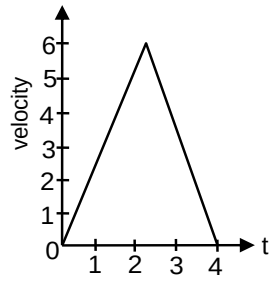
(2) 

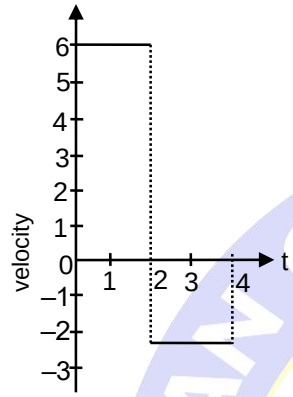
(3) 

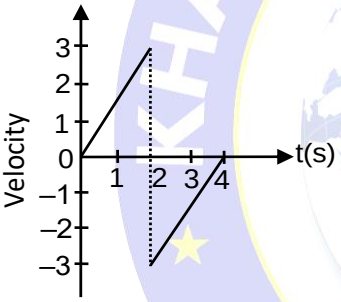
(4) 

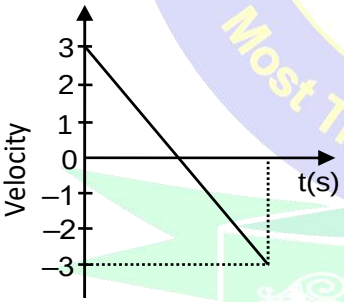
Q.82 For motion of a particle which starts from rest and finally come to rest in 4 second acceleration time graph is shown in figure then the velocity time curve for the duration of 0-4 sec is :–



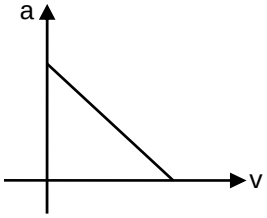
(1)


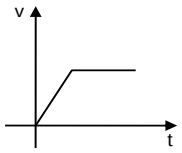
(2)


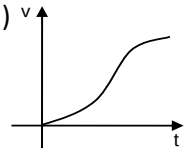
(3)


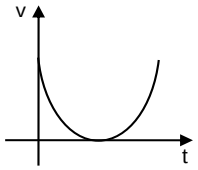
(4)


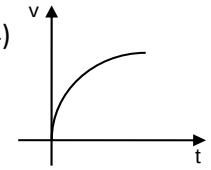
Q.83 Acceleration versus velocity graph of a particle moving in a straight line starting from rest is as shown in figure. The corresponding velocity – time graph would be:-



(1)


(2)


(3)


(4)


DEFINITION, PROJECTILE ON A HORIZONTAL PLANE

Q.84 A body starts from rest from the origin with an acceleration of $6m/s^2$ along the x–axis and $8m/s^2$ along the y–axis. Its distance from the origin after 4 seconds will be :

(1) 56 m (2) 64 m
(3) 80 m (4) 128 m

Q.85 The x and y coordinates of a particle at any time t are given by $x = 7t + 4t^2$ and $y = 5t$, where x and y are in metre and t in seconds. The acceleration of particle at t = 5 s is :

(1) Zero (2) $8\ m/s^2$
(3) $20\ m/s^2$ (4) $40\ m/s^2$

Q.86 When a body is thrown with a velocity u making an angle θ with the horizontal plane, the maximum distance covered by it in horizontal direction is :

(1) $\frac{u^2 \sin\theta}{g}$ (2) $\frac{u^2 \sin\theta}{2g}$
(3) $\frac{u^2 \sin 2\theta}{g}$ (4) $\frac{u^2 \cos 2\theta}{g}$

Q.87 If a projectile is fired at an angle θ with the vertical with velocity u, then maximum height attained is given by :–

(1) $\frac{u^2 \cos\theta}{2g}$ (2) $\frac{u^2 \sin^2\theta}{2g}$
(3) $\frac{u^2 \sin^2\theta}{g}$ (4) $\frac{u^2 \cos^2\theta}{2g}$

Q.88 A ball is thrown at an angle θ with the horizontal and the range is maximum. The value of $\tan\theta$ is:

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

Q.89 The range of a particle when launched at an angle of 15° with the horizontal is 1.5 km. What

is the range of the projectile when launched at an angle of 45° to the horizontal :

(1) 1.5 km (2) 3.0 km

(3) 6.0 km (4) 0.75 km

Q.90 A cricketer can throw a ball to a maximum horizontal distance of 100 m. The speed with which he throws the ball is (to the nearest integer):

(1) 30 ms^{-1} (2) 42 ms^{-1}

(3) 32 ms^{-1} (4) 35 ms^{-1}

Q.91 The horizontal range of a projectile is $4\sqrt{3}$ times its maximum height. Its angle of projectile will be:

(1) 45° (2) 60° (3) 90° (4) 30°

Q.92 Two bodies are thrown up at angles of 45° and 60° respectively, with the horizontal. If both bodies attain same vertical height, then the ratio of velocities with which these are thrown is:

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

Q.93 A bullet is fired with a speed of 1000 m/sec in order to hit a target 100 m away. If g = 10 m/s^2, the gun should be aimed :

(1) Directly towards the target

(2) 5 cm above the target

(3) 10 cm above the target

(4) 15 cm above the target

Q.94 The range of a projectile when fired at 75° with the horizontal is 0.5 km. what will be its range when fired at 45° with same speed :–

(1) 0.5 km. (2) 1.0 km.

(3) 1.5 km. (4) 2.0 km.

Q.95 The speed at the maximum height of a projectile is $\frac{\sqrt{3}}{2}$ times of its initial speed 'u' of projection. Its range on the horizontal plane :–

(1) $\frac{\sqrt{3}u^2}{2g}$ (2) $\frac{u^2}{2g}$

(3) $\frac{3u^2}{2g}$ (4) $\frac{3u^2}{g}$

Q.96 If R is the maximum horizontal range of a particle, then the greatest height attained by it is :–

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

Q.97 A projectile is thrown into space so as to have the maximum possible horizontal range equal to 400m. Taking the point of projection as the origin, the coordinates of the point where the velocity of the projectile is minimum are :–

(1) (400, 100) (2) (200, 100)

(3) (400, 200) (4) (200, 200)

Q.98 Two stones are projected with the same speed but making different angles with the horizontal. Their ranges are equal. If the angle of projection of one is $\frac{\pi}{3}$ and its maximum height is y_1 then the maximum height of the other will be :–

(1) $3y_1$ (2) $2y_1$ (3) $\frac{y_1}{2}$ (4) $\frac{y_1}{3}$

Q.99 An arrow is shot into the air. Its range is 200 metres and its time of flight is 5 s. If the value of g is assumed to be 10 ms^{-2}, then the horizontal component of the velocity of arrow is :–

(1) 25 m/s (2) 40 m/s

(3) 31.25 m/s (4) 12.5 m/s

Q.100 A particle is moving in x–y plane at 2 m/s along x–axis. 2 seconds later, its velocity is 4 m/s in a direction making 60° with positive x–axis. Its average acceleration for this period of motion is:-

(1) $\sqrt{5}$ m/s^2, along y–axis

(2) $\sqrt{3}$ m/s^2, along y–axis

(3) $\sqrt{5}$ m/s^2, along at 60° with positive x–axis

(4) 3m/s^2, at 60° with positive x–axis.

Q.101 The horizontal range of a projectile is R and the maximum height attained by it is H. A strong wind now begins to blow in the direction of

motion of the projectile, giving it a constant horizontal acceleration = g/2. Under the same conditions of projection. Find the horizontal range of the projectile.

(1) R + H (2) R + 2H
(3) R (4) R +H/2

Q.102 A ball is projected from a certain point on the surface of a planet at a certain angle with the horizontal surface. The horizontal and vertical displacements x and y vary with time t in second as: $x = 10\sqrt{3}\,t$; $y = 10t - t^2$ the maximum height attained by the ball is :-

(1) 100m (2) 75m (3) 50 m (4) 25m

PROJECTILE FROM A TOWER

Q.103 An aeroplane moving horizontally with a speed of 180 km/hr. drops a food packet while flying at a height of 490 m. The horizontal range of the packet is :–

(1) 180 m (2) 980 m
(3) 500 m (4) 670 m

Q.104 A plane is flying horizontally at 98 ms^{-1} and releases an object which reaches the ground in 10 s. The angle made by it while hitting the ground is:–

(1) 55° (2) 45° (3) 60° (4) 75°

Q.105 An aeroplane is moving with a velocity u. It drops a packet from a height h. The time t taken by the packet in reaching the ground will be :

(1) $\sqrt{\left(\frac{2g}{h}\right)}$ (2) $\sqrt{\left(\frac{2u}{h}\right)}$
(3) $\sqrt{\left(\frac{h}{2g}\right)}$ (4) $\sqrt{\left(\frac{2h}{g}\right)}$

Q.106 An aeroplane is moving with horizontal velocity u at height h. The velocity of a packet dropped from it on the earth's surface will be
(g is acceleration due to gravity)

(1) $\sqrt{u^2+2gh}$ (2) $\sqrt{2gh}$
(3) 2gh (4) $\sqrt{u^2-2gh}$

Q.107 Particle is dropped from the height of 20 m on horizontal ground. There is wind blowing due to which horizontal acceleration of the particle becomes 6 ms^{-2}. Find the horizontal displacement of the particle till it reaches ground.

(1) 6m (2) 10 m (3) 12m (4) 24 m

EQUATION OF TRAJECTORY

Q.108 The equation of a projectile is $y = \sqrt{3}x - \frac{gx^2}{2}$ the angle of projection is :–

(1) 30° (2) 60°
(3) 45° (4) none

Q.109 The equation of projectile is $y = 16x - \frac{x^2}{4}$ the horizontal range is :–

(1) 16 m (2) 8 m
(3) 64 m (4)12.8 m

RELATIVE MOTION IN ONE DIMENSION

Q.110 A stone is dropped from a height h. Simultaneously, another stone is thrown up from the ground which reaches a height 4h. The two stones will cross each other after time:-

(1) $\sqrt{\frac{h}{8g}}$ (2) $\sqrt{8gh}$ (3) $\sqrt{2gh}$ (4) $\sqrt{\frac{h}{2g}}$

Q.111 A jet air plane travelling at a speed of 500 km/h ejects its products of combustion at a speed of 1500km/h relative to the jet plane. The speed of the latter with respect to an observer on the ground is :

(1) 1500 km/h (2) 2000 km/h
(3) 1000 km/h (4) 500 km/h

Q.112 A train of 150m length is going towards north direction at a speed of 10 ms^{-1}. A parrot flies at a speed of 5ms^{-1} towards south direction parallel to the railway track. The time taken by the parrot to cross the train is equal to :–

(1) 12 s (2) 8 s (3) 15 s (4) 10 s

Q.113 Two trains, each 50m long, are travelling in opposite directions with velocity 10 m/s and 15 m/s. The time of crossing is :–

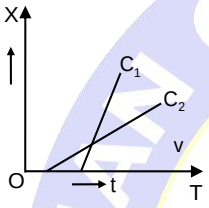
(1) 2 s (2) 4 s (3) $2\sqrt{3}$s (4) $4\sqrt{3}$s

Q.114 A train moves in north direction with a speed of 54 km/hr and a monkey running on the roof of the train, against its motion with a velocity of 18 km/hr with respect to the train, then the velocity of monkey as observed by a man standing on the ground :–

(1) 5 ms^{-1} due south (2) 25 ms^{-1} due south

(3) 10 ms^{-1} due south (4) 10 ms^{-1} due north

Q.115 Shown in the figure are the displacement time graph for two children going home from the school. Which of the following statements about their relative motion is true after both of them started moving ?



Their relative velocity :

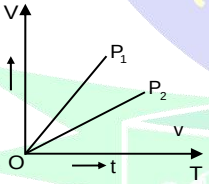
(1) first increases and then decreases

(2) first decreases and then increases

(3) is zero

(4) is non zero constant.

Q.116 Shown in the figure are the velocity time graphs of the two particles P_1 and P_2. Which of the following statements about their relative motion is true? Their relative velocity :



(1) is zero

(2) is non-zero but constant

(3) continuously decreases

(4) continuously increases

Q.117 A thief is running away on a straight road in a jeep moving with a speed of 9 m s^{-1}. A police man chases him on a motor cycle moving at a speed of 10 m s^{-1}. If the instantaneous separation of the jeep from the motorcycle is 100m, how long will it take for the police man to catch the thief?

(1) 1s (2) 19s (3) 90s (4) 100s

Q.118 An elevator car, whose floor to ceiling distance is equal to 2.7 m, starts ascending with constant acceleration of 1.2 ms^{-2}. 2 sec after the start, a bolt begins fallings from the ceiling of the car. The free fall time of the bolt is :

(1) $\sqrt{0.54}$ s (2) $\sqrt{6}$ s

(3) 0.7 s (4) 1 s

Q.119 Two cars A and B at rest at same point initially. If A starts with uniform velocity of 40 m/sec and B starts in the same direction with constant acceleration of 4m/s^2, then B will catch A after how much time :

(1) 10 sec (2) 20 sec

(3) 30 sec (4) 35 sec

Q.120 A student is standing at a distance of 50 metres from the bus. As soon as the bus begins its motion with an acceleration of 1ms^{-2}, the student starts running towards the bus with a uniform velocity u. Assuming the motion to be along a straight road, the minimum value of u, so that the student is able to catch the bus is :

(1) 5 ms^{-1} (2) 8 ms^{-1}

(3) 10 ms^{-1} (4) 12 ms^{-1}

Q.121 A man is 45 m behind the bus when the bus start accelerating from rest with acceleration 2.5 m/s^2. With what minimum velocity should the man start running to catch the bus?

(1) 12 m/s (2) 14 m/s

(3)15 m/s (4) 16 m/s

Q.122 A car A is travelling on a straight level road with a uniform speed of 60 km/h. It is followed by another car B which is moving with a speed of 70 km/h. When the distance between them is 2.5 km, the car B is given a deceleration of 20 km/h^2. After how much time will B catch up with A:

(1) 1 hr (2)1/2 hr

(3) 1/4 hr (4)1/8 hr

RELATIVE MOTION IN TWO DIMENSION

Q.123 A bird is flying with a speed of 40 km/hr in the north direction. A train is moving with a speed of 40 km/hr in the west direction. A passenger sitting in the train will see the bird moving with velocity :–

(1) 40 $\sqrt{2}$ km/hr in NE direction

(2) 40 $\sqrt{2}$ km/hr in NE direction

(3) 40 km/hr in NW direction
(4) $40\sqrt{2}$ km/hr in NW direction

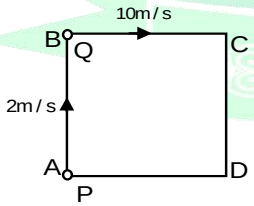
Q.124 A ship is travelling due east at 10 km/h. A ship heading 30° east of north is always due north from the first ship. The speed of the second ship in km/h is -

(1) $20\sqrt{2}$ (2) $20\sqrt{3/2}$
(3)20 (4) $20/\sqrt{2}$

Q.125 Two balls are thrown simultaneously, (A) vertically upwards with a speed of 20 m/s from the ground and (B) vertically downwards from a height of 40 m with the same speed and along the same line of motion. At which point the balls will collide:–
(take g = 10 m/sec^2)
(1)15 m above from the ground
(2) 15 m below from the top of the tower
(3) 20 m above from the ground
(4) 20 m below from the top of the tower

Q.126 A bus starts from rest moving with acceleration 2ms^{-2}. A cyclist 96 m behind the bus starts simultaneously towards the bus at 20 m/s. After what time he will be able to overtake the bus: –
(1)8 s (2) 10 s (3) 12 s (4) 14s

Q.127 Two men P & Q are standing at corners A & B of square ABCD of side 8 m. They start moving along the track with constant speed 2 m/s and 10 m/s respectively. Find the time when they will meet for the first time.



(1) 2 s (2) 3 s (3) 1 s (4) 6 s

RELATIVE MOTION IN RIVER FLOW & AIR FLOW

Q.128 A river is flowing from east to west at a speed of 5m/min. A man on south bank of river, capable of swimming 10 m/min in still water, wants to swim across the river in shortest time; he should swim:–
(1) due north
(2) due north-east
(3) due north-east with double the speed of river
(4) none of the above

Q.129 A boat is sailing at a velocity $(3\hat{i}+4\hat{j})$ with respect to ground and water in river is flowing with a velocity $(-3\hat{i}-4\hat{j})$. Relative velocity of the boat with respect to water is: –
(1) $8\hat{j}$ (2) $5\sqrt{2}$
(3) $6\hat{i}+8\hat{j}$ (4) $-6\hat{i}-8\hat{j}$

Q.130 A boat takes 2 hours to go 8 km and come back in still water lake. With water velocity of 4km/hr, the time taken for going upstream of 8 km and coming back is: –
(1) 140 min (2) 150 min
(3) 160 min (4) 170 min

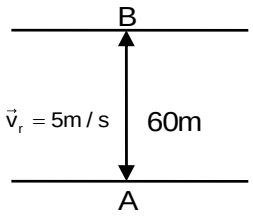
Q.131 A river is flowing at the rate of 6 km/hr. A swimmer swims across with a velocity of 9 km/hr w.r.t. water. The resultant velocity of the man will be in (km/hr) :–
(1) $\sqrt{117}$ (2) $\sqrt{340}$
(3) $\sqrt{17}$ (4) $3\sqrt{40}$

Q.132 A boat, which has a speed of 5 km/h in still water, crosses a river of width 1 km along the shortest possible path in 15 minutes. The velocity of the river water in km/h is -
(1) 1 (2)3 (3) 4 (4) $\sqrt{41}$

Q.133 A man wishes to swim across a river 0.5 km wide. If he can swim at the rate of 2 km/h in still water and the river flows at the rate of 1 km/h. The angle (w.r.t. the flow of the river) along which he should swim so as to reach a point exactly opposite his starting point, should be: –
(1) 60° (2)120° (3) 145° (4) 90°

Q.134 A boat moving towards east with velocity 4 m/s with respect to still water and river is flowing towards north with velocity 2 m/s and the wind is blowing towards north with velocity 6 m/s. The direction of the flag blown over by the wind hoisted on the boat is :-
(1) North–west
(2) South–east
(3) $\tan^{-1}(1/2)$ with east
(4) North

Q.135 A man is crossing a river flowing with velocity of 5 m/s. He reaches a point directly across at distance of 60 m in 5s. His velocity in still water should be :



(1) 12 m/s (2) 13 m/s
(3) 5 m/s (4) 10 m/s

RELATIVE MOTION IN RAIN AND WIND

Q.136 A man is walking on a road with a velocity 3 km/hr. Suddenly rain starts falling. The velocity of rain is 10 km/hr in vertically downward direction. the relative velocity of the rain with respect to man is :–
(1) $\sqrt{13}$ km/hr (2) $\sqrt{7}$ km/hr
(3) $\sqrt{109}$ km/hr (4) 13 km/hr

Q.137 It is raining vertically downwards with a velocity of 3 km h^{-1}. A man walks in the rain with a velocity of 4 kmh^{-1}. The rain drops will fall on the man with a relative velocity of;
(1) 1 kmh^{-1} (2) 3 kmh^{-1}
(3) 4 kmh^{-1} (4) 5 kmh^{-1}

Q.138 A man walks in rain with a velocity of 5 kmh^{-1}. The rain drops strike at him at an angle of 45° with the horizontal. Velocity of rain if it is falling vertically downward -
(1) 5 kmh^{-1} (2) 4 kmh^{-1}
(3) 3 kmh^{-1} (4) 1 kmh^{-1}

Q.139 A man standing on a road has to hold his umbrella at 30° with the verticle to keep the rain away. He throws the umbrella and starts running at 10 km/hr then he finds that rain drops are hitting his head vertically, then speed of rain drops with respect to moving man :–
(1) 20 km/hr (2) $10\sqrt{3}$ km/hr
(3) $\frac{10}{\sqrt{3}}$ km/hr (4) 10 km/hr

ANSWER KEY

TOPIC WISE QUESTIONS

Ques.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	2	1	3	3	4	1	2	4	4	2	4	4	1	3
Ques.	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Ans.	2	4	1	3	2	1	3	4	3	2	2	4	4	4	3
Ques.	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**
Ans.	4	4	3	1	1	3	2	2	1	2	2	2	4	3	2
Ques.	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
Ans.	3	3	4	3	2	3	3	1	2	4	2	2	1	2	3
Ques.	**61**	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
Ans.	3	1	1	3	4	2	1	4	3	3	1	3	4	4	3
Ques.	**76**	**77**	**78**	**79**	**80**	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**
Ans.	1	2	4	1	3	4	1	4	3	2	3	4	1	2	3
Ques.	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**100**	**101**	**102**	**103**	**104**	**105**
Ans.	4	3	2	2	1	4	2	4	2	2	2	4	3	2	4
Ques.	**106**	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**	**115**	**116**	**117**	**118**	**119**	**120**
Ans.	1	3	2	3	1	3	4	2	4	4	4	4	3	2	3
Ques.	**121**	**122**	**123**	**124**	**125**	**126**	**127**	**128**	**129**	**130**	**131**	**132**	**133**	**134**	**135**
Ans.	3	2	2	3	1	1	2	1	3	3	1	2	2	1	2
Ques.	**136**	**137**	**138**	**139**											
Ans.	3	4	1	2											