Exercise-1

ONLY ONE OPTION CORRECT TYPE

SECTION (A) : DISTANCE AND DISPLACEMENT

1. A runner completes one round of a circular path of radius r in 40 seconds. His displacement after 2 minutes
20 seconds will be
(1) zero (2) $2\pi r$ (3) 2r (4) $7\pi r$

2. A body moves along a curved path of a quarter circle. The ratio of distance to displacement is
(1) $\frac{\pi}{2\sqrt{2}}$ (2) $\frac{2\sqrt{2}}{\pi}$ (3) $\frac{\pi}{\sqrt{2}}$ (4) $\frac{\sqrt{2}}{\pi}$

3. A Body moves 6 m north. 8 m east and 10m vertically upwards, what is its resultant displacement frominitial position
(1) $10\sqrt{2}$m (2) 10 m (3) $\frac{10}{\sqrt{2}}$m (4) 10 × 2 m

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 long south (3) 10 m along west (4) Zero

5. A hall has the dimensions 10 m × 10 m × 10 m. A fly starting at one corner ends up at a diagonally opposite corner. The magnitude of its displacement is nearly
(1) 5 $\sqrt{3}$ m (2) 10 $\sqrt{3}$ m (3) 20 $\sqrt{3}$ m (4) 30 $\sqrt{3}$ m

6. A particle starting from the origin (0, 0) moves in a straight line in the (x, y) plane. Its coordinates at a later time are ($\sqrt{3}$, 3). The path of the particle makes with the x-axis an angle of :
(1) 30º (2) 45º (3) 60º (4) 0º

SECTION (B) : AVERAGE SPEED AND AVERAGE VELOCITY

1. A motor car covers $\frac{1}{3}$rd part of total distance with $v_1 = 10 km/hr$, second $\frac{1}{3}$rd part with $v_2 = 20$ km/hr and rest $\frac{1}{3}$rd part with $v_3 = 60 km/hr$. What is the average speed of the car?
(1) 18 km/hr (2) 45 km/hr (3) 6 km/hr (4) 22.5 km/hr

2. A car travels a distance of 2000m. If the first half distance is covered at 40 km/hour and the second half at velocity v and if the average velocity is 48 km/hour then the value of v is
(1) 56 km/hour (2) 60 km/hour (3) 50 km/hour (4) 48 km/hour

3. A particle moves towards east for 2 sec with velocity 15 m/s and move towards north for 8 sec with velocity 5 m/s. Then average velocity of the particle is :
(1) 1 m/s (2) 5 m/s (3) 7 m/s (4) 10 m/s

4. Which of the following is a one dimensional motion
(1) Landing of an aircraft (2) Earth revolving a round the sun
(3) Motion of wheels of a moving trains (4) Train running on a straight track

5. 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

6. A car runs at constant speed on a circular track of radius 100 m taking 62.8 s on each lap. What is the average speed and average velocity on each complete lap?
(1) velocity 10m/s, speed 10 m/s (2) velocity zero, speed 10 m/s
(3) velocity zero, speed zero (4) velocity 10 m/s, speed zero

7. Mark the correct statements :
(1) The magnitude of the instantanteous velocity of a particle is equal to its instantanteous speed.
(2) The magnitude of average velocity in an interval is equal to its average speed in that interval.
(3) It is possible to have a situation in which the speed of a particle is always zero but the average speed is not zero
(4) It is possible to have a situation in which the speed of the particle is never zero but the average speed in an interval is zero.

8. A car moves from X to Y with a uniform velocity v_u and returns to X with a uniform velocity v_d. The average speed for this round trip is :
(1) $\frac{2v_d v_u}{v_d + v_u}$ (2) $\sqrt{v_u \quad v_d}$ (3) $\frac{v_d v_u}{v_d + v_u}$ (4) $\frac{v_u v_d}{2}$

SECTION (C) : VELOCITY, ACCELERATION, AVERAGE ACCELERATION

1. A particle is moving with velocity 5 m/s towards east and its velocity changes to 5 m/s north in 10 sec. Find the acceleration.
(1) $\sqrt{2}\,N-W$ (2) $\frac{1}{\sqrt{2}}N-W$ (3) $\frac{1}{\sqrt{2}}N-E$ (4) $\sqrt{2}\,N-E$

2. The displacement-time relationship for a particle is given by $x = a_0 + a_1 t + a_2 t^2$. The acceleration of the particle is
(1) a_0 (2) a_1 (3) a_2 (4) $2a_2$

3. A particle has velocity given by v = 20 + 0.1 t_2 then it has
(1) uniform acceleration (2) uniform retardation
(3) non uniform acceleration (4) zero acceleration

4. The displacement is given by x = 2t_2 + t + 5, the acceleration at t = 5 sec will be
(1) 8 m/s_2 (2) 12 m/s_2 (3) 15 m/s_2 (4) 4 m/s_2

5. A particle is moving so that its displacement is given as $s = t^3 - 6t^2 + 3t + 4$ meter. Its velocity at the instant when its acceleration is zero will be
(1) 3 m/s (2) –12 m/s (3) 42 m/s (4) –9 m/s

6. If velocity of a particle is given by $V = 10 + 2t^2\ m/s$. The average acceleration between 2 and 5 s is
(1) 2 m/s_2 (2) 4 m/s_2 (3) 12 m/s_2 (4) 14 m/s_2

7. If the displacement of a particle varies with time as $\sqrt{x} = t + 7$, the
(1) velocity of the particle is inversely porportional to t
(2) velocity of the particle is directly proportional to t
(3) velocity of the particle is proportional to $\sqrt{t}$
(4) the particle moves with a constant acceleration

8. The displacement [s] of a body is directly proportional to the square of the time [t] than the acceleration of the body is
(1) increases (2) constant (3) decreases (4) zero

9. A truck travelling due north at 20 ms_{-1} turns west and travels with same speed. What is the change in velocity ?
(1) 20 $\sqrt{2}$ ms_{-1} south-west (2) 40 ms_{-1} south west

(3) $20\sqrt{2}$ ms^{-1} north west (4) 40 ms^{-1} north west

10. If relation between distance and time is $s = a + bt + ct^2$, and initial velocity and acceleration :
(1) b + 2 ct, 2 c (2) b, 2 c (3) 2 c, b (4) b + 2 c, 2 c

11. A car starts from rest and has an acceleration a = t. A truck is moving with a uniform velocity of 6 m/s. At what distance will the car overtake the truck? (at t = 0 both start their motion in the same direction from the same position)
(1) 36 m (2) 8 m (3) 32 m (4) 4 m

12. Two balls are dropped from the same point after an interval of 1 s. If acceleration due to gravity is 10 m/s^2, what will be the separation 3 seconds after the release of first ball?
(1) 5 m (2) 10 m (3) 25 m (4) 20 m

13. A truck travelling due to North at 20 m/s turns East and travels at the same speed. The change in its velocity is
(1) $20\sqrt{2}\,m/s$ North – East (2) $20\sqrt{2}\,m/s$ South – East
(3) $40\sqrt{2}\,m/s$ North – East (4) $20\sqrt{2}\,m/s$ North – West

14. If velocity varies with time as v = 4t, find the distance travelled by the body in the interval of 2 s to 4 s.
(1) 24 m (2) 240 m (3) 2.4 m (4) 0.24 m

15. 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 ?
(1) 24 m (2) 40 m (3) 56 m (4) 16 m

16. 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 metre and t in second. What will be the position of this particle when it achieves maximum speed along the + x direction?
(1) 32 m (2) 54 m (3) 81 m (4) 24 m

17. The displacement of a body is given to be proportional to the cube of time passed. The magnitude of the acceleration of the body, is
(1) Increasing with time (2) Decreasing with time
(3) Constant but not zero (4) Zero

18. Velocity-time curve for a body projected vertically upwards is
(1) Ellipse (2) Parabola (3) Hyperbola (4) Straight line

19. The relation between time t and distance x is $t = ax^2 + bx$, where a and b are constants. The acceleration is:
(1) $–2abv^2$ (2) $2bv^2$ (3) $–2av^3$ (4) $2av^3$

20. A particle is moving eastwards with a velocity of 5 ms^{-1}. In 10 second the velocity changes to 5 ms^{-1} northwards. The average acceleration in this time is :
(1) $\frac{1}{\sqrt{2}}$ ms^{-1} towards north-west (2) $\frac{1}{2}$ ms^{-2} towards north
(3) zero (4) $\frac{1}{2}$ ms^{-2} towards north-west.

SECTION (D) : EQUATIONS OF MOTION AND MOTION UNDER GRAVITY

1. Which one of the following equations represent the motion of a body with finite constant non-zero acceleration. In these equations y denotes the displacement of the body at time t and a,b and c are the constant of the motion

(1) $y = \frac{a}{t} + bt$ (2) $y = at$ (3) $y = at + bt^2$ (4) $y = at + bt^2 + ct^3$

2. A ball is thrown upward and reaches a height of 64 feet, its initial velocity should be (g = 32 ft/sec^2)
(1) 64 ft/sec (2) 72 ft/sec (3) 32 ft/sec (4) 4096 ft/sec

3. Two bodies of different masses m_a and m_b are dropped from two different heights, viz a and b. The ratio of times taken by the two to drop through these distance is
(1) a : b (2) $\frac{m_a}{m_b} : \frac{b}{a}$ (3) $\sqrt{a} : \sqrt{b}$ (4) $a^2 : b^2$

4. A body thrown up with a finite speed is caught back after 4 sec. The speed of the body with which it is thrown up is
(1) 10 m/sec (2) 20 m/sec (3) 30 m/sec (4) 40 m/sec

5. A body is thrown upward and reaches its maximum height. At that position
(1) its velocity is zero and its acceleration is also zero
(2) its velocity is zero but its acceleration is maximum
(3) its acceleration is minimum
(4) its velocity is zero and its acceleration is the acceleration due to gravity

6. The initial velocity of a particle (at t = 0) is u and the acceleration f of particle at time t is given by f = at. Where a is a constant which of the following relation for velocity v of particle after time t is true?
(1) $v = u + at^2$ (2) $v = u + at^2/2$ (3) v = u + at (4) none of these

7. A body starting from rest and has uniform acceleration 8 m/sec^2. The distance travelled by it in 5th second will be
(1) 36 m (2) 40 m (3) 100 m (4) 200 m

8. A body starts from rest, the ratio of distances travelled by the body during 3rd and 4th seconds is
(1) 7/5 (2) 5/7 (3) 7/3 (4) 3/7

9. The initial velocity of a particle is 10 m/sec and its retardation is 2 m/sec^2. The distance covered in the fifth second of the motion will be
(1) 1 m (2) 19 m (3) 50 m (4) 75 m

10. An object is released from some height. Exactly after one second, another object is released from the same height. The distance between the two objects exactly after 2 seconds of the release of second object will be
(1) 4.9 m (2) 9.8 m (3) 19.6 m (4) 24.5 m

11. A man standing on the edge of a cliff throws a stone straight up with initial speed u and then throws another stone straight down with same initial speed u from the same position. Find the ratio of speeds, the stones would have attained when they hit the ground at the base of the cliff?
(1) 2 : 1 (2) 1 : 2 (3) 1 : 1 (4) 3 : 1

12. A stone is dropped from a bridge and it reaches the ground in 4 seconds. The height of the bridge is
(1) 78.4 m (2) 64 m (3) 260 m (4) 2000 m

13. A stone is dropped from the top of a tower and it strikes with 3 km/hr against the ground. Another stone is thrown vertically downwards from the same top of the tower with a velocity 4 km/hr. Its velocity when it strikes the ground will be
(1) 7.0 km/hr (2) 5.0 km/hr (3) 3.5 km/hr (4) 4.0 km/hr

14. A ball is thrown vertically upwards from the top of a tower with a velocity of 10 m/sec. If the ball falls on the ground after 5 seconds, the height of the tower will be (use g = 10 m/s^2)
(1) 25 m (2) 50 m (3) 75 m (4) 100 m

15. In the above question, what maximum height above the tower will the ball attain?

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

16. In the above question, the total distance travelled by the ball before it returns to the ground is
(1) 85 m (2) 75 m (3) 100 m (4) 175 m

17. In the above question, in what time will it reach the maximum height
(1) 1 sec (2) 2 sec (3) $\sqrt{2}$ sec (4) $1/\sqrt{2}$ sec

18. In the above question, with what velocity will the ball strike the ground
(1) zero (2) 40 m/s (3) 10 m/s (4) 60 m/s

19. If a body starts from rest and travels 1.2 m in the 8th second then what is the acceleration
(1) 0.20 m/s^2 (2) 0.16 m/s^2 (3) 0.08 m/s^2 (4) 0.2255 m/s^2

20. A body starts from rest and has an acceleration 20 cm/sec^2. What is the distance covered by the body in first 8 sec
(1) 160 cm (2) 640 cm (3) 1280 cm (4) 1640 cm

21. The initial velocity of a body moving along a straight line is 7 m/s. It has a uniform acceleration of 4 m/s^2. The distance covered by the body in the 5^{th} second of its motion is
(1) 25 m (2) 35 m (3) 50 m (4) 85 m

22. A train covers 50 metre distance and stops when applied the breaks. If the velocity of train is just doubled and applied the same retarding force then the distance covered by the train is
(1) 50 m (2) 100 m (3) 150 m (4) 200 m

23. A particle after starting from rest, experiences constant acceleration for 20 sec. If it covers a distance s_1 in first 10 sec, then the distance covered during next 10 sec will be
(1) s_1 (2) $2s_1$ (3) $3s_1$ (4) $4s_1$

24. When two particles each of mass m are dropped from height h and 2h respectively, then the ratio of their times to reach the ground is
(1) $1 : \sqrt{2}$ (2) $\sqrt{2} : 1$ (3) 1 : 2 (4) 2 : 1

25. The velocity of bullet is reduced from 200 m/s to 100 m/s while travelling through a wooden block of thickness of 10 cm. The retardation assuming to be uniform, will be :
(1) 15×10^4 m/s^2 (2) 13.5×10^4 m/s^2 (3) 12×10^4 m/s^2 (4) none of these

26. A body falls from a height h = 200 m. The ratio of distance travelled in each 2 s, during t = 0 to t = 6 s of the journey is :
(1) 1 : 4 : 9 (2) 1 : 2 : 4 (3) 1 : 3 : 5 (4) 1 : 2 : 3

27. A car moving with a speed of 50 km/h, can be stopped by brakes after at least 6m. If the same car is moving at a speed of 100 km/h, the minimum stopping distance is
(1) 12 m (2) 18 m (3) 24 m (4) 6 m

28. Speeds of two identical cars are u are 4u at a specific instant. The ratio of the respective distances in which the two cars are stopped in the same time
(1) 1 : 1 (2) 1 : 4 (3) 1 : 8 (4) 1 : 16

29. Juggler keeps on moving four balls in the air continuously such that each ball attains 20 m height. When the first ball leaves his hand, the position of the other balls (in metre height) will be
(1) 10, 20, 10 (2) 15, 20, 15 (3) 5, 51, 20 (4) 5, 10, 20

30. A particle is thrown upwards from ground. It experiences a constant air resistance which can produce a retardation of 2 m/s^2 opposite to the direction of velocity of particle. The ratio of time of ascent to the time of descent is : [g = 10 m/s^2]
(1) 1 : 1 (2) $\sqrt{\frac{2}{3}}$ (3) $\frac{2}{3}$ (4) $\sqrt{\frac{3}{2}}$

31. A block is moving down 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. The ratio $\frac{S_n}{S_{n+1}}$ is

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

32. An alpha particle enters a hollow tube of 4 m length with an initial speed of 1 km/s. It is accelerated in the tube and comes out of it with a speed of 9 km/s. The time for which it remains inside the tube is

(1) 8×10^{-3} s (2) 80×10^{-3} s (3) 800×10^{-3} s (4) 8×10^{-4} s

33. A student is standing at a distance of 50metres 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}

34. A man throws balls with the same speed vertically upwards one after the other at an interval of 2 seconds. What should be the speed of the throw so that more than two balls are in the sky at any time ? (Given g = 9.8 m/s^2)

(1) Any speed less than 19.6 m/s (2) Only with speed 19.6 m/s
(3) more than 19.6 m/s (4) At least 9.8 m/s

35. A ball is thrown vertically upward. It has a speed of 10 m/s when it has reached one half of its maximum height. How high does the ball rise ? (Taking g = 10 m/s^2)

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

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

(1) 5/4 (2) 12/5 (3) 5/12 (4) 4/5

37. The distance travelled by a particle starting from rest and moving with an acceleration $\frac{4}{3}$ ms^{-2}, in the third second is

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

38. If a ball is thrown vertically upwards at 40 m/s, its velocity after two seconds will be

(1) 10 m/s (2) 20 m/s (3) 30 m/s (4) 40 m/s

39. A body A starts from rest with an acceleration a_1. After 2 s another body B starts from rest with an acceleration a_2. If they travel equal distances in 5^{th} s, after the starts of A, the ratio $a_1 : a_2$ will be equal to :

(1) 9 : 5 (2) 5 : 7 (3) 5 : 9 (4) 7 : 9

40. A parachutist after bailing out falls 50 m without friction. When parachute opens, it decelerates at 2 m/s^2. He reaches the ground with a speed of 3 m/s. At what height , did he bail out?

(1) 91 m (2) 182 m (3) 293 m (4) 111 m

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

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

42. A ball is released from the top of a tower of height h metres. It takes T seconds to reach the ground. What is the position of the ball in T/3 seconds?

(1) h/9 metre from the ground (2) 7h/9 metre from the ground
(3) 8h/9 metre from the ground (4) 17h/9 metre from the ground

43. An automobile travelling with a speed of 60 km/h, can brake to stop within a distance of 20 m. If the car is going twice as fast, ie. 120 km/h, the stopping distance will be

(1) 20 m (2) 40 m (3) 60 m (4) 80 m

44. A particle is moving along straight line with initial velocity 48 m/sec and acceleration –10m/s^2. The distance travelled by particle in 5th second is :

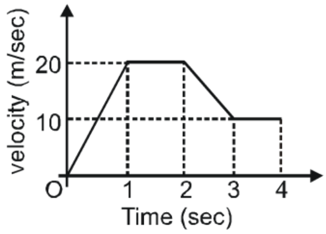
(1) 3m (2) 115 m (3) $\frac{17}{5}$ m (4) $\frac{14}{5}$ m

SECTION (E) : GRAPH RELATED QUESTIONS

1. The displacement-time graph for the two particles A and B are straight lines inclined at angles 30^0 and 60^0 with the time axis. The ratio of the velocities of A to B will be

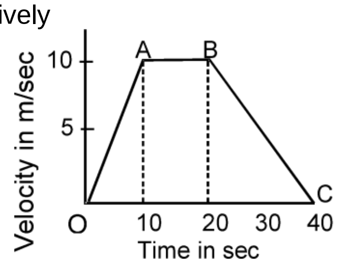
(1) 1 : 2 (2) $1:\sqrt{3}$ (3) $\sqrt{3}:1$ (4) 1 : 3

2. The variation of velocity of a particle moving along straight line is shown in figure. The distance traversed by the body in 4 seconds is



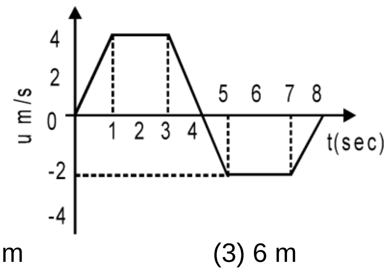
(1) 70 m (2) 60 m (3) 40 m (4) 55 m

3. The adjoining curve represents the velocity-time graph of a particle, its acceleration values along OA, AB and BC in metre/sec^2 are respectively



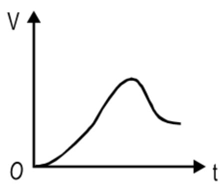
(1) 1,0,–0.5 (2) 1,0,0.5 (3) 1,1,0.5 (4) 1,0.5,0

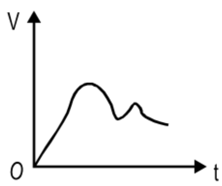
4. The velocity-time graph of a linear motion is shown below. The displacement from the origin after 8 seconds is

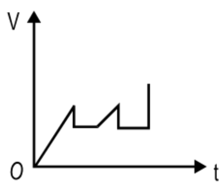


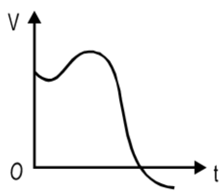
(1) 18 m (2) 16 m (3) 6 m (4) 6 cm

5. The following figures show some velocity V versus time t curves. But only some of these can be realised in practice. These are

(1) 

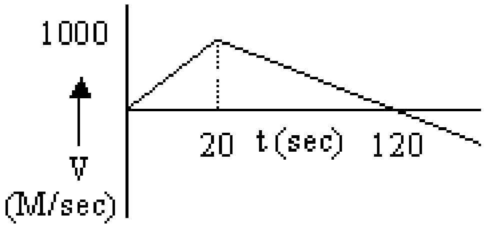
(2) 

(3) 

(4) 

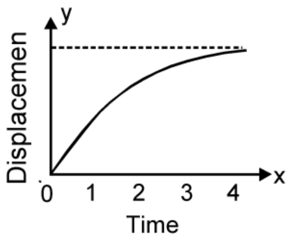
(1) Only a,b and d (2) only a,b,c (3) only b and c (4) all of them

6. A rocket is projected vertically upwards and its time velocity graph is shown in the figure. The maximum height attained by the rocket is



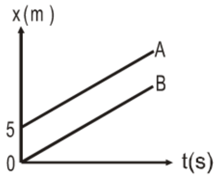
(1) 1 km (2) 10 km (3) 100 km (4) 60 km

7. The displacement of a particle as a function of time is shown in fig. The fig. indicates that



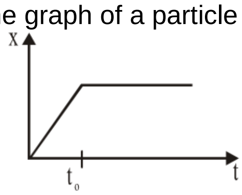
(1) the particle starts with a certain velocity, but the motion is retarded and finally the particle stops
(2) the velocity of particle is constant throught
(3) the acceleration of the particle is constant throughout
(4) the particle starts with a constant velocity, the motion is accelerated and finally the particle moves with another constant velocity.

8. Figure shows position-time graph of two cars A and B.



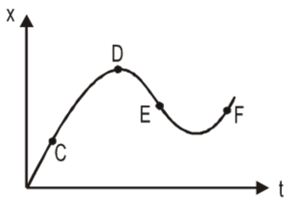
(1) Car A is faster than car B. (2) Car B is faster than car A.
(3) Both cars are moving with same velocity. (4) Both cars have non zero positive acceleration.

9. Fig. shows the displacement time graph of a particle moving on the X-axis.



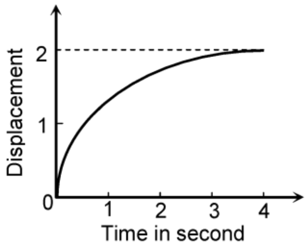
(1) the particle is continuously going in positive x direction
(2) the particle is at rest
(3) the velocity increases up to a time t_0, and then becomes constant.
(4) the particle moves at a constant velocity up to a time t_0, and then stops.

10. The displacement–time graph of a moving particle is shown below. The instantaneous velocity of the particle is negative at the point :



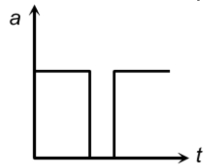
(1) C (2) D (3) E (4) F

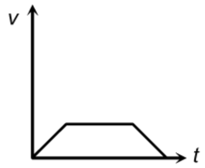
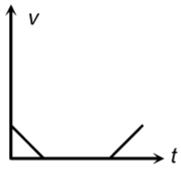
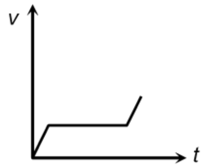
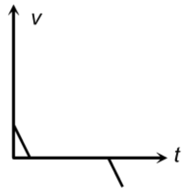
11. The displacement of a particle as a function of time is shown in the figure. The figure shows that



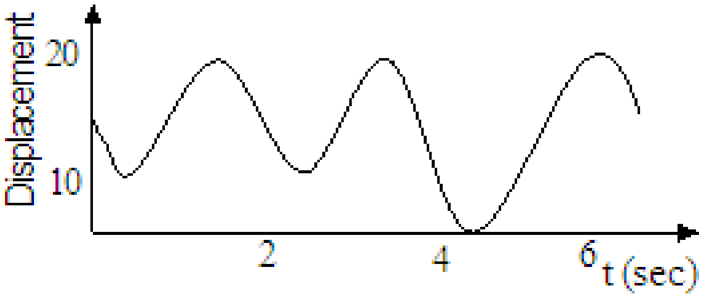
(1) The particle starts with certain velocity but the motion is retarded and finally the particle stops
(2) The velocity of the particle is constant throughout
(3) The acceleration of the particle is constant throughout.
(4) The particle starts with constant velocity, then motion is accelerated and finally the particle moves with another constant velocity

12. Acceleration-time graph of a body is shown. The corresponding velocity-time graph of the same body is



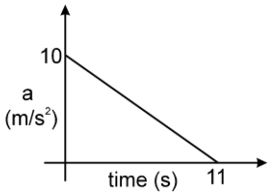
(1)  (2)  (3)  (4) 

13. Figure shows the position of a particle moving on the x-axis as a function of time



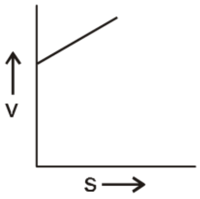
(1) the particle has come to rest 6 times
(2) the maximum speed is at t = 6 sec
(3) the velocity remains positive for t = 0 to t = 6 sec
(4) the average velocity for the total period show in negative

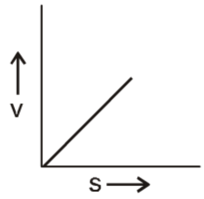
14. A particle is initially at rest, It is subjected to a linear acceleration a, as shown in the figure. The maximum speed attained by the particle is

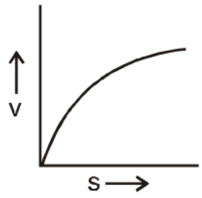


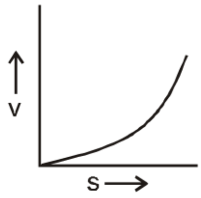
(1) 605 m/s (2) 110 m/s (3) 55 m/s (4) 550 m/s

15. A body starting from rest moves along a straight line with a constant acceleration. The variation of speed (v) with distance (s) is represented by the graph :

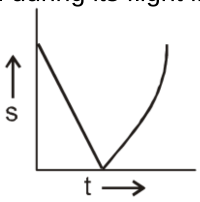
(1) 

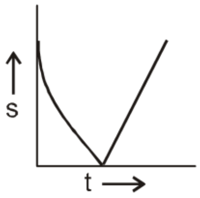
(2) 

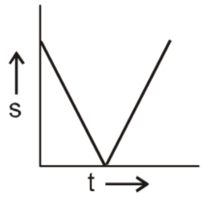
(3) 

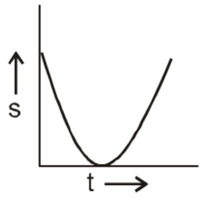
(4) 

16. A ball is thrown vertically upwards. Which of the following plots represents the speed-time graph of the ball during its flight if the air resistance is not ignored ?

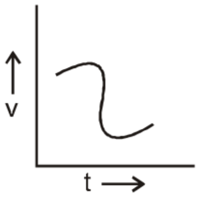
(1) 

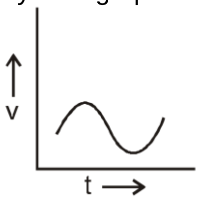
(2) 

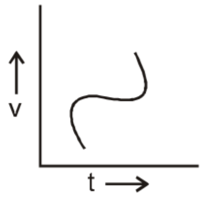
(3) 

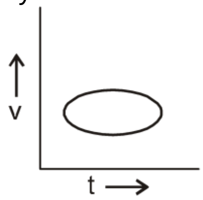
(4) 

17. Which of the following velocity time graphs shows a realistic situation for a body in motion?

(1) 

(2) 

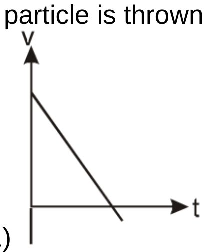
(3) 

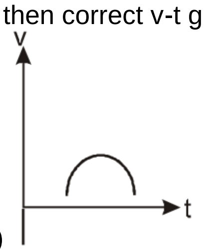
(4) 

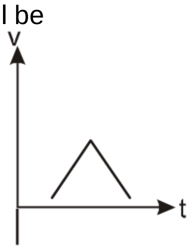
18. When a ball is thrown up vertically with velocity υ_0 , it reaches a maximum height of h. If one wishes to triple the maximum height then the ball should be thrown with velocity :

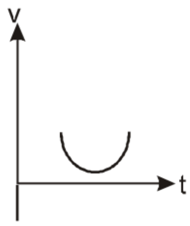
(1) $\sqrt{3}\ \upsilon_0$ (2) 3 υ_0 (3) 9 υ_0 (4) 3/2 υ_0

19. A particle is thrown above, then correct v-t graph will be

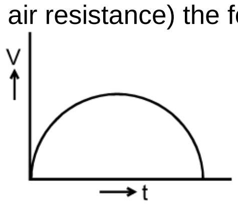
(1) 

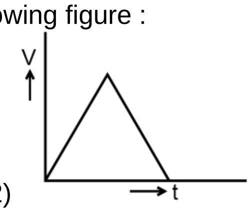
(2) 

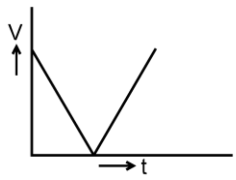
(3) 

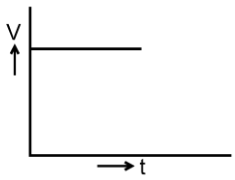
(4) 

20. A particle is thrown vertically upwards. The graph between its speed v and time t is given by (neglecting the air resistance) the following figure :

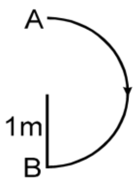
(1) 

(2) 

(3) 

(4) 

21. In 1.0 sec. a particle goes from point A to point B moving in a semicircle of radius 1.0 m. The magnitude of average velocity is:



(1) 3.14 m/sec (2) 2.0 m/sec (3) 1.0 m/sec (4) zero

Exercise-2

1. Between two stations a train accelerates uniformly at first, then moves with constant speed and finally retards uniformly to come to rest. If the ratios of time taken are 1 : 8 : 1 and the greatest speed is 60 km/hour. Then the average speed over the whole journey

(1) 45 km/hr (2) 54 km/hr (3) 35 km/hr (4) 53 km/hr

2. A ball is thrown vertically upwards with a velocity of 30 m/s. If the acceleration due to gravity is 10 m/s_2, what will be the distance travelled by it in the last second of motion before again come to his hand :

(1) 5 m (2) 10 m (3) 25 m (4) 30 m

3. Two balls are dropped from different heights. One ball is dropped 2 sec after the other but they both strike the ground at the same time, 3 sec after the first is dropped. The difference in the heights at which they were dropped is

(1) 7.8 m (2) 78 m (3) 15.6 m (4) 39.2 m

4. Two bodies are thrown vertically upward, with the same initial velocity of 98 m/s but 4 sec apart. How long after the first one is thrown when they meet ?

(1) 10 sec (2) 11 sec (3) 12 sec (4) 13 sec

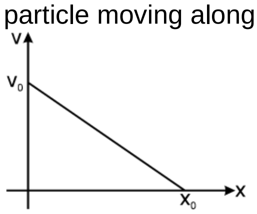
5. A particle moves with constant speed v along a regular hexagon ABCDEF in same order (ie., A to B, B to C, C to D, D to E, E to F, F to A....) Then magnitude of average velocity for its motion from A to C

(1) V (2) V/2 (3) $\sqrt{3}V/2$ (4) None of these

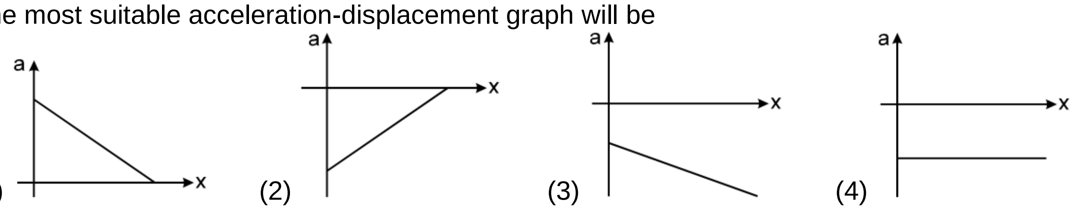
6. A ball is dropped from a height of 20 m and rebounds with a velocity which is 3/4th of the velocity with which it hits the ground. What is the time interval between the first and second bounces (g = 10 m/s_2)

(1) 3 sec (2) 4 sec (3) 5 sec (4) 6 sec

7. The velocity displacement graph of a particle moving along a straight line is shown.



The most suitable acceleration-displacement graph will be



8. 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

9. A body is moving from rest under constant acceleration and let S_1 be the displacement in the first (p – 1) sec and S_2 be the displacement in the first p sec. The displacement in $(p^2 - p + 1)^{th}$ sec. will be

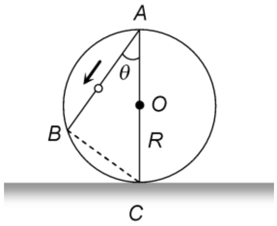
(1) $S_1 + S_2$ (2) $S_1 S_2$ (3) $S_1 - S_2$ (4) S_1 / S_2

10. Two cars A and B are traveling in the same direction with velocities v_1 and v_2 ($v_1 > v_2$). When the car A is at a distance d ahead of the car B, the driver of the car A applied the brake producing a uniform retardation a There will be no collision when

(1) $d < \frac{(v_1 - v_2)^2}{2a}$ (2) $d < \frac{v_1^2 - v_2^2}{2a}$ (3) $d > \frac{(v_1 - v_2)^2}{2a}$ (4) $d > \frac{v_1^2 - v_2^2}{2a}$

11. 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) 30 sec (2) 15 sec (3) 10 sec (4) 5 sec

12. A frictionless wire AB is fixed on a sphere of radius R. A very small spherical ball slips on this wire. The time taken by this ball to slip from A to B is



(1) $\frac{2\sqrt{gR}}{g\cos\theta}$ (2) $2\sqrt{gR}.\frac{\cos\theta}{g}$ (3) $2\sqrt{\frac{R}{g}}$ (4) $\frac{gR}{\sqrt{g\cos\theta}}$

13. The acceleration of a particle is increasing linearly with time t as bt. The particle starts from the origin with an initial velocity v_0. The distance travelled by the particle in time t will be
(1) $v_0t+\frac{1}{3}bt^2$ (2) $v_0t+\frac{1}{3}bt^3$ (3) $v_0t+\frac{1}{6}bt^3$ (4) $v_0t+\frac{1}{2}bt^2$

14. A particle located at x = 0 at time t = 0, starts moving along the positive x-direction with a velocity v that varies as v = $\alpha\sqrt{x}$ The displacement of the particle varies with time as
(1) $t_{1/2}$ (2) t_3 (3) t_2 (4) t

15. The velocity of a particle is v = v_0 + gt + ft_2 . If its position is x = 0 at t = 0, then its displacement after unit time (t = 1) is
(1) v_0 + 2g + 3f (2) v_0 + $\frac{g}{2}$ + $\frac{f}{3}$ (3) v_0 + g + f (4) v_0 + $\frac{g}{2}$ + f

16. The distance (x) travelled by a particle in time, t, is given by t = $2x_2$ + 3x. If 'v' is the velocity. Then acceleration will be
(1) $-4v_3$ (2) $-3v_4$ (3) $4v_2$ (4) $-3v_3$

17. A particle moving along x-axis has acceleration f, at time t, given by f = $f_0\left(1-\frac{t}{T}\right)$, where f_0 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 :
(1) f_0T (2) $\frac{1}{2}f_0T_2$ (3) $f_0\,T_2$ (4) $\frac{1}{2}f_0\,T$

18. A point initially at rest moves along x-axis. Its acceleration varies with time as a = (6t + 5) m/s_2. If it starts from origin, the distance covered in 2 s is.
(1) 20 m (2) 18 m (3) 16 m (4) 25 m

19. The displacement x of a particle varies with time t as x = $ae_{-\alpha t}$ + $be_{\beta t}$, where a, b, α and β are positive constants. The velocity of the particle will :
(1) go on decreasing with time (2) be indepenent of α and β
(3) drop to zero when α = β (4) go on increasing with time

20. The coordinates of a moving particle at any time t are given by x = αt_3 and y = βt_3. The speed of the particle at time t is given by :
(1) $\sqrt{\alpha^2+\beta^2}$ (2) $3t_2\sqrt{\alpha^2+\beta^2}$ (3) $t_2\sqrt{\alpha^2+\beta^2}$ (4) $\sqrt{\alpha^2+\beta^2}$

21. 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 as the rate f/2 to come to rest. If the total distance travelled is 15 S, then

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

22. A ball is projected upwards from a height h above the surface of the earth with velocity v. The time at which the ball strikes the ground is

(1) $\frac{v}{g} + \frac{2hg}{\sqrt{2}}$ (2) $\frac{v}{g}\left[1 - \sqrt{1 + \frac{2h}{g}}\right]$ (3) $\frac{v}{g}\left[1 + \sqrt{1 + \frac{2gh}{v^2}}\right]$ (4) $\frac{v}{g}\left[1 + \sqrt{v^2 + \frac{2g}{h}}\right]$

Exercise-3

PART - I : NEET / AIPMT QUESTION (PREVIOUS YEARS)

1. 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 screening 2009]**

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

2. A particle starts its motion from rest under the action of a constant force. If the distance covered in first 10s is s_1 and that covered in the first 20 s is s_2, then **[AIPMT screening2009]**

(1) $s_2 = 2s_1$ (2) $s_2 = 3s_1$ (3) $s_2 = 4s_1$ (4) $s_2 = s_1$

3. 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 ball meet at t = 18s. What is the value of v ? [take g = 10 ms^{-2}] [g = 10 ms^{-2}] **[AIPMT 2010]**

(1) 75 ms^{-1} (2) 55 ms^{-1} (3) 40ms^{-1} (4) 60ms^{-1}

4. 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 Screening 2011]**

(1) 1 m/s^2 (2) 7 m/s^2 (3) m/s^2 (4) 5 m/s^2

5. 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) 24 ms^{-2} (2) zero (3) 6 ms^{-2} (4) 12 ms^{-2}

6. 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 : **[NEET_2013]**

(1) $h_1 = \frac{h_2}{3} = \frac{h_3}{5}$ (2) $h_2 = 3h_1$ and $h_3 = 3h_2$ (3) $h_1 = h_2 = h_3$ (4) $h_1 = 2h_2 = 3h_3$

7. A particle is moving such that its position coordinates (x,y) are **[AIPMT _2014]**

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

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

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

Average velocity vector $(\vec{V}_{av})$ from t = 0 to t = 5 s is :

(1) $\frac{1}{5}(13\hat{i} + 14\vec{j})$ (2) $\frac{7}{3}(\hat{i} + \vec{j})$ (3) $2(\hat{i} + \vec{j})$ (4) $\frac{11}{5}(\hat{i} + \vec{j})$

8. A particle of unit mass undergoes one-dimensional motion such that its velocity varies according to :

$v(x) = b x^{-2n}$

where b and n are constants and x is the position of the particle. The acceleration of the particle as function of x, is given by : **[AIPMT-2015]**

(1) $-2nb^2 x^{-4n-1}$ (2) $-2b^2 x^{-2n+1}$ (3) $-2nb^2 e^{-4n+1}$ (4) $-2nb^2 x^{-2n-1}$

9. The position vector of a particle $\vec{R}$ as a function of time is given by:

$\vec{R} = 4\sin(2\pi t)\,\hat{i} + 4\cos(2\pi t)$ **[AIPMT-2015]**

Where R is in meters, t is seconds and $\hat{i}$ and $\hat{j}$ denote unit vectors along x-and y-directions, respectively. Which one of the following statements is wrong for the motion of particle?

(1) Magnitude of acceleration vector is $\frac{v^2}{R}$, where v is the velocity of particle
(2) Magnitude of the velocity of particle is 8 meter/second
(3) path of the particle is a circle of radius 4 meter.
(4) Acceleration vector is along - $\vec{R}$

10. Two particles A and B, move with constant velocities $\vec{v}_1$ and $\vec{v}_2$. At the initial moment their position vector are $\vec{r}_1$ and $\vec{r}_2$ respectively. The condition for particles A and B for their collision is: **[AIPMT-2015]**

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

11. The x and y corrdinates of the particle at any time are $x = 5t - 2t^2$ and $y = 410t$ respectively, where x and y are in meters and t in seconds. The acceleration of the particle at t = 2s is : **[NEET 2017]**

(1) 0 (2) 5 m/s^2 (3) – 4m/s^2 (4) – 8 m/s^2

12. 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 moving uniformly. Then **[NEET_2019-II]**

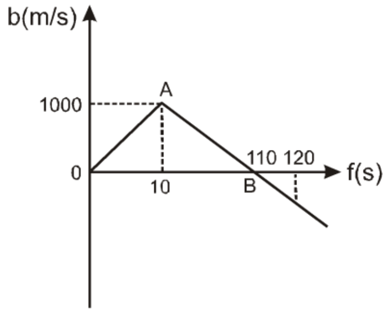
(1) $t_1 < t_2$ or $t_1 > t_2$ depending upon whether the lift is going up or down
(2) $t_1 < t_2$
(3) $t_1 > t_2$
(4) $t_1 = t_2$

PART - II : AIIMS QUESTION (PREVIOUS YEARS)

1. 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 **[AIIMS 2009]**
$s = 6t_2 - t_3$

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

2. The graph shows the variation of velocity of a rocket with time. The time of burning of fuel from the graph is **[AIIMS 2009]**



(1) 10 s (2) 110 s (3) 120 s (4) Data insufficient

PART - III : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

1. 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 $\frac{f}{2}$ to come to rest. If the total distance travelled is 15 S, then : **[AIEEE 2005, 4/300]**

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

2. A parachutist after bailing out falls 50 m without friction. When parachute opens, it decelerates at 2 m/s^2. He reaches the ground with a speed of 3 m/s. At what height approximately, did he bail out? **[AIEEE 2005, 4/300]**

(1) 91 m (2) 182 m (3) 293 m (4) 111 m

3. An object moving with a speed of 6.25 m/s, is decelerated at a rate given by :

$$\frac{d\upsilon}{dt} = -2.5\sqrt{\upsilon}$$

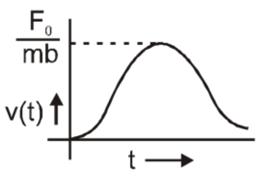
[AIEEE - 2011, 4/120, –1]

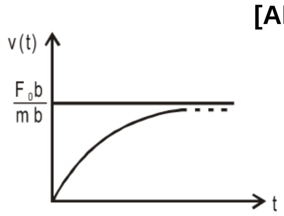
where υ is the instantaneous speed. The time taken by the object, to come to rest, would be :

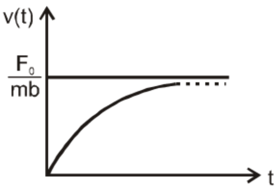
(1) 1 s (2) 2 s (3) 4 s (4) 8 s

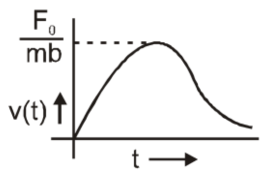
4. A particle of mass m is at rest at the origin at time t = 0. It is subjected to a force $F(t) = F_0e^{-bt}$ in the x direction. Its speed v(t) is depicted by which of the following curves ?

Hint : Acceleration = $\frac{\text{Force}}{\text{Mass}}$ **[AIEEE 2012 ; 4/120, –1]**

(1)


(2)


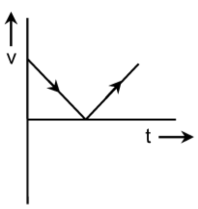
(3)


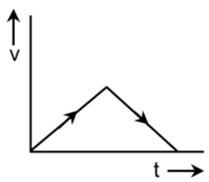
(4)


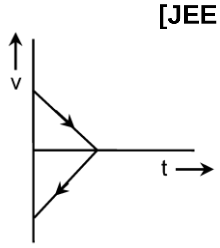
5. From a tower of height H, a particle is thrown vertically upwards with a speed u. The time taken by the particle, to hit the ground, is a n times that taken by it to reach the highest point of its path.
The relation between H, u and n is : **[JEE-,MAIN 2014 ; 4, – 1]**

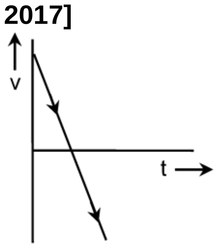
(1) $2gH = n^2u^2$ (2) $gH = (n-2)^2u^2$ (3) $2gH = nu^2(n-2)$ (4) $gH = (n-2)u^2$

6. A body is thrown vertically upwards. Which one of the following graphs correctly represent the velocity vs time ? **[JEE Main 2017]**

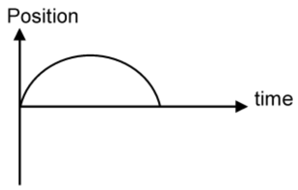
(1)


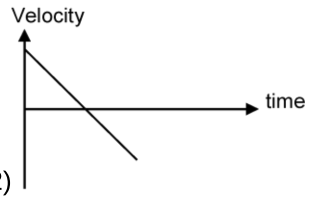
(2)


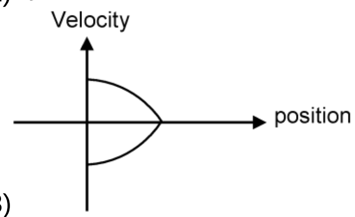
(3)


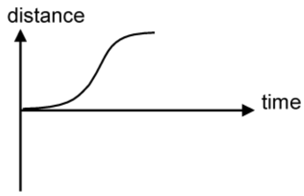
(4)


7. All the graphs below are intended to represent the same motion. One of them does it incorrectly. Pick it up. **[JEE-Main-2018]**

(1) 

(2) 

(3) 

(4) 

8. The position co-ordinates of a particle moving in a 3-D coordinate system is given

by $x = a\cos\omega t$ **[JEE-Main-2019]**

$y = a\sin\omega t$

and $z = a\omega t$

The speed of the particle is :

by $x = a\cos\omega t$

$y = a\sin\omega t$

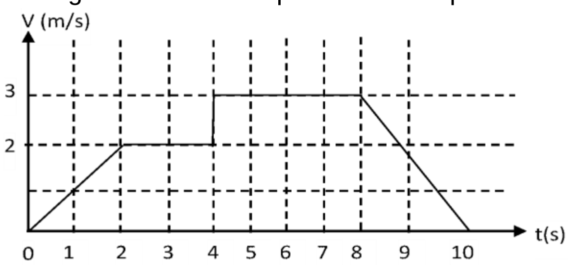
and $z = a\omega t$

(1) $\sqrt{3}a\omega$ (2) $2a\omega$ (3) $\sqrt{2}a\omega$ (4) $a\omega$

9. In a car race on straight road, car A takes a time t less than car B at the finish and passes finishing point with a speed 'v' more that that of car B. Both the cars start from rest and travel with constant acceleration a_1 and a_2 respectively. Then 'v' is equal **[JEE-Main-2019]**

(1) $\frac{2a_1a_2}{a_1+a_2}t$ (2) $\sqrt{2a_1a_2}\,t$ (3) $\frac{a_1+a_2}{2}t$ (4) $\sqrt{a_1a_2}\,t$

10. A particle starts from origin at time t = 0 and moves along the positive x-axis. The graph of velocity with respect to time is shown in figure. What is the position of the particle at time t = 5s ?**[JEE-Main-2019]**



(1) 6 m (2) 9 m (3) 3 m (4) 16 m

11. A passenger train of length 60 m travels at a speed of 80 km/hr. Another freight train of length 120 m travels at a speed of 30 km/hr. the ratio of times taken by the passenger train to completely cross the freight train when : (i) they are moving in the same direction and (ii) in the opposite directions is : **[JEE-Main-2019]**

(1) $\frac{25}{11}$ (2) $\frac{3}{2}$ (3) $\frac{5}{2}$ (4) $\frac{11}{5}$

Answers

EXERCISE - 1

SECTION (A)

1.	(3)	**2.**	(1)	**3.**	(1)	**4.**	(3)	**5.**	(2)	**6.**	(3)

SECTION (B)

1.	(1)	**2.**	(2)	**3.**	(2)	**4.**	(4)	**5.**	(2)	**6.**	(2)	**7.**	(1)
8.	(1)												

SECTION (C)

1.	(2)	**2.**	(4)	**3.**	(3)	**4.**	(4)	**5.**	(4)	**6.**	(4)	**7.**	(4)
8.	(2)	**9.**	(1)	**10.**	(2)	**11.**	(1)	**12.**	(3)	**13.**	(2)	**14.**	(1)
15.	(4)	**16.**	(2)	**17.**	(1)	**18.**	(4)	**19.**	(3)	**20.**	(1)		

SECTION (D)

1.	(3)	**2.**	(1)	**3.**	(3)	**4.**	(2)	**5.**	(4)	**6.**	(2)	**7.**	(1)
8.	(2)	**9.**	(1)	**10.**	(4)	**11.**	(3)	**12.**	(1)	**13.**	(2)	**14.**	(3)
15.	(2)	**16.**	(1)	**17.**	(1)	**18.**	(2)	**19.**	(2)	**20.**	(2)	**21.**	(1)
22.	(4)	**23.**	(3)	**24.**	(1)	**25.**	(1)	**26.**	(3)	**27.**	(3)	**28.**	(2)
29.	(2)	**30.**	(2)	**31.**	(2)	**32.**	(4)	**33.**	(3)	**34.**	(3)	**35.**	(2)
36.	(4)	**37.**	(3)	**38.**	(2)	**39.**	(3)	**40.**	(3)	**41.**	(3)	**42.**	(3)
43.	(4)	**44.**	(3)										

SECTION (E)

1.	(4)	**2.**	(4)	**3.**	(1)	**4.**	(3)	**5.**	(1)	**6.**	(4)	**7.**	(1)
8.	(3)	**9.**	(4)	**10.**	(3)	**11.**	(1)	**12.**	(3)	**13.**	(1)	**14.**	(3)
15.	(3)	**16.**	(4)	**17.**	(2)	**18.**	(1)	**19.**	(1)	**20.**	(3)	**21.**	(2)

EXERCISE - 2

1.	(2)	**2.**	(3)	**3.**	(4)	**4.**	(3)	**5.**	(3)	**6.**	(1)	**7.**	(2)
8.	(1)	**9.**	(1)	**10.**	(3)	**11.**	(1)	**12.**	(3)	**13.**	(3)	**14.**	(3)
15.	(2)	**16.**	(1)	**17.**	(4)	**18.**	(2)	**19.**	(4)	**20.**	(2)	**21.**	(3)
22.	(3)												

EXERCISE - 3

PART - I

1.	(1)	**2.**	(3)	**3.**	(1)	**4.**	(4)	**5.**	(4)	**6.**	(1)	**7.**	(4)
8.	(1)	**9.**	(2)	**10.**	(4)	**11.**	(3)	**12.**	(4)				

PART - II

1.	(2)	**2.**	(1)

PART - III

1.	(3)	**2.**	(3)	**3.**	(2)	**4.**	(3)	**5.**	(3)	**6.**	(4)	**7.**	(4)
8.	(3)	**9.**	(4)	**10.**	(2)	**11.**	(4)						