EXERCISE-I (Conceptual Questions) **Build Up Your Understanding**

DIATANCE & DISPLACEMENT, SPEED & VELOCITY, AVERAGE SPEED & AVERAGE VELOCITY

1. A man walks 30 m towards north, then 20m towards east and in the last $30\sqrt{2}$ m towards south-west. The displacement from origin is :

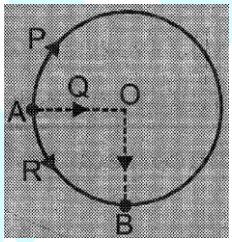
(1) 10 m towards west (2) 10 m towards east

(3) $60\sqrt{2}$ m towards north west (4) $60\sqrt{2}$ m towards east north

2. A body moves along the curved path of a quarter circle. Calculate the ratio of distance to displacement:

(1) 11 : 7 (2) 7 : 11 (3) 11 : $\sqrt{2} \times 7$ (4) 7 : $11\sqrt{2}$

3. Three particles P, Q and R are situated at point A on the circular path of radius 10 m. All three particles move along different paths and reach point B as shown in figure. Then the ratio of distance traversed by particles P and Q is :



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

4. If displacement of a particle is zero, the distance covered:

(1) must be zero (2) may or may not be zero

(3) cannot be zero (4) depends upon the particle

5. If the distance covered is zero, the displacement:

(1) must be zero (2) may or may not be zero

(3) cannot be zero (4) depends upon the particle

6. The location of a particle is changed. What can we say about the displacement and distance covered by the particle :

(1) Both cannot be zero

(2) One of the two may be zero

(3) Both must be zero

(4) If one is positive, the other is negative and vice-versa

7. An athlete completes one round of a circular track of radius R in 20 seconds. What will be his displacement at the end of 2 minutes 20 seconds ? ·

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

8. A man walks for some time 't' with velocity (v) due east. Then he walks for same time 't' with velocity (v) due north. The average velocity of the man is:

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

9. A drunkard is walking along a straight road. He takes 5 steps forward and 3 steps backward, followed by 5 steps forward and 3 steps backward and so on. Each step is one meter long and takes one second. There is a pit on the road 11 meters away from the starting point. The drunkard will fall into the pit after :

(1) 29 s (2) 21 s (3) 37s (4) 31 s

10. A car runs at constant speed on a circular track of radius 10 m taking 6.28s on each lap (i.e. round). The average speed and average velocity for each complete lap is :
(1) Velocity 10 m/s, speed 10 m/s (2) Velocity zero, speed 10 m/s
(3) Velocity zero, speed zero (4) Velocity 10 m/s speed zero

11. A particle moving in a straight line covers half the distance with speed of 12 m/s. The other half of the distance is covered in two equal time intervals with speed of 4.5 m/s and 7.5 m/s respectively. The average speed of the particle during this motion is:
(1) 8.0m/s (2) 12.0 m/s (3) 10.0 m/s (4) 9.8 m/s

12. The magnitude of average velocity is equal to the average speed when a particle moves :
(1) on a curved path (2) in the same direction
(3) with constant acceleration (4) with constant retardation

13. A body covers one-third of the distance with a velocity v_1 the second one-third of the distance with a velocity v_2, and the last one-third of the distance with a velocity v_3. The average velocity is :
(1) $\frac{v_1+v_2+v_3}{3}$ (2) $\frac{3v_1v_2v_3}{v_1v_2+v_2v_3+v_3v_1}$
(3) $\frac{v_1v_2+v_2v_3+v_3v_1}{3}$ (4) $\frac{v_1v_2v_3}{3}$

14. A car travels a distance d on a straight road in two hours and then returns to the starting point in next three hours. Its average speed is :
(1) $\frac{d}{5}$ (2) $\frac{2d}{5}$ (3) $\frac{d}{2}+\frac{d}{3}$ (4) none of these

15. A train covers the first half of the distance between two stations with a speed of 40 km/h and the other half with 60 km/h. Then its average speed is:
(1) 50 km/h (2) 48 km/h (3) 52 km/h (4) 100 km/h

16. A car moving on a straight road covers one third of a certain distance with 20 km/h and the rest with 60 km/h. The average speed is :
(1) 40 km/h (2) 80 km/h (3) $46\frac{2}{3}$ km/h (4) 36 km/h

17. A particle moves in the east direction with 15 m/sec for 2 sec then northwards with 5 m/s for 8 sec. Average speed of the particle is :-
(1) 1 m/s (2) 5 m/s (3) 7 m/s (4) 10 m/s

18. The numerical ratio of displacement to the distance cover is always :-
(1) less than one (2) equal to one
(3) equal to or less than one (4) equal to or greater than one

19. A particle moves in a straight line for 20 seconds with velocity 3 m/s and then moves with velocity 4 m/s for another 20 seconds and finally moves With velocity 5 m/s for next 20 seconds. What is the average velocity of the particle ?
(1) 3 m/s (2) 4 m/s (3) 5 m/s (4) zero

20. An object travels 10 km at a speed of 100 m/s and another 10 km at 50 m/s. The average speed over the whole distance is :-
(1) 75 m/s (2) 55 m/s (3) 66.7 m/s (4) 33.3 m/s

21. A point object traverses half the distance with velocity v_0. The remaining part of the distance is covered with velocity v_1 for the half time and with velocity v_2 for the rest half. The average velocity of the object for the whole journey is
(1) $2v_1 (v_0 + v_2) / (v_0 + 2v_1 + 2v_2)$ (2) $2v (v_0 + v_1) / (v_0 + v_1 + v_2)$
(3) $2v_0 (v_1 + v_2) / (v_1 + v_2 + 2v_0)$ (4) $2v_2 (v_0 + v_1) / (v_1 + 2v_2 + v_0)$

22. Select the incorrect statements from the following.
S1. Average velocity is path length divided by time interval.
S2. In general, average speed is greater than the magnitude of the average velocity.
S3. A particle moving in a given direction with a non-zero velocity can have zero speed.
S4. The magnitude of average velocity is the average speed.
(1) S2 and S3 (2) S1 and S4 (3) S1, S3 and S4 (4) All four statements

ACCELERATION, AVERAGE ACCELERATION & APPLICATION OF CALCULUS

23. If x denotes displacement in time t and x = a cost, then acceleration is :
(1) a cost t (2) –a cost t (3) a sin t (4) –a sin t

24. The velocity-time relation of an electron starting from rest is given by u = kt, where k = 2 m/s^2. The distance traversed in 3 sec is :
(1) 9 m (2) 16 m (3) 27 m (4) 36 m

25. The position x of a particle varies with time (t) as $x = at^2 - bt^3$. The acceleration at time t of the particle will be equal to zero, where t is equal to :
(1) $\frac{2a}{3b}$ (2) $\frac{a}{b}$ (3) $\frac{a}{3b}$ (4) zero

26. 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 m/s (2) –12 m/s (3) 42 m/s (4) –9 m/s

27. The displacement of a particle starting from rest (at t = 0) is given by $s = 6t^2 - t^3$
The time when the particle will attain zero velocity again, is:
(1) 4s (2) 8s (3) 12s (4) 16s

28. The velocity of a body depends on time according to the equation $v = 20 + 0.1t^2$. The body has:
(1) uniform acceleration (2) uniform retardation
(3) non-uniform acceleration (4) zero acceleration

29. The displacement of a particle is given by $y = a + bt + ct^2 - dt^4$. The initial velocity and acceleration are respectively : ·
(1) b, –4d (2) –b, 2c (3) b, 2c (4) 2c, –4d

30. The initial velocity of a particle is u (at t = 0) and the acceleration is given by f = at. Which of the following relations is valid ?

(1) $v = u + at^2$ (2) $v = u + \frac{at}{2}$ (3) $v = u + at$ (4) $v = u$

31. A particle located at x=0 at time t=0, starts moving along the positive x-direction with a velocity 'v' which varies as $v = \alpha\sqrt{x}$, then velocity of particle varies with time as : (a is a constant)
(1) $v \propto t$ (2) $v \propto t^2$ (3) $v \propto \sqrt{t}$ (4) v = constant

32. A particle starts from rest with constant acceleration. The ratio of space-average velocity to the time average velocity is :
(1) $\frac{1}{2}$ (2) $\frac{3}{4}$ (3) $\frac{4}{3}$ (4) $\frac{3}{2}$

33. The relation $t = \sqrt{x} + 3$ describes the position of a particle where x is in meters and t is in seconds. The position, when velocity is zero, is :-
(1) 2 m (2) 4 m (3) 5 m (4) zero

34. The displacement of a particle is represented by the following equation : $s = 3t^3 + 7t^2 + 5t + 8$ where s is in meters and t in seconds. The acceleration of the particle at t = 1s is :-
(1) 14 m/s^2 (2) 18 m/s^2 (3) 32 m/s^2 (4) zero

35. If for a particle position $x \propto t^2$ then :
(1) velocity is constant (2) acceleration is constant
(3) acceleration is variable (4) none of these

36. A body is moving according to the equation $x = at + bt^2 - ct^3$. Then its instantaneous speed is given by
(1) a + 2b + 3ct (2) $a + 2bt - 3ct^2$ (3) 2b – 6ct (4) None of these

37. The motion of a particle is described by the equation $x = a + bt^2$ where a = 15 cm and b = 3 cm/sec^2. Its instantaneous velocity at time 3 sec will be :-
(1) 36 cm/sec (2) 18 cm/sec (3) 16 cm/sec (4) 32 cm/sec

38. Starting from rest, the acceleration of a particle is a = 2(t–1). The velocity of the particle at t=5 s is:
(1) 15 m/s (2) 25 m/s (3) 5 m/s (4) None of these

39. Which of the following equations represents the motion of a body moving with constant finite acceleration? in these equations, y denotes the displacement in time t and p, q and rare arbitrary constants:
(1) $y = (p + qt)^2 (r + pt)$ (2) y = p + tqr
(3) y = (p + t) (q + t) (r + 1) (4) y = (p + qt)r

40. Which of the following relations representing displacement x of a particle describes motion with constant acceleration?
(1) $x = 6 - 7t^{-2}$ (2) $x = 3t^2 + 5t^3 + 7$ (3) $x = 9t^2 + 8$ (4) $x = 4t^{-2} + 3t^{-1}$

41. Equation of a particle moving along the x axis is $x = u(t - 2) + a(t - 2)^2$
(1) the initial velocity of the particle is u (2) the acceleration of the particle is a
(3) the acceleration of the. particle is 2a (4) at t = 2 particle is not at origin

CONSTANT ACCELERATION MOTION, FREE FALL

42. The velocity of a particle moving with constant acceleration at an instant t_0 is 10 m/s. After 5 seconds of that instant the velocity of the particle is 20 m/s. The velocity at 3 second before t_0 is:
(1) 8 m/s (2) 4 m/s (3) 6 m/s (4) 7 m/s

43. The velocity acquired by a body moving with uniform acceleration is 30 m/s in 2 seconds and 60 m/s in 4 seconds. The initial velocity is:
(1) zero (2) 2 m/s (3) 4 m/s (4) 10 m/s

44. If a body starts from rest, the time in which it covers a particular displacement with uniform acceleration is :
(1) inversely proportional to the square root of the displacement
(2) inversely proportional to the displacement
(3) directly proportional to the displacement
(4) directly proportional to the square root of the displacement

45. A body at rest is imparted motion to move in a straight line. It is then obstructed by an opposite force, then:
(1) the body may necessarily change direction
(2) the body is sure to slow down
(3) the body will necessarily continue to move in the same direction at the same speed
(4) none of the above ..

46. If a car at rest accelerates uniformly to a speed of 144 km/h in 20 seconds, it covers a distance of:
(1) 20 m (2) 400 m (3) 1440 m (4) 2980 m

47. A body starts from rest and with a uniform acceleration of 10 ms^{-2} for 5 seconds. During next 10 seconds it moves with uniform velocity. The total distance travelled by the body is.:-
(1) 100 m (2) 125 m (3) 500 m (4) 625 m

48. Initially a body is at rest. If its acceleration is 5 ms^{-2} then the distance travelled in the 18^{th} second is:-
(1) 86.6 m (2) 87.5 m (3) 88 m (4) 89 m

49. If a body starts from rest and travels 120 m in 8^{th} second, then acceleration is :
(1) 16 m/s^2 (2) 10 m/s^2 (3) 0.227 m/s^2 (4) 0.03 m/s^2

50. If a train travelling at 72 km/h is to be brought rest in a distance of 200 m, then its retardation should be:
(1) 20 m/s^2 (2) 2 m/s^2 (3) 10 m/s^2 (4) 1 m/s^2

51. A car moving with a speed of 40 km/h can be stopped by applying brakes after at least 2m. If the same car is moving with a speed of 80 km/h., what is the minimum stopping distance ?
(1) 2 m (2) 4 m (3) 6 m (4) 8 m

52. 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 20m. 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) 180 m

53. If a car at rest accelerates uniformly and attains speed of 72 km/h in l0s, then it covers a distance of

(1) 50 m (2) 100 m (3) 200 m (4) 400 m

54. 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) $T = \sqrt{\frac{h}{2g}} + \frac{2h}{v}$

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

(1) $\frac{3u^2}{g}$ (2) $\frac{4u^2}{g}$ (3) $\frac{6u^2}{g}$ (4) $\frac{9u^2}{g}$

56. A stone falls from a balloon that is descending at a uniform rate of 12 ms^{-1}. The displacement of the stone from the point of release after 10 seconds is:
(g = 9.8 m/s2)

(1) 490 m (2) 510 m (3) 610 m (4) 725 m

57. A rocket is fired vertically from the ground. It moves upwards with a constant acceleration of 10 m/s^2. After 30 seconds the fuel is finished. After what time from the instant of firing the rocket will it attain the maximum height? g = 10 m/s^2 :

(1) 30 s (2) 45 s (3) 60 s (4) 75 s

58. A body is released from the top of a tower of height H metres. It takes t time to reach the ground. Where is the body $\frac{1}{2}$ time after the release:

(1) At $\frac{H}{2}$ meters from ground (2) At $\frac{H}{4}$ meters from ground

(3) At $\frac{3H}{4}$ meters from the ground (4) At $\frac{H}{6}$ meters from the ground

59. A body dropped from the top of tower covers a distance 7x in the last second of its journey, where x is the distance covered in first second. How much time does it take to reach the ground?

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

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

(1) $t_2 = \frac{t_1}{\sqrt{2}}$ (2) $t_1 = \frac{t_1}{\sqrt{2}}$ (3) $t_2 = \sqrt{3}\, t_1$ (4) None of these

61. Two balls are dropped from different heights at different instants. Second ball is dropped 2 seconds after the first ball. If both balls reach the ground simultaneously after 5 seconds of dropping the first ball, then the difference between the initial heights of the two balls will be: ($g = 9.8\ m/s^2$)
(1) 58.8 m (2) 78.4 m (3) 98.0 m (4) 117.6 m

62. Drops of water fall from the roof of a building 18 m high at regular intervals of time. When the first drop reaches the ground, at the same instant fourth drop begins 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) 8 m and 2 m (4) 4 m and 2 m

63. If an iron ball and a wooden ball of same radii are released from a height h in vacuum then time taken by both of them to reach ground will be :
(1) unequal (2) exactly equal (3) roughly equal (4) zero

64. Water drops fall at regular intervals from a tap 5 m above the ground. The third drop is leaving the tap at the instant the first drop touches the ground. How far above the ground is the second drop at that instant ?
(1) 1.25 m (2) 2.50 m (3) 3.75 m (4) 4.00 m

65. If a ball is thrown vertical upwards with 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

66. A stone is dropped from a certain height which can reach the ground in 5 seconds. It is stopped after 3 seconds of its fall and is again released. The total time taken by the stone to reach the ground will be:
(1) 6 s (2) 6.5 s (3) 7 s (4) 7.5 s

67. Which what speed should a body be thrown upwards so that the distances traversed in 5^{th} second and 6^{th} second are equal?
(1) 58.4 m/s (2) 49 m/s (3) $\sqrt{98}$ m/s (4) 98 m/s

68. Which of the following four statements is false?
(1) A body can have zero velocity and still he accelerated
(2) A body can have a constant velocity and still have a varying speed
(3) A body can have a constant speed and still have a varying velocity
(4) The direction of the velocity of a body can change when its acceleration is constant

69. A body dropped from a tower reaches the ground in 4s. The height of the tower is about :
(1) 80 m (2) 20 m (3) 160 m (4) 40 m

70. A particle is dropped from a certain height. The time taken by it to fall through successive distances of 1 km each will be:
(1) all equal, being equal to $\sqrt{\frac{2}{g}}$ second.
(2) in the ratio of the square roots of the integers $1:\sqrt{2}:\sqrt{3}$
(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 reciprocals of the square roots of the integers

i.e., $\frac{1}{\sqrt{1}},\frac{1}{\sqrt{2}},\frac{1}{\sqrt{3}}$.....

71. A ball is thrown upward with a velocity of 100 m/s. It will reach the ground after :-

(1) 10 s (2) 20 s (3) 5 s (4) 40 s

72. A particle is thrown vertically upward. Its velocity at half of the maximum height is l0 m/s. The maximum height attained by it is ($g = 10\ ms^{-2}$):-

(1) 8m (2) 20m (3) l0m (4) 16m

73. Three different objects of masses m_1, m_2 and m_3 are allowed to fall from rest and from the same point 'O' along three different frictionless paths. The speeds of the three objects on reaching the ground, will be in the ratio of :-

(1) $m_1 : m_2 : m_3$ (2) $m_1 : 2m_2 : 3m_3$

(3) 1 : 1 : 1 (4) $\frac{1}{m_1}:\frac{1}{m_2}:\frac{1}{m_3}$

74. If a ball is thrown vertically upwards with speed u, the distance covered during the last 't' seconds of its ascent is :-

(1) ut (2) $\frac{1}{2}gt^2$ (3) $ut-\frac{1}{2}gt^2$ (4) (u + gt)t

75. A stone falls freely such that the distance covered by it in the last second of its motion is equal to the distance covered by it in the first 5 seconds. It remained in air for :-

(1) 12 s (2) 13 s (3) 25 s (4) 26 s

76. When a ball is thrown vertically up with velocity v_0, it reaches a maximum height 'h'. If one wishes to triple the maximum height then the ball should be thrown with velocity -

(1) $\sqrt{3}\,v_0$ (2) $3\,v_0$ (3) $9\,v_0$ (4) $3/2\,v_0$

77. An object is dropped vertically down on earth. The change in its speed after falling through a distance d from its highest point is

(1) mgd (2) $\sqrt{2gd}$ (3) $2\sqrt{g/d}$ (4) $2\sqrt{\frac{mg}{d}}$

78. The ratio of the distances traversed, in successive intervals of time by a body falling from rest, are

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

(3) 1 : 4 : 7 : 10 : 13 : ..... . (4) None of these

79. A body starts from rest. What is the ratio of the distance travelled by the body during the 4^{th} and 3^{rd} second?

(1) $\frac{7}{5}$ (2) $\frac{5}{7}$ (3) $\frac{7}{3}$ (4) $\frac{3}{7}$

80. A particle is thrown up vertically with a speed 'v_1', in air. It takes time t_1 in upward journey and t_2 ($> t_1$) in the downward journey and returns to the ·starting point with a 'speed v_2. Then:

(1) $v_1 = v_2$ (2) $v_1 < v_2$ (3) $v_1 > v_2$ (4) Data is insufficient

81. A ball is thrown vertically upwards. Assuming the air resistance to be constant and considerable:-
(1) the time of ascent ≥ the time of descent (2) the time of ascent < the time of descent
(3) the time of ascent > the time of descent (4) the time of ascent = the time of descent

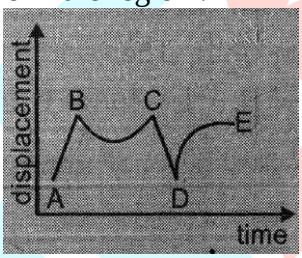
82. A body is projected vertically up at t = 0 with a velocity of 98 m/s. Another body is projected from the same point with same velocity after 4 seconds. Both bodies will meet at t =
(1) 6 s (2) 8 s (3)10 s (4) 12 s

83. A body released from a height falls freely towards earth. Another body is released from the same point exactly one second later. The separation between them two seconds after the release of the second body is:-
(1) 9.8 m (2) 49 m (3) 24.5 m (4) 19.6 m

GRAPHICAL ANALYSIS

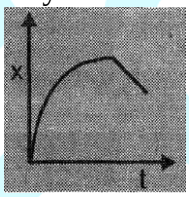
84. Velocity-time curve for a body projected vertically upwards is a/an:-
(1) Parabola (2) Ellipse (3) Hyperbola (4) Straight line

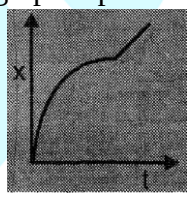
85. Fig. shows the displacement of a particle moving along x-axis as a function of time. The acceleration of the particle is zero in the region :

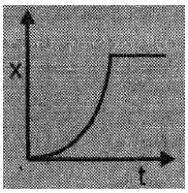


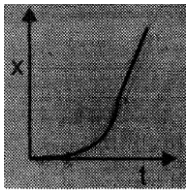
(a) AB (b) BC (c) CD (d) DE
Select correct alternative
(1) a, b (2) a, c (3) b, d (4) c, d

86. A car starts from rest and accelerates uniformly by for 4 seconds and then moves with uniform velocity which of the x-t graph represe11:t the motion of the car?

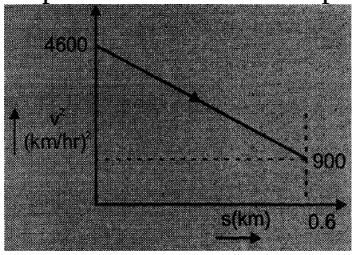
(1) 

(2) 

(3) 

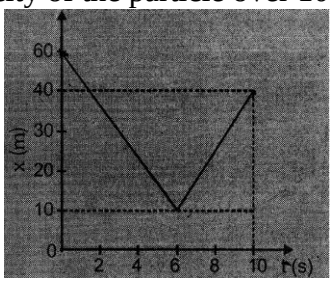
(4) 

87. Graph between the square of the velocity (v) of a particle and the distance (s) moved is shown in figure. The acceleration of the particle in kilometers per hour square is :



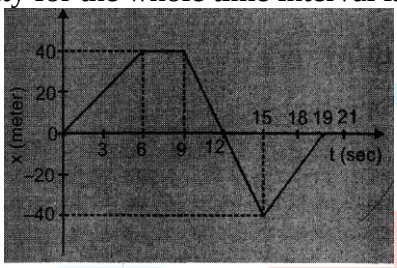
(1) 2250 (2) 3084 (3) –2250 (4) –3084

88. The fig. shows the position time graph of a particle V moving on a straight line path. What is the magnitude of average velocity of the particle over 10 seconds?



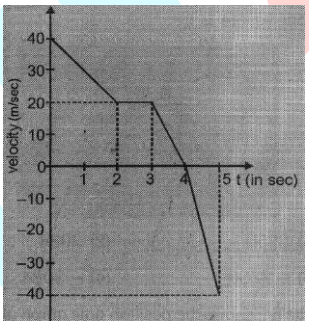
(1) 2 m/s (2) 4 m/s (3) 6 m/s (4) 8 m/s

89. A person walks along an east-west street and a graph of his displacement from home is shown in figure. His average velocity for the whole time interval is :



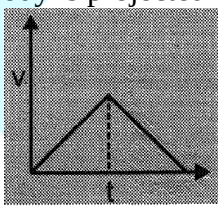
(1) 0 (2) 23 m/s (3) 8.4 m/s (4) None of above

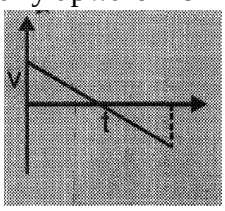
90. From the following velocity time graph of a body the distance travelled by the body and its displacement during 5 seconds in metres will be :

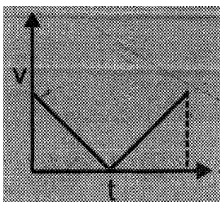


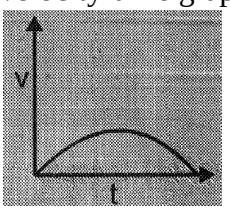
(1) 75, 75 (2) 110, 70 (3) 110, 110 (4) 110, 40

91. A body is projected vertically upward from the surface of the earth, its velocity-time graph is :

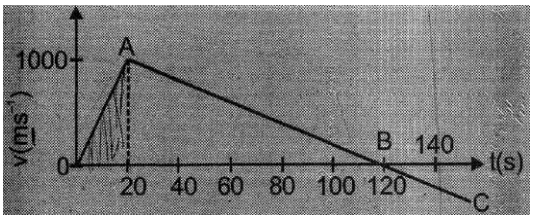
(1) 

(2) 

(3) 

(4) 

92. A rocket is launched upward from the earth is surface whose velocity time graphs shown in figure. Then maximum height attained by the rocket is :



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

93. In above question, height covered by the rocket before retardation is :
(1) 1 km (2) 10 km (3) 20 km (4) 60 km

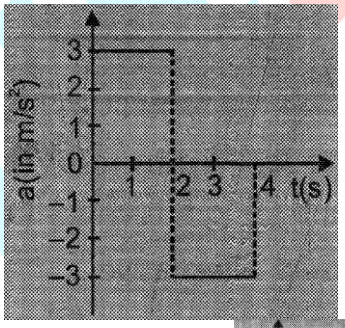
94. In above question mean velocity of rocket during the time it took to attain the maximum height:
(1) 100 m/s (2) 50 m/s (3) 500 m/s (4) 25/3 m/s

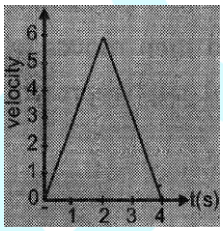
95. In above question the retardation of rocket is :
(1) 50 m/s^2 (2) 100 m/s^2 (3) 500 m/s^2 (4) 10 m/s^2

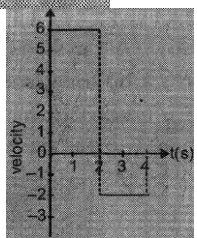
96. In above question the acceleration of rocket is :
(1) 50 m/s^2 (2) 100 m/s^2 (3) 10 m/s^2 (4) 1000 m/s^2

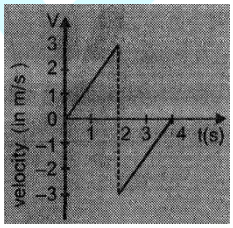
97. In above question the rocket goes up and comes down on the following parts respectively :
(1) OA and AB (2) AB and BC (3) OA and ABC (4) OAB and BC

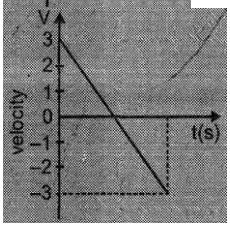
98. For the motion of a particle acceleration-time graph is shown in figure. The velocity time curve for the duration of 0 – 4 seconds is :



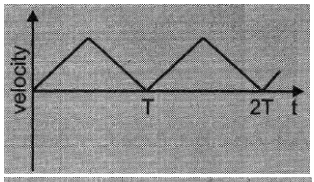
(1)


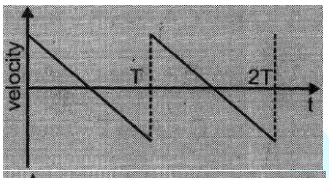
(2)


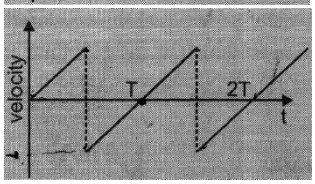
(3)


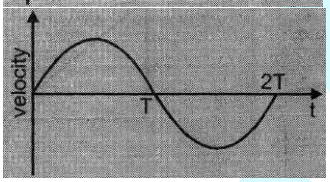
(4)


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

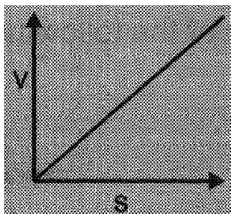
(1) 

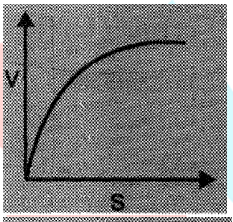
(2) 

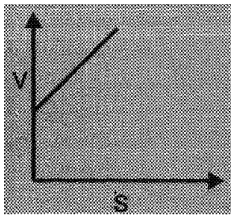
(3) 

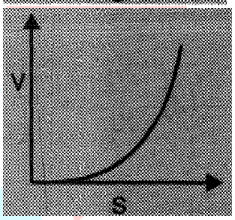
(4) 

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

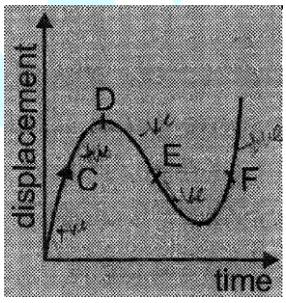
(1) 

(2) 

(3) 

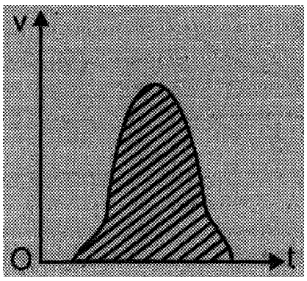
(4) 

101. The displacement-time graph of a moving particle is shown. The instantaneous velocity of the particle is negative at the point :



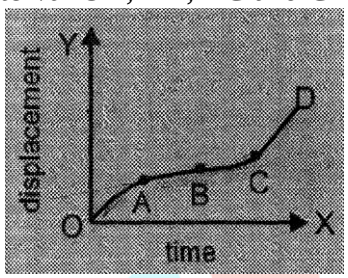
(1) D (2) F (3) C (4) E

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



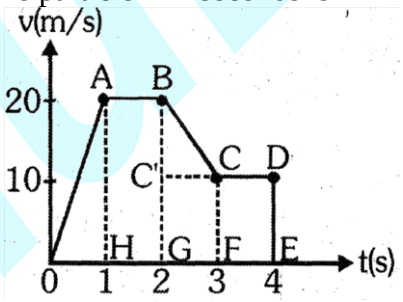
(1) Speed (2) Displacement (3) Acceleration (4) Momentum

103. The graph between the displacement x and time t for a particle moving in a straigh line is shown in figure. During the interval OA, AB, BC and CD, the acceleration of the particle is :



	OA	AB	BC	CD
(1)	+	0	+	0
(2)	–	0	+	0
(3)	+	0	–	+
(4)	–	0	–	0

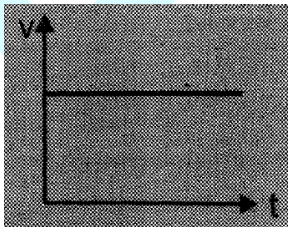
104. The variation of velocity of a particle moving along a straight line is illustrated in the figure. The distance transvered by the particle in 4 seconds is



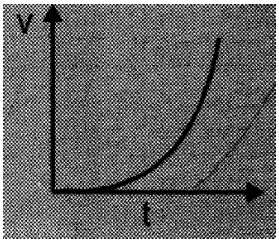
(1) 60 m (2) 25 m (3) 55 m (4) 30m

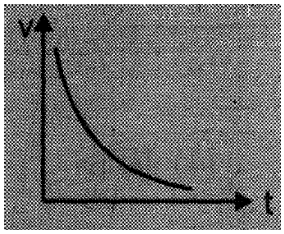
105. Which of the following velocity-time graphs represent uniform motion ?

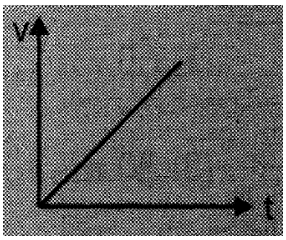
(1)



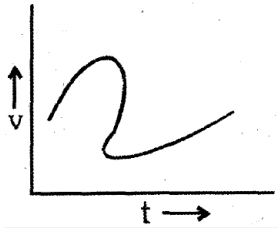
(2)

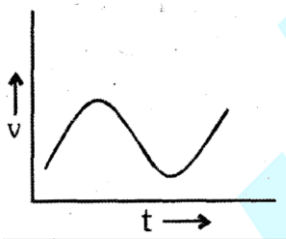


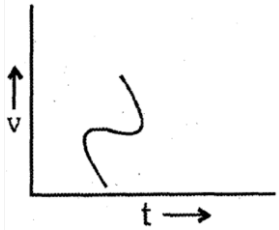
(3) 

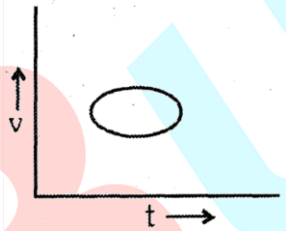
(4) 

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

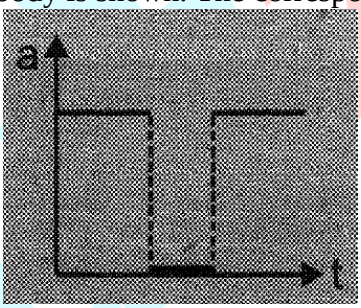
(1) 

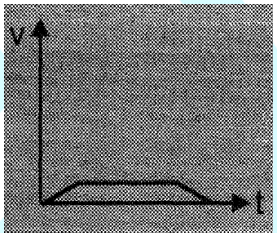
(2) 

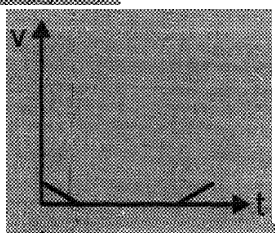
(3) 

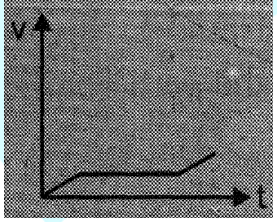
(4) 

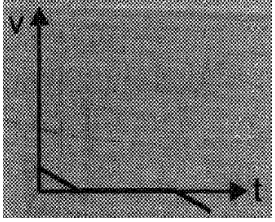
107. Acceleration-time graph of a body is shown. The corresponding velocity-time graph is :



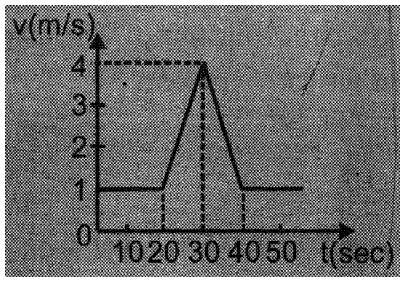
(1) 

(2) 

(3) 

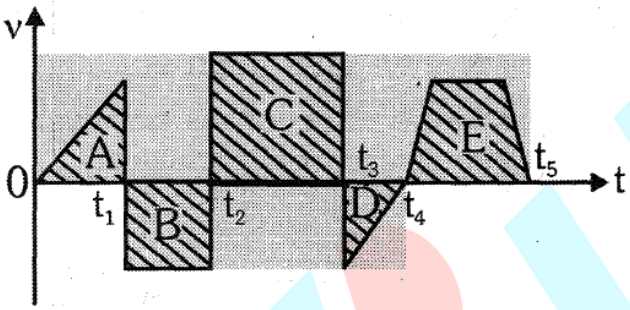
(4) 

108. Velocity-time (v-t) graph for a moving object is shown in the figure. Total displacement of the object during the time interval when there is non-zero acceleration and retardation is :-



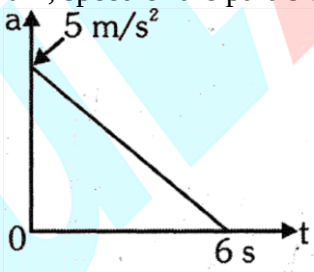
(1) 60 m (2) 50 m (3) 30m (4) 40m

109. The velocity-time graph of an object is shown. The displacement during the interval 0 to t_4 is:-



(1) Area A + Area B + Area C + Area D + Area E
(2) Area A + Area C – Area B – Area D
(3) Area A + Area B + Area C + Area D
(4) Area A + Area C + Area E – Area B + Area D

110. A particle starts from rest. Its acceleration at time t = 0 is 5 m/s^2 which varies with time as shown in the figure. The maximum, speed of the particle will be:



(1) 7.5 m/s (2) 15 m/s (3) 30 m/s (4) 37.5 m/s

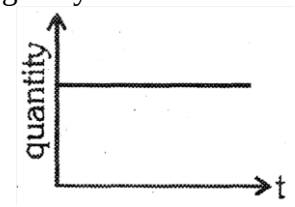
111. A train accelerates from rest at a constant rate α for distance x_1 and time t_1. After that is retards at constant rate β for distance x_2 and time t_2 and comes to the rest. Which of the following relations is correct ?

(1) $\frac{x_1}{x_2}=\frac{\alpha}{\beta}=\frac{t_1}{t_2}$ (2) $\frac{x_1}{x_2}=\frac{\beta}{\alpha}=\frac{t_1}{t_2}$ (3) $\frac{x_1}{x_2}=\frac{\alpha}{\beta}=\frac{t_2}{t_1}$ (4) $\frac{x_1}{x_2}=\frac{\beta}{\alpha}=\frac{t_2}{t_1}$

112. 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 seconds, 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

113. In the graph shown in fig. time is plotted along x-axis. Which quantity associated with a projectile motion is plotted along the y - axis ?



(1) kinetic energy (2) momentum
(3) horizontal velocity (4) none of the above

114. In case of a projectile fired at an angle equally inclined to the horizontal and vertical with velocity u, the horizontal range is:

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

115. A shell is fired vertically upwards with a velocity v_1 from the deck of a ship moving with a speed v_2. A person on the shore observes the motion of the shell as a parabola. Its horizontal range is given by :

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

116. The range of a projectile when fired at 75º to the horizontal is 0.5 km. What will be its range when fired at 45º with the same speed ?

(1) 0.5 km (2) 0.1 km (3) 1.5 km (4) 2.0 km

117. A particle is projected with a velocity u making an angle θ with the horizontal. At any instant, its velocity v is at right angle to its initial velocity u; then vis:

(1) u cos θ (2) u tan θ (3) u cot θ (4) u sec θ

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

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

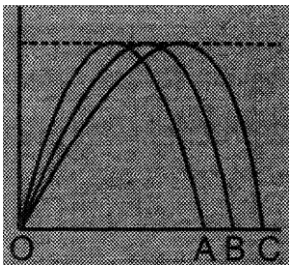
119. A ball is thrown at an angle θ to the horizontal and the range is maximum. The value of tanθ is:

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

120. A student is able to throw a ball vertically to a maximum height of 40 m. The maximum distance to which he can throw the ball in the horizontal direction is :

(1) 40 $(2)^{1/2}$ m (2) 20 $(2)^{1/2}$ m (3) 20 m (4) 80 m

121. Three projectiles A, B and C are thrown from the same point in the same plane. Their trajectories are shown in the figure. Which of the following statement is true ?



(1) The time of flight is the same for all the three
(2) The launch speed is largest for particle C
(3) The horizontal velocity component is largest for particle C
(4) All of the above

122. A projectile is thrown with an initial velocity of $\vec{v} = a\hat{i} + b\hat{j}$. If range of the projectile is double the maximum height attained by it then :

(1) a = 2 b (2) b = a (3) b = 2a (4) b = 4a

123. 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

124. The equation of a 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

125. If a projectile is fired at an angle θ to 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) $\frac{u^2\cos^2\theta}{2g}$

l26. 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) $\frac{R}{4}$

127. 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) $\frac{y_1}{3}$

128. A projectile is thrown from a point in a horizontal plane such that its horizontal and vertical velocity components are 9.8 m/s and 19.6 m/s respectively. Its horizontal range is:

(1) 4.9 m (2) 9.8 m (3) 19.6 m (4) 39.2 m

129. A particle is projected with a velocity v, so that its range on a horizontal plane is twice the greatest height attained. If g is acceleration due to gravity, then its range is :

(1) $\frac{4v^2}{5g}$ (2) $\frac{4g}{5v^2}$ (3) $\frac{4v^3}{5g^2}$ (4) $\frac{4v}{5g^2}$

130. A projectile is thrown into space so as to have the maximum possible horizontal range equal to 400 m. 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) m (2) (200, 100) m (3) (400, 200) m (4) (200, 200) m

131. A particle is fired with velocity u making θ angle with the horizontal. What is the change in velocity when it is at the highest point ?
(1) u cosθ (2) u (3) u sinθ (4) (u cosθ – u)

132. In the above, the change in speed is :
(1) u Cosθ (2) u (3) u sinθ (4) (u cosθ – u)

133. An arrow is shot into the air. Its range is 200 meters and its time of flight is 5 s. lf the value of g is assumed to be 10 m/s^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

134. In the Q. 133, the maximum height attained by the arrow is:
(1) 25 m (2) 40 m (3) 31.25 m (4) 12.5 m

135. In the Q.133, the vertical component of the velocity is :
(1) 25 m/s (2) 40 m/s (3) 12.5 m/s (4) 31.25 m/s

136. In the Q.133, the angle of projection with the horizontal is :
(1) $\tan^{-1}\left(\frac{4}{5}\right)$ (2) $\tan^{-1}\left(\frac{5}{4}\right)$ (3) $\tan^{-1}\left(\frac{5}{8}\right)$ (4) $\tan^{-1}\left(\frac{8}{5}\right)$

137. A ball is thrown at different angles with the same speed u and from the same point; it has the same range in both the cases. If y_1 and y_2 be the heights attained in the two cases, then y_1+y_2 = ….
(1) $\frac{u^2}{g}$ (2) $\frac{2u^2}{g}$ (3) $\frac{u^2}{2g}$ (4) $\frac{u^2}{4g}$

138. Two balls A and B are thrown with speeds u and u/2 respectively. Both the balls cover the same horizontal distance before returning to the plane of projection. If the angle of projection of ball B is 15° with the horizontal, then the angle of projection of A is:
(1) $\sin^{-1}\left(\frac{1}{8}\right)$ (2) $\frac{1}{2}\sin^{-1}\left(\frac{1}{8}\right)$ (3) $\frac{1}{3}\sin^{-1}\left(\frac{1}{8}\right)$ (4) $\frac{1}{4}\sin^{-1}\left(\frac{1}{8}\right)$

139. At what angle to the horizontal should a ball be thrown so that its range R is related to the time of flight T as R = ST? Take g = 10 rns^{-2} :
(1) 30º (2) 45º (3) 60º (4) 90º

140. A projectile is projected with initial velocity $(6\hat{i}+8\hat{j})$ m/s. If g = 10 ms^{-2}, then horizontal range is:
(1) 4.8 meter (2) 9.6 meter (3) 19.2 meter (4) 14.0 meter

141. If the range of a gun which fires a shell with muzzle speed v, is R, then the angle of elevation of the gun is:

(1) $\cos^{-1}\left(\frac{v^2}{Rg}\right)$ (2) $\cos^{-1}\left(\frac{Rg}{v^2}\right)$ (3) $\frac{1}{2}\sin^{-1}\left(\frac{v^2}{Rg}\right)$ (4) $\frac{1}{2}\sin^{-1}\left(\frac{Rg}{v^2}\right)$

142. The maximum range of a projectile fired with some initial velocity is found to be 1000 m. The maximum height (H) reached by this projectile is :

(1) 250 meter (2) 500 meter (3) 1000 meter (4) 2000 meter

143. The angle which the velocity vector of a projectile, will make with the horizontal after time t of its being thrown with a velocity v at an angle θ to the horizontal, is :

(1) θ (2) $\tan^{-1}\left(\frac{\theta}{t}\right)$

(3) $\tan^{-1}\left(\frac{v\cos\theta}{v\sin\theta - gt}\right)$ (4) $\tan^{-1}\left(\frac{v\sin\theta - gt}{v\cos\theta}\right)$

144. A particle is projected at an angle of 45°, 8m away from the foot of a wall, just touches the top of the wall and falls on the ground on the opposite side at a distance 4m from it. The height of wall is :

(1) $\frac{3}{4}$ m (2) $\frac{4}{3}$ m (3) $\frac{8}{3}$ m (4) $\frac{3}{4}$ m

145. The maximum horizontal range of a gun is 16 km.
If g = 10 m/s^2, the muzzle velocity of the shell must be:

(1) 1600 m/s (2) 400 m/s (3) $200\sqrt{2}$ m/s (4) $160\sqrt{10}$ m/s

146. A body is thrown with a velocity of 9.8 m/s making an angle of 30° with the horizontal. It will hit the ground after a time :-

(1) 3 s (2) 2 s (3) 1.5 s (4) 1 s

147. Three' particles A, B and C are projected from the same point with the same initial speeds making angles 30º, 45º and 60º respectively with the horizontal. Which of the following statements are correct?

(1) A, Band C have unequal ranges
(2) Ranges of A and C are equal and less than that of B
(3) Ranges of A and C are equal and greater than that of B
(4) A, B and C have equal ranges

148. A ball whose kinetic energy is E, is thrown at an angle of 45°to the horizontal. Its kinetic energy at the highest point of its flight will be :-

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

149. A body is projected at such an angle that the horizontal range is three times the greatest height. The angle of projection is :-

(1) 25° (2) 33° (3) 42° (4) 53°

150. A projectile can have the same range R for two angles of projection. If t_1 and t_2 be the times of flight in the two cases, then :-

(1) $t_1 t_2 \propto R^2$ (2) $t_1 t_2 \propto R$ (3) $t_1 t_2 \propto \frac{1}{R}$ (4) $t_1 t_2 \propto \frac{1}{R^2}$

151. A body is thrown with some velocity from the ground. Maximum height attained when it is thrown at 60° to the horizontal is 90 m. What is the height attained when it is thrown at 30° to the horizontal ?

(1) 90 m (2) 45 m (3) 30 m (4) 15 m

152. At the uppermost point of a projectile its velocity and acceleration are at an angle, of :-

(1) 180° (2) 90° (3) 60° (4) 45°

153. A force $\vec{F} = 6t^2\hat{i} + 4t\hat{j}$ acts on a particle of mass 3 kg. What will be velocity of the particle at t = 3 second if at t = 0, the particle was at rest :-

(1) $18\hat{i} + 6\hat{j}$ (2) $18\hat{i} + 12\hat{j}$ (3) $12\hat{i} + 6\hat{j}$ (4) none

154. A number of bullets are fired I all possible directions with the same initial velocity u. The maximum area of ground covered by bullets is :-

(1) $\pi\left(\frac{2u^2}{g}\right)^2$ (2) $3\pi\left(\frac{u}{g}\right)^2$ (3) $5\pi\left(\frac{u}{2g}\right)^2$ (4) $\pi\left(\frac{u^2}{g}\right)^2$

155. For a given angle of projection if the initial velocity is doubled the range of the projectile becomes:

(1) half (2) one-fourth (3) two times (4) four times

156. A ball is projected to attain the maximum range. If the height attained is H, the range is:

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

157. Two projectiles are fired from the same point with the same speeds at angles of projection 60° and 30° respectively. Which one of the following is true?

(1) Their horizontal ranges will be the same
(2) Their maximum heights will be the same
(3) Their landing velocities will be the same
(4) Their times of flight will be the same

158. A ball is projected vertically upwards with a certain speed. Another ball of the same mass is projected at an angle 60° to the vertical with the same initial speed. The ratio of their potential energies at highest points of their journey, will be:

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

PROJECTION FROM A HEIGHT

159. A body is thrown horizontally with a velocity $\sqrt{2gh}$ from the top of a tower of height h. It strikes the ground level through the foot of the tower at a distance x from the tower. The value of x is:

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

160. When a particle is thrown horizontally, the resultant velocity of the projectile at any time t is given by:

(1) gt (2) $\frac{3}{4}gt^2$ (3) $\sqrt{u^2+g^2t^2}$ (4) $\sqrt{u^2-g^2t^2}$

161. A ball is projected upwards from the top of a tower wit~ a velocity of 50 m/s making an angle of 30° with the horizontal. The height of the tower is 70m. After how much time from the instant of throwing, will the ball reach the ground ?

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

162. An aeroplane moving horizontally with a speed of 180 km/h 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

163. A plane is flying horizontally at 98 m/s 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°

164. A stuntman plans to run along a roof top and then horizontally off it to land on the roof of next building. The roof of the next building is 4.9 meters below the first one and 6.2 meters away from it. What should be his minimum roof top speed in m/s, so that he can successfully make the jump ?

(1) 3.1 (2) 4.0 (3) 4.9 (4) 6.2

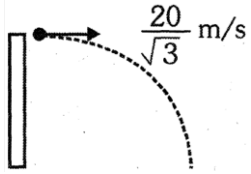
165. From the top of a tower 19.6 m high, a ball is thrown horizontally. If the line joining the point of projection to the point where it hits the ground makes an angle of 45° with the horizontal, then initial velocity of the ball is :

(1) 9.8 m/s (2) 4.9 m/s (3) 14.7 m/s (4) 2.8 m/s

166. A bomber is flying horizontally with a constant speed of 150m/sat a height of 78.4 m. The pilot has to drop a bomb at the enemy target. At what horizontal distance from the target should he release the bomb?

(1) 0 m (2) 300 m (3) 600 m (4) 1000 m

167. A particle is projected horizontally with a speed of $\frac{20}{\sqrt{3}}$ m/s, from some height at t = 0. At what time will its velocity make 60° angle with the initial velocity

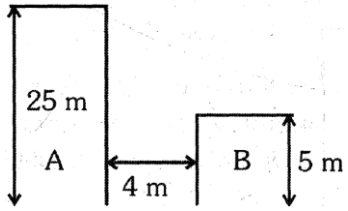


(1) 1 sec (2) 2 sec (3) 1.5 sec (4) 2.5 sec

168. In the above question what will be the displacement of the particle in x-direction when its velocity makes 60° angle with the initial velocity

(1) $\frac{20}{\sqrt{3}}$ m (2) $\frac{40}{\sqrt{3}}$ m (3) $\frac{50}{\sqrt{3}}$ (4) $\frac{10}{\sqrt{3}}$

169. A boy wants to jump from building A to building B. Height of building A is 25 m and that of building B is 5m. Distance between buildings is 4m. Assume that the boy jumps horizontally, then calculate minimum velocity with which he has to jump to land safely on building B.



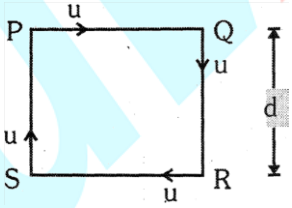
(1) 6 m/s (2) 8 m/s (3) 4 m/s (4) 2 m/s

RELATIVE MOTION IN ONE DIMENSION

70. A train moves in north direction With a speed of 54 km/h A monkey is running on the roof of the train, against its motion with a velocity of 18 km/h. with respect to train. The velocity of monkey as observed by a man standing on the ground is:
(1) 5 m/s due south (2) 25 m/s due south (3) 10 m/s due south (4) 10 m/s due north

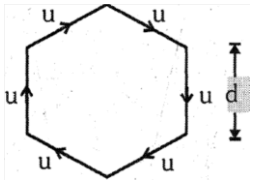
171. A boat takes 2 hours to go 8 km and come back in still water lake. The time taken for going 8 km upstream and coming back with water velocity of 4 km/h is:
(1) 140 min (2) 150 min (3) 160 min (4) 170 min

172. Four persons P, Q, R and S of same mass travel with same speed u along a square of side 'd' such that each one always faces the other. After what time will they meet each other ?



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

173. Six persons of same mass travel with same speed u along a regular hexagon of side 'd' such that each one always faces the other. After how what will they meet each other ?



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

174. A person walks up a stalled escalator in 90 sec. He is carried in 60s, when sanding on the same escalator which is now moving. The time he would take to walk up the moving escalator will be:

(1) 27 s (2) 72 s (3) 18 s (4) 36 s

175. A jet air plane travelling with a speed of 500 km/h ejects its products of combustion with a speed of 1500 km/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

176. A train of 150 m length is running towards north at a speed of 10 m/s. A parrot flies at a speed of 5 m/s towards south 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

177. Two trains each 50 m long, are travelling in opposite directions with respective velocities 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

178. Two cars are moving in the same direction with the same speed of 30 km/h. They are separated by 5 km. What is the speed of a car moving in the opposite direction if it meets the two cars at an interval of 4 minute?
(1) 45 km/h (2) 60 km/h (3) 105 km/h (4) None

179. A stone is thrown upwards and it rises to a height of 200 m. The relative velocity of the stone with respect to the earth will be maximum at :-
(1) Height of 100 m (2) Height of 150 m (3) Highest point (4) The ground

180. A bus starts from rest moving with an acceleration of $2m/s^2$. A cyclist, 96 m behind the bus starts simultaneously towards the bus at 20 m/s. After what time will he be able to overtake the bus:
(1) 8 s (2) 10 s (3) 12 s (4) 1 s

181. A train is moving towards East with a speed 20 m/s. A person is running on the roof of the train with a speed 3 m/s against the motion of train. Velocity of the person as seen by an observer on ground will be:
(1) 23 m/s towards East (2) 17 m/s towards East
(3) 23 m/s towards West (4) 17 m/s towards West

182. A motorcycle is moving with a velocity of 80 km/h ahead of a car moving with a velocity of 65 km/h in the same direction. What is the relative velocity of the motorcycle with respect to the car ?
(1) 15 km/h (2) 20 km/h (3) 25 km/h (4) 145 km/h

183. A 100 m long train crosses a man travelling at 5 km/h, in opposite direction in 7.2 seconds, then the velocity of train is :-
(1) 40 km/h (2) 25 km/h (3) 20 km/h (4) 45 km/h

184. An elevator is accelerating upward at a rate of 6 ft/sec^2 when a bolt from its ceiling falls to the floor of the lift (Distance = 9.5 feet). The time (in seconds) taken by the falling bolt to hit the floor is (take g = 32 ft/ sec^2)

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

185. A 210 meters long train is moving due north with a speed of 25 m/s. A small bird is flying due south a little above the train with 5 m/ s speed The time taken by the bird to cross the train is :-
(1) 6 s (2) 7 s (3) 9 s (4) 10 s

186. 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 will the balls collide? (take g = 10 m/s^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

187. A body A is thrown up vertically from the ground with velocity v_0 and another body B is simultaneously dropped from a height H. They meet at a height $\frac{H}{2}$ if v_0 is equal to

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

RELATIVE MOTION IN TWO DIMENSION

188. A boy is running on a leveled road with velocity (v) with a long hollow tube in his hand. Water is falling vertically downwards with velocity (u). At what angle to the vertical, should he incline the tube so that the water drops enters Without touching its side :

(1) $\tan^{-1}\left(\frac{v}{u}\right)$ (2) $\sin^{-1}\left(\frac{v}{u}\right)$ (3) $\tan^{-1}\left(\frac{v}{u}\right)$ (4) $\cos^{-1}\left(\frac{v}{u}\right)$

189. A river flows from east to west with a speed of 5m/min. A man on south bank of river, capable of swimming at the rate of 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

190. A boat is sailing with 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) $-6\hat{i}-8\hat{j}$

191. A river is flowing at the rate of 6 km/h. A swimmer swims across the river with a velocity of 9 km/h w.r.t. water. The resultant velocity of the man will be in (km/h):

(1) $\sqrt{117}$ (2) $\sqrt{340}$ (3) $\sqrt{17}$ (4) $3\sqrt{40}$

192. 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 made by the direction (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°

193. A boat-man can row a boat to make it move with a speed of 10 km/h in still water. River flows steadily at the rate of 5 km/h. and the width of the river is 2 km. If the boat man cross the river along the minimum distance of approach then time elapsed in rowing the boat will be :

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

194. A bird is flying towards south with a velocity 40 km/h and a train is moving with a velocity 40 km/h towards east. What is the velocity of the bird w.r.t. an obserber in the train ?

(1) $40\sqrt{2}$ km/h. N-E (2) $40\sqrt{2}$ km/h. S-E
(3) $40\sqrt{2}$ km/h. S-W (4) $40\sqrt{2}$ km/h. N-W

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

(1) 40 km/h in N-E direction (2) $40\sqrt{2}$ km/h in N-E direction
(3) 40 km/h in N-W direction (4) $40\sqrt{2}$ km/h in N-W direction

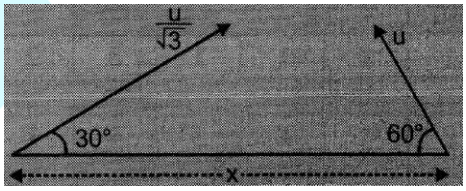
196. A particle is moving with a velocity of 10 m/s towards east. After 10 s its velocity changes to 10 m/s towards north. Its average acceleration is:

(1) zero (2) $\sqrt{2}$ m/s^2 towards N-W
(3) $\frac{1}{\sqrt{2}}$ m/s^2 towards N-E (4) $\frac{1}{\sqrt{2}}$ m/s^2 towards N-W

197. A man is walking on a road with a velocity of 3 km/h when suddenly, it starts raining velocity of rain is 10 km/h in vertically downward direction, 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) $\sqrt{13}$ km/h .

198. Two particles are separated by a horizontal distance x as shown in figure. They are projected as shown in figure with different initial speeds. The time after which the horizontal distance between them becomes zero is :



(1) $\frac{x}{u}$ (2) $\frac{u}{2x}$ (3) $\frac{2u}{x}$ (4) none of these

199. Let $\vec{r}_1(t) = 3t\hat{i} + 4t^2\hat{j}$ and $\vec{r}_2(t) = 4t^2\hat{i} + 3t\hat{j}$ represent the positions of particles 1 and 2, respectively as functions of time t; $\vec{r}_1(t)$ and $\vec{r}_2(t)$ are in meters and t is in seconds. The relative speed of the two particles at the instant t = 1 s, will be

(1) 1 m/s (2) $3\sqrt{2}$ m/s (3) $5\sqrt{2}$ m/s (4) $7\sqrt{2}$ m/s

200. A river 4.0 miles wide is flowing at the rate of 2 miles/hr. The minimum time taken by a boat to cross the river with a speed v = 4 miles/hr (in still water) is approximately
(1) 1 hr and 0 minute (2) 2 hr and 7 minutes
(3) 1 hr and 12 minutes (4) 2 hr and 25 minutes

201. A river 2 km wide is flows at the rate of 2 km/h. A boatman who can row a boat at a speed of 4 km/h in still water, goes a distance of 2 km upstream and then comes back. The time taken by him to complete his journey is
(1) 60 min (2) 70 min (3) 80 min (4) 90 min

202. Two cars A and B start moving from the same, point with same velocity v = 5 km/minute. Car A moves towards North and car B is moving towards East.
What is the relative velocity of B with respect to A ?
(1) $5\sqrt{2}$ km/min towards South-East (2) $5\sqrt{2}$ km/min towards North-West
(3) $5\sqrt{2}$ km/min towards South-West (4) $5\sqrt{2}$ km/min towards North-East

ANSWER KEY

EXERCISE-I (Conceptual Questions)

1.	(1)	**2.**	(3)	**3.**	(3)	**4.**	(2)	**5.**	(1)	**6.**	(1)	**7.**	(1)
8.	(4)	**9.**	(1)	**10.**	(2)	**11.**	(1)	**12.**	(2)	**13.**	(2)	**14.**	(2)
15.	(2)	**16.**	(4)	**17.**	(3)	**18.**	(3)	**19.**	(2)	**20.**	(3)	**21.**	(3)
22.	(3)	**23.**	(2)	**24.**	(1)	**25.**	(3)	**26.**	(4)	**27.**	(1)	**28.**	(3)
29.	(3)	**30.**	(2)	**31.**	(1)	**32.**	(3)	**33.**	(4)	**34.**	(3)	**35.**	(2)
36.	(2)	**37.**	(2)	**38.**	(1)	**39.**	(3)	**40.**	(3)	**41.**	(3)	**42.**	(2)
43.	(1)	**44.**	(4)	**45.**	(2)	**46.**	(2)	**47.**	(4)	**48.**	(2)	**49.**	(1)
50.	(4)	**51.**	(4)	**52.**	(4)	**53.**	(2)	**54.**	(2)	**55.**	(2)	**56.**	(3)
57.	(3)	**58.**	(3)	**59.**	(2)	**60.**	(1)	**61.**	(2)	**62.**	(3)	**63.**	(2)
64.	(3)	**65.**	(2)	**66.**	(3)	**67.**	(2)	**68.**	(2)	**69.**	(1)	**70.**	(3)
71.	(2)	**72.**	(3)	**73.**	(3)	**74.**	(2)	**75.**	(2)	**76.**	(1)	**77.**	(2)
78.	(1)	**79.**	(1)	**80.**	(3)	**81.**	(2)	**82.**	(4)	**83.**	(3)	**84.**	(4)
85.	(2)	**86.**	(4)	**87.**	(4)	**88.**	(1)	**89.**	(1)	**90.**	(2)	**91.**	(2)
92.	(4)	**93.**	(2)	**94.**	(3)	**95.**	(4)	**96.**	(1)	**97.**	(4)	**98.**	(1)
99.	(3)	**100.**	(2)	**101.**	(4)	**102.**	(2)	**103.**	(2)	**104.**	(3)	**105.**	(1)
106.	(2)	**107.**	(3)	**108.**	(2)	**109.**	(2)	**110.**	(2)	**111.**	(2)	**112.**	(3)
113.	(3)	**114.**	(1)	**115.**	(3)	**116.**	(2)	**117.**	(3)	**118.**	(1)	**119.**	(1)
120.	(4)	**121.**	(4)	**122.**	(3)	**123.**	(2)	**124.**	(3)	**125.**	(4)	**126.**	(4)
127.	(4)	**128.**	(4)	**129.**	(1)	**130.**	(2)	**131.**	(3)	**132.**	(4)	**133.**	(2)
134.	(3)	**135.**	(1)	**136.**	(3)	**137.**	(3)	**138.**	(2)	**139.**	(2)	**140.**	(2)
141.	(4)	**142.**	(1)	**143.**	(4)	**144.**	(3)	**145.**	(2)	**146.**	(4)	**147.**	(2)
148.	(3)	**149.**	(4)	**150.**	(2)	**151.**	(3)	**152.**	(2)	**153.**	(1)	**154.**	(4)
155.	(4)	**156.**	(3)	**157.**	(1)	**158.**	(4)	**159.**	(3)	**160.**	(3)	**161.**	(3)
162.	(3)	**163.**	(2)	**164.**	(4)	**165.**	(1)	**166.**	(3)	**167.**	(2)	**168.**	(2)
169.	(4)	**170.**	(4)	**171.**	(3)	**172.**	(1)	**173.**	(3)	**174.**	(4)	**175.**	(3)
176.	(4)	**177.**	(2)	**178.**	(1)	**179.**	(4)	**180.**	(1)	**181.**	(2)	**182.**	(1)
183.	(4)	**184.**	(2)	**185.**	(2)	**186.**	(1)	**187.**	(2)	**188.**	(1)	**189.**	(1)

190.	(3)	**191.**	(1)	**192.**	(2)	**193.**	(2)	**194.**	(3)	**195.**	(2)	**196.**	(2)
197.	(3)	**198.**	(1)	**199.**	(3)	**200.**	(1)	**201.**	(3)	**202.**	(1)		