EXERCISE

Multiple Choice Questions

1. The displacement-time graph for two particles A and B are straight lines inclined at angles of 30° and 60° with the time axis. The ratio of velocities of $v_A : v_B$ is

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

(c) $\sqrt{3}:1$ (d) 1 : 3

2. A 150 m long train is moving with a uniform velocity of 45 km/h. The time taken by the train to cross a bridge of length 850 meters is

(a) 56 sec (b) 68 sec

(c) 80 sec (d) 92 sec

3. A man walks on a straight road from his home to market 2.5 km away with a speed of 5 km/h. Finding the market closed, he instantly turns and walks back home with a speed of 7.5 km/h. The average speed of the man over the interval of time 0 to 40 min is equal to

(a) 5 km/h (b) 25/4 km/h

(c) 30/4 km/h (d) 45/8 km/h

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

(a) 7/5 (b) 5/7

(c) 7/3 (d) 3/7

5. The position of a particle moving along the x-axis at certain times is given below :

t (s)	0	1	2	3
x (m)	-2	0	6	16

Which of the following describes the motion correctly

(a) Uniform, accelerated

(b)Uniform, decelerated

(c) Non-uniform, accelerated

(d) There is not enough data for generalization

6. A body *A* starts from rest with an acceleration a_1. After 2 seconds, another body *B* starts from rest with an acceleration a_2. If they travel equal distances in the 5th second, then the ratio $a_1 : a_2$ is equal to

(a) 5 : 9 (b) 5 : 7 (c) 9 : 5 (d) 9 : 7

7. An object is projected upwards with a velocity of 100 m/s. It will strike the ground after (approximately)

(a) 10 sec (b) 20 sec

(c) 15 sec (d) 5 sec

8. A body moving with a initial velocity of 5 m/s accelerates at 2 m/s^2. Its velocity after 10 seconds is

(a) 20 m/s (b) 25 m/s

(c) 5 m/s (d) 22.5 m/s

9. A racing car has a uniform acceleration of 4 m/s^2. The distance covered by the car in 10 seconds after the start is :

(a) 200 m (b) 100 m

(c) 300 m (d) 400 m

10. A scooter acquires a velocity of 36 km/hr in just 10 seconds after the start. The acceleration of the scooter was

(a) 0.2 m/s^2 (b) 0.5 m/s^2

(c) 1.0 m/s^2 (d) 2.0 m/s^2

11. A moving train is brought to rest within 20 seconds by applying brakes. If the retardation due to brakes is 2 m/s^2, then the initial velocity was,

(a) 10 m/s (b) 20 m/s

(c) 30 m/s (d) 40 m/s

12. A body starts from rest and moves with a uniform acceleration of 10 m/s^2 in the first 10 seconds. During the next 10 seconds it moves with a uniform velocity. The total distance covered by it is

(a) 2000 m (b) 1500 m

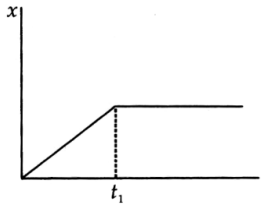
(c) 100 m (d) 500 m

13. A motor car travels with a speed v_1 from A to B and returns back from B to A with a speed v_2. The average speed of the car during its journey is

(a) $\frac{v_1 + v_2}{2}$ (b) $\frac{v_1 v_2}{v_1 + v_2}$

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

14. The figure shows the displacement-time graph of a particle moving along the x - axis. Which of the following statement will describe the motion of the particle correctly?



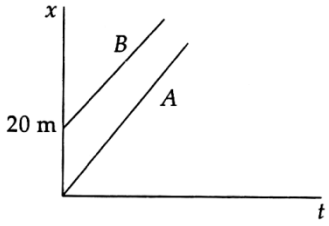
(a) The particle is moving continuously

(b) The particle is at rest

(c) The velocity of the particle increases upto time t_1 and then becomes constant.

(d) The particle moves with a constant velocity upto time t_1 and then stops.

15. The displacement-time graphs of two bodies A and B are shown in figure. Which of the following statements is correct?



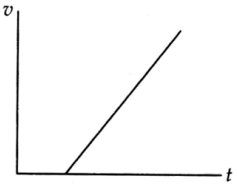
(a) A is moving faster than B

(b) B is moving faster than A

(c) B is always 20 m behind A

(d) A is always 20 m behind B

16. The velocity-time graph of a particle is shown in figure. Which of the following statements will describe the motion of the particle correctly?



(a) The particle has a constant acceleration

(b) The particle has zero displacement

(c) The body is moving with a uniform velocity

(d) The acceleration of the body is increasing

(e) The body is experiencing retardation

17. 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

(a) 6 m (b) 12 m

(c) 18 m (d) 24 m

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

(a) Velocity of A is more than B at the ground

(b) Velocity of B is more than A at the ground

(c) Both A and B strike the ground with same velocity

(d) None of these

19. A ball is released from the top of a tower of Height *h* meters. It takes *T* seconds to reach of the ground. What is the position of the ball in T/3 seconds

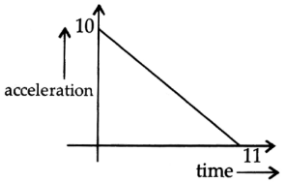
(a) h/9 meters from the ground

(b) 7h/9 meters from the ground

(c) 8h/9 meters from the ground

(d) 17/1/18 meters from the ground.

20. A particle moving in a straight line covers half the distance with speed of 3 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



(a) 4.0 m/s (b) 5.0 m/s

(c) 5.5 m/s (d) 4.8 m/s.

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

(a) 110 m/s (b) 55 m/s

(c) 550 m/s (d) 660 m/s

22. A particle is travelling with a constant speed. This means

(a) its position remains constant as time passes

(b) it covers equal distances in equal time intervals

(c) its acceleration is zero

(d) it does not change its direction of motion.

23. A particle moves with a uniform velocity.

(a) The particle must be at rest
(b) The particle moves along a curved path
(c) The particle moves along a circle
(d) The particle moves along a straight line

24. If a particle covers equal distances in equal time intervals, it is said to
(a) be at rest
(b) move with a uniform speed
(c) move with a non-uniform speed
(d) move with a uniform acceleration

25. A quantity has a value of -6.0 m/s. It may be the
(a) speed of a particle
(b) velocity of a particle
(c) acceleration of a particle
(d) position of a particle

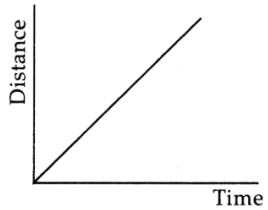
26. The area under a graph between two quantities is given in the unit m/s. The quantities are
(a) velocity and time
(b) distance and time
(c) acceleration and time
(d) all of these

27. The area under a speed-time graph is represented by the unit
(a) m (b) m^2
(c) m^3 (d) m^{-1}

28. The velocity-time graph of a particle is not a straight line. Its acceleration is
(a) zero (b) constant
(c) negative (d) variable

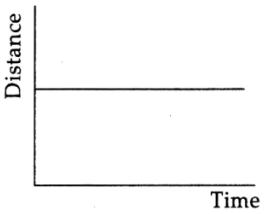
29. If a particle moves with a constant speed/ the distance- time graph is a
(a) straight line (b) circle
(c) stairlike line (d) polygon

30. The distance-time graph of an object moving in a fixed direction is shown in the figure



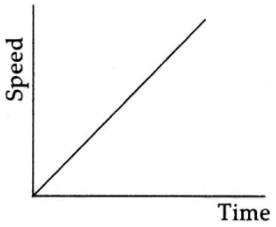
The object
(a) is at rest
(b) moves with a constant velocity
(c) moves with a variable velocity
(d) moves with a constant acceleration

31. The distance-time graph of an object is shown in figure



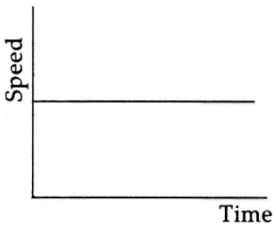
The object
(a) is at rest
(b) moves with a constant speed
(c) moves with a constant velocity
(d) moves with a constant acceleration

32. The speed-time graph of an object moving in a fixed direction is shown in figure



The object
(a) is at rest
(b) moves with a constant speed
(c) moves with a constant velocity
(d) moves with a constant acceleration

33. The speed-time graph of an object moving in a fixed direction is shown in figure



The object
(a) is at rest
(b) moves with fluctuating speed
(c) moves with a constant speed
(d) moves with a nonzero acceleration

34. In circular motion the
(a) direction of motion is fixed
(b) direction of motion changes continuously
(c) acceleration is zero
(d) velocity is constant

35. The displacement of a body is given to be proportional to the cube of time elapsed. The magnitude of the acceleration of the body, is
(a) constant but not zero
(b) increasing with time
(c) zero
(d) decreasing with time

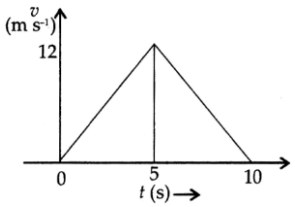
36. The ratio of magnitudes of average speed to average velocity, is
(a) always less than one
(b) always equal to one
(c) always more than one
(d) equal to or more than one

37. A man waves his arms while walking. This is
(a) to keep constant velocity
(b) to ease the tension
(c) to increase the velocity
(d) to balance the effect of earth's gravity.

38. Three different objects 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
(a) $m_1 : m_2 : m_3$ (b) 1 : 1 : 1
(c) $m_1 : 2m_2 : 3m_3$ (d) $\frac{1}{m_1} : \frac{1}{m_2} : \frac{1}{m_3}$

39. A particle starts from rest and has an acceleration of 2 m/s^2 for 10 sec. After that, it travels for 30 sec with constant speed and then undergoes a retardation of 4 m/s^2 and comes back to rest. The total distance covered by the particle is
(a) 650 m (b) 750 m
(c) 700 m (d) 800 m

40. The speed time graph of a particle moving in a fixed direction is as shown in the figure. The distance traversed by the particle between $t = 0$ to $t = 5$ s is



(a) 24 m (b) 30 m
(b) 36 m (d) 40 m

41. A man walks on a straight road from his home to a market 2.5 km away with a speed of 5 km/h. Finding the market closed, he instantly turns and walks back home with a speed of 7.5 km/h. The average speed of the man over the interval of time 0 to 40 min is equal to
(a) 5 km/h (b) 25/4 km/h
(b) 30/4 km/h (d) 45/8 km/h

42. A river 4.0 miles wide is following at the rate of 2 miles/hr. The minimum time taken by a boat to cross the river with a speed $\upsilon = 4$ miles/hr (in still water) is approximately
(a) 1 hr and 9 minutes (b) 2 hr and 7 minutes
(c) 1 hr and 12 minutes (d) 2hr and 25 minutes

43. A horizontal beam of thermal neutrons with velocity v = 2.2 x 103 meters/sec, is directed to hit a target 1.1 meter away. If gravity is the only force, the beam would miss the target approximately by
(a) 1.01 x 10^{-6} meters (b) 1.25 x 10^{-6} meters
(c) 1.1 x 10^{-6} meters (d) 4.4 x 10-4 meters.

44. A point object transverses half the distance with velocity υ_0. The remaining part of the distance was covered with velocity υ_1 for the half the time and with velocity υ_2 for the rest half. The average velocity of the object for the whole journey is
(a) $2\upsilon_1(\upsilon_0 + \upsilon_2) / (\upsilon_0 + 2\upsilon_1 + 2\upsilon_2)$
(b) $2\upsilon_0(\upsilon_0 + \upsilon_1) / (\upsilon_0 + \upsilon_1 + \upsilon_2)$
(c) $2\upsilon_0(\upsilon_1 + \upsilon_2) / (\upsilon_1 + \upsilon_2 + 2\upsilon_0)$
(d) $2\upsilon_2(\upsilon_0 + \upsilon_1) / (\upsilon_1 + 2\upsilon_2 + \upsilon_2)$.

45. If a car at rest accelerates uniformly and attains a speed of 75 km/hr in 10 s, then it covers a distance of
(a) 50 m (b) 100 m
(c) 200 m (d) 400 m.

46. If a body is moving at constant speed in a circular path, its
(a) velocity is constant and its acceleration is zero
(b) velocity and acceleration are both changing direction only
(c) velocity and acceleration are both increasing

(d) velocity is constant and acceleration is changing direction.

47. If a velocity of 3 meters per second is added to another of 5 meters per second, the sum is
(a) 2 meters per second
(b) 4 meters per second
(c) anything over 3 meters per second
(d) between 2 meters per second and 8 meters per second.

48. A graph is plotted showing the velocity of a car as a function of time. If the graph is a straight line, means that
(a) the car started at rest
(b) acceleration was constant
(c) acceleration was increasing
(d) velocity was constant. ,

49. The acceleration of an object will be 9.8 meters per second squared if the object is falling freely
(a) near the surface of the earth
(b) anywhere
(c) traveling straight down
(d) traveling upward

50. If a car is traveling north on a straight road and its brakes are applied, it will
(a) have no acceleration
(b) accelerate to the south
(c) accelerate to the north
(d) accelerate either east or west

51. A bicycle averages 4.5 meters per second while traveling for 10 minutes. How far does it travel
(a) 2700 m (b) 2800 m
(c) 2500 m (d) 2400 m.

52. The acceleration of a car that speeds up from 12 meters per second to 30 meters per second in 15 seconds
(a) 2.4 m/s^2 (b) 1.2 m/s^2
(c) 2m/s^2 (d) 5.2 m/s^2

53. The angular velocity of the second hand of a clock is
(a) 0.105 rad/s (b) 1.105 rad/s
(c) 2.102 rad/s (d) 3.120 rad/s

54. If a car can accelerate 3.2 meters per second squared, how long will it take to speed up from 15 meters per second to 22 meters per second
(a) 2.2 s (b) 1.2 s
(c) 5 s (d) 4 s

55. A body, starting from rest, moves in a straight line with a constant acceleration a for a time interval t during which it travels a distance s_1. If it continues to move with the same acceleration for the next time interval t during which it travels a distance s_2. The relation between s_1 and s_2 is
(a) $s_2 = s_1$ (b) $s_2 = 2s_1$
(c) $s_2 = 3s_1$ (d) $s_2 = 4s_1$

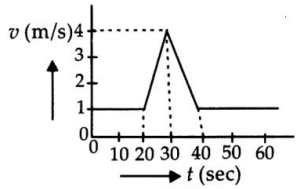
56. A body, moving in a straight line, with an initial velocity u and a constant acceleration a, covers a distance of 40 m in the 4th second and a distance of 60 m in the 6th second. The values of u and a respectively are
(a) 10 m s^{-1}, 5 m s^{-2} (b) 10 m s^{-1}, 10 m s^{-2}
(c) 5 m s^{-1}, 5 m s^{-2} (d) 5 m s^{-1}, 10 m s^{-2}

57. A body, starting from rest and moving with a constant acceleration, converts a distance s_1 in the 4th second and a distance s_2 in the 6th second. The ratio s_1 / s_2 is
(a) $\frac{2}{3}$ (b) $\frac{4}{9}$
(c) $\frac{6}{11}$ (d) $\frac{7}{11}$

58. A car, starting from rest, has a constant acceleration a_1 for a time interval t_1 during which it covers a distances s_1. In the next time interval t_2, the car has a constant retardation a_2 and comes to rest after covering a distance s_2 in time t_2. Which of the following relations is correct?
(a) $\frac{a_1}{a_2} = \frac{s_1}{s_2} = \frac{t_1}{t_2}$ (b) $\frac{a_1}{a_2} = \frac{s_2}{s_1} = \frac{t_1}{t_2}$
(c) $\frac{a_1}{a_2} = \frac{s_1}{s_2} = \frac{t_2}{t_1}$ (d) $\frac{a_1}{a_2} = \frac{s_2}{s_1} = \frac{t_2}{t_1}$.

59. Velocity-time $(\upsilon - t)$ 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



(a) 60 m (b) 50 m
(c) 30 m (d) 40 m

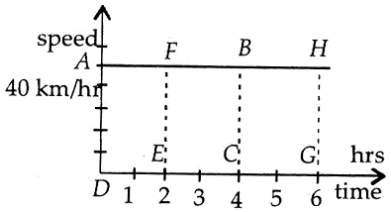
60. When a bullet is fired at a target, its velocity decreases by half after penetrating 30 cm into it. The additional thickness it will penetrate before coming to rest is
(a) 30 cm (b) 40 cm
(c) 10 cm (d) 50 cm

61. A car accelerates from rest at a constant rate α for some time, after which it decelerates at a constant rate β and comes to rest. If total time elapsed is t, then maximum velocity acquired by car will be

(a) $\frac{(\alpha^2-\beta^2)t}{\alpha\beta}$ (b) $\frac{\alpha\beta t}{\alpha+\beta}$

(c) $\frac{(\alpha^2+\beta^2)t}{\alpha\beta}$ (d) $\frac{(\alpha+\beta)t}{\alpha\beta}$

62. A car is moving uniformly with a speed of 40 km per hour as shown in the graph. The distance travelled in 4 hours is



(a) Area ADEF (b) Area ABCD
(c) Area AHGD (d) Less than AFED

63. How far does a motorcycle travel if it starts at rest and is going 22 meters per second after 15 seconds
(a) 160 m (b) 110 m
(c) 165 m (d) 100 m

64. The acceleration of a car that gets to a speed of 18 meters per second from rest while traveling 240 meters
(a) 1.2 m/s^2 (b) 0.68 m/s^2
(c) 12.8 m/s^2 (d) 4.2 m/s^2

65. A ball is dropped from a window 24 meters high. How long will it take to reach the ground
(a) 2.2 s (b) 1.2 s
(c) 4.5 s (d) 0.2 s

66. An arrow is fired straight up, leaving the bow at 15 meters per second. If air resistance is negligible, how high will the arrow rise
(a) 10.5 m (b) 15.0 m
(c) 11.5 m (d) 8.5 m

67. A firefighter drops from a window into a net. If the window is 34 meters above the net, the speed with which firefighter hit the net
(a) 18 m/s (b) 20 m/s
(c) 12 m/s (d) 26 m/s

68. A toy train is traveling around a circular track 2.0 meters in radius, and it makes a complete circuit every 4.5 seconds, its velocity is
(a) 1.2 m/s (b) 2.8 m/s
(c) 1.8 m/s (d) 3.2 m/s

69. A pitcher throws his fastball horizontally at 42.1 meters per second. How far does it drop before crossing the plate, 18.3 meters away
(a) 0.8 m (b) 1.2 m
(c) 2.2 m (d) 0.93 m

70. The breaks applied to a scooter produces a retardation of 6 m/s^2. If the scooter takes 2 seconds to stop after applying the breaks, the distance it covers during this time is
(a) 12 m (b) 10 m
(c) 8 m (d) 6 m

71. A bullet is fired from a rifle, emerging from the muzzle at 340 meters per second. It strikes a sandbag some distance away, having lost 10 percent of its velocity due to air resistance. If it penetrates the sandbag to a depth of 12.0 centimeters, how long did it take for the bullet to come to rest in the sandbag
(a) 8 x 10^{-4} s (b) 2 x 10^{-4} s
(c) 6 x 10^{-4} s (d) 4 x 10^{-4} s

72. Mohan takes 20 minutes to cover a distance of 3.2 kilometers due north on a bicycle, his velocity in kilometer/hour
(a) 8.1 (b) 9.6
(c) 1.2 (d) 7.2

73. The initial velocity of a body is 15 m/s. If it is having an acceleration of 10 m/s^2, then the velocity of body after 10 seconds from start
(a) 110 m/s (b) 105 m/s
(c) 120 m/s (d) 115 m/s

74. A bus is moving eastward. It covers a distance of 200 kilometers in 4 hours, its velocity is
(a) 50 km/hr (b) 20 km/hr
(c) 30 km/hr (d) 10 km/hr

75. The initial velocity of a cyclist was 4 m/s. If it is having an acceleration of 2 m/s^2, then the velocity of body after 5 seconds from start
(a) 13 m/s (b) 14 m/s
(c) 15 m/s (d) 16 m/s

76. A car going at 24 meters per second passes a motorcycle at rest. As it passes, the motorcycle starts up, accelerating at 3.2 meters per second squared. If the motorcycle can keep up that acceleration, how long will it take for it to catch the car
(a) 12 s (b) 14 s
(c) 20 s (d) 18 s

77. Distance is
(a) always positive
(b) always negative
(c) may be positive or negative
(d) cannot say

78. In case of a moving body
(a) displacement = distance
(b) displacement > distance
(c) displacement < distance
(d) distance < displacement

79. When the distance travelled by a body is directly proportional to the square of the time taken, the motion of the body is
(a) uniform
(b) uniformly accelerated
(c) zig zag
(d) circular

80. A body covers half the distance with a speed of 20 m/s and the other half with a speed of 30 m/s. The average speed of the whole journey is
(a) 25 m/s (b) zero
(c) 24 m/s (d) 2.4 m/s

81. The average velocity of a body is equal to mean of its initial velocity and final velocity. The acceleration of the body is
(a) variable (b) zero
(c) negative (d) uniform

82. The distance-time graph of a body is a straight line inclined to time axis. The body is in
(a) uniform motion
(b) uniformly accelerated motion
(c) uniformly retarded motion
(d) rest position

83. The velocity time-graph of a body has a negative slope. The body is undergoing
(a) uniform acceleration
(b) uniform retardation
(c) variable acceleration
(d) variable retardation

84. Uniform circular motion is
(a) uniform motion
(b) uniformly retarded motion
(c) uniformly accelerated motion
(d) cannot say

85. A stone of mass 10 g is being moved in a circle of radius 50 cm with a uniform speed of 1 m/s. The acceleration of the stone is
(a) zero (b) 2 m/s^2
(c) 1 m/s^2 (d) 0.5 m/s^2

86. A scooter moving at 36 km/h is brought to rest in 10 s. The acceleration of the scooter is
(a) 1 m/s^2 (b) -1 m/s^2
(c) 10 m/s^2 (d) -10 m/s^2

87. A stone tied to a string is whirled in a circle. As it is revolving, the rope suddenly breaks. Then
(a) the stone flies tangentially
(b) the stone moves radially inward
(c) the stone moves radially outward
(d) the motion of the stone depends upon its velocity

FILL IN THE BLANKS

1. If a car starts at rest and accelerates uniformly, the distance it travels is proportional to the…….. of the time it travels.

2. All objects in free fall at a given place have the same.....

3. If a car is going northward and the driver jams on its brakes, the direction of its acceleration is……

4. When an object is going in a circular path at constant speed, the direction of its acceleration is.....

5. A truck travelling due north at 20 m/s turns left and travels at same speed. Then the change in velocity is.....

6. A particle is moving eastward with a velocity of 5 m/s. In 10 second the velocity changes to 5 m/s northward. The average acceleration in this time is.....

7. If a particle moves in a circle describing equal angles in equal interval of times, its velocity vector.....

8. A particle moves with a velocity v in a circle of radius r, then its angular velocity is equal to..... and acts along the.....

9. The ratio of angular speeds of minute hand and hour hand of watch is.....

10. A body falling freely from the rest has a velocity υ after it has fallen through a distance *h*. The distance it has to fall down further for its velocity to become 2v is.....

11. A body, dropped from a tower with zero velocity, reaches the ground in 4 sec. The height of the tower is about..... m.

12. The magnitude of average velocity..... equal to the average speed.

13. Average velocity of an object is zero in some time-interval, the displacement of the object for that time interval is.....

14. Distance is always ..... than or ..... to the magnitude of displacement.

15. An object is at rest at position x = 40 m. Then, its displacement-time graph will be straight line ..... to the time axis.

16. The motion of an object in which it's..... is constant, is called uniform motion.

17. In uniform circular motion, magnitude of velocity is ..... but direction of velocity is continuously.....

18. In uniform circular motion, linear velocity (υ) and angular velocity (ω) are related as.....

19. In uniform circular motion, magnitude of acceleration is..... but direction of acceleration is continuously.....

20. Displacement is ..... quantity; whereas distance is a ..... quantity.

21. Velocity is a ..... quantity; whereas speed is a..... quantity.

22. Distance travelled divided by elapsed time gives……..

23. The length of second's hand in a watch is 1 cm. The change in velocity of its tip in 15 second is…….

24. A ball thrown vertically upwards return to its starting point in 4 s. lig = 10 m/s^2, its initial speed was.....

TRUE OR FALSE

1. Area under velocity-time graph shows displacement.

2. Magnitude of displacement can be equal to or lesser than distance.

3. If particle speed is constant, acceleration of the particle must be zero.

4. A particle moving with a uniform velocity must be along a straight line.

5. A particle is known to be at rest at time t = 0. Its acceleration at t = 0 must be zero.

6. The equation $s = ut + \frac{1}{2}at^2$ with the usual notation is vectorial in nature.

7. Scalar quantities can be added according to the rules of arithmetic.

8. The magnitude of the displacement of a particle can be greater than the distance traversed.

9. The magnitude of the displacement of a particle can be equal to the distance traversed.

10. Vector quantities can be added according to the rules of arithmetic.

11. The displacement of a particle in a 10-minute interval is zero. Its velocity at every instant in this interval must be zero.

12. A ball is thrown vertically upwards in vacuum. Then the time of ascent is equal to the time of descent.

13. In a journey, numerical value of displacement $\leq$ distance.

14. An object covers distances in direct proportional to the square of the time elapsed. Its acceleration is increasing.

15. Magnitude of acceleration is constant in the rotating motion along a circular path.

16. For a particle moving with a constant velocity, the distance-time graph is a straight line.

17. For a particle moving with a constant acceleration along a straight line, the velocity time graph is a straight line.

18. Forces responsible for uniform circular motion are called centrifugal force.

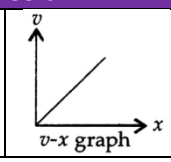
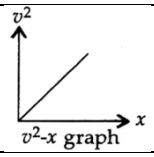
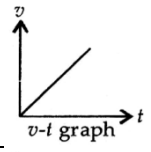
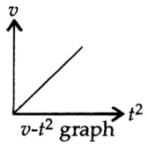
19. Centrifugal force is the reaction of the centripetal force.

20. If a body is moving on a curved path with constant speed the its acceleration is perpendicular to the direction of motion.

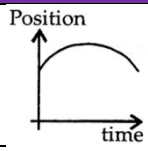
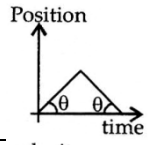
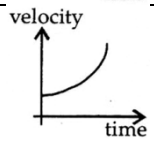
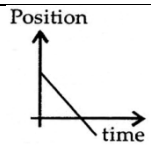
Matrix Match Type

In this section each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in Column-I have to be matched with statements (p, q, r, s) in Column-II.

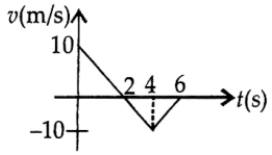
1. Column I gives some graphs for a particle moving along x-axis in positive x - direction. The variables υ, x and t represent speed of particle, x- coordinate of particle and time respectively. Column II gives certain resulting interpretation Match the graphs in column I with the statements in column II.

Column I		Column II	
(A)		(p)	Acceleration of particle is uniform
(B)		(q)	Acceleration of particle is non uniform
(C)		(r)	Acceleration of particle is directly proportional to t
(D)		(s)	Acceleration of particle is directly proportional to x

2. Match the situation given in column I with the possible curves in column II.

Column I		Column II	
(A)	Particle moving with constant speed	(p)	
(B)	Particle moving with increasing acceleration	(q)	
(C)	Particle moving with constant negative acceleration	(r)	
(D)	Particle moving with zero acceleration	(s)	

3. For the velocity-time graph shown in figure, in a time interval from t = 0 to t ≠ 6 s/ match the following

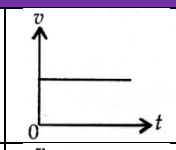
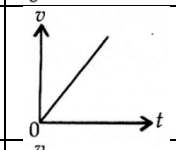
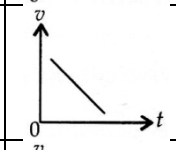
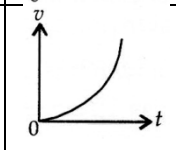


Column I		Column II	
(A)	Change in velocity	(p)	-5/3 SI unit
(B)	Average acceleration	(q)	-20 SI unit
(C)	Total displacement	(r)	-10 SI unit
(D)	Acceleration at t = 3 s	(s)	-5 SI unit

4. An insect trapped in a circular groove of radius 12 cm moves along the groove steadily and completes 7 revolutions in 100 s. Then

Column I		Column II	
(A)	Angular speed (in rad/sec)	(p)	5.3
(B)	Linear speed (in cm/s)	(q)	0.44
(C)	Acceleration (in cm/s^2)	(r)	14.2
(D)	Time period (in s)	(s)	2.3

5.

Column I		Column II	
(A)		(p)	Motion with non-uniform acceleration
(B)		(q)	Uniform acceleration
(C)		(r)	Constant retardation
(D)		(s)	Motion of body covering equal distances in equal interval of time

ASSERTION & REASON QUESTIONS

Directions: In each of the following questions, statement of Assertion (A) is given followed by a corresponding statement of Reason (R) just below it. Of the statements, mark the correct answer as

(a) If both assertion and reason are true and reason is the correct explanation of assertion

(b) If both assertion and reason are true but reason is not the correct explanation of assertion

(c) If assertion is true but reason is false

(d) If assertion is false but reason is true.

1. **Assertion:** The distance 'x' in which a car can be stopped depends on the initial velocity.
Reason: Change in mass has no role to play.

2. **Assertion:** A body can have acceleration even if its velocity is zero at a given instant of time.
Reason: A body is momentarily at rest when it reverses its direction of motion.

3. **Assertion:** Displacement of a body may be zero when distance travelled by it is not zero.
Reason: The displacement is the longest distance between initial and final position.

4. **Assertion:** The relative velocity between any two bodies moving in opposite direction is equal to sum of the velocities of two bodies.
Reason: Sometimes relative velocity between two bodies is equal to difference in velocities of the two bodies.

5. **Assertion:** Velocity-time graph for an object in uniform motion along a straight path is a straight line parallel to the time axis.
Reason: In uniform motion of an object velocity increases as the square of time elapsed.

6. **Assertion:** A body may be accelerated even when it is moving at uniform speed.
Reason: When direction of motion of the body is changing then body may have acceleration.

7. **Assertion:** The motion of a body moving in a circular path with constant speed is an example of variable acceleration.
Reason: Acceleration varies due to change in direction.

8. **Assertion:** The position-time graph of a body may be a straight line parallel to time axis.
Reason: It is possible that position of a body does not change with time.

9. **Assertion:** Displacement of a body is the signed sum of the area under velocity-time graph.
Reason: Displacement is a vector quantity.

10. **Assertion:** The average speed of an object may be equal to arithmetic mean of individual speed.
Reason: Average speed is equal to total distance travelled divided by total time taken.

11. **Assertion:** The speedometer of an automobile measure the average speed of the automobile.
Reason: Average velocity is equal to total displacement divided by total time taken.

12. **Assertion:** A negative acceleration of a body is associated with a slowing down of a body.
Reason: Acceleration is vector quantity.

13. **Assertion:** Motion with uniform velocity is always along a straight line path.
Reason: In such a motion speed is the magnitude of the velocity and is equal to the instantaneous velocity.

14. **Assertion:** When an object returns to its initial position, its displacement is zero, but the distance covered is not zero.
Reason: It means that its average velocity and average speed are both zero.

15. **Assertion:** The accelerated motion of an object may be due to change in magnitude of velocity or direction of velocity or both.
Reason: Acceleration can be produced only by change in the magnitude of the velocity.

16. **Assertion:** Displacement of an object is the algebraic sum of the area under velocity-time graph.
Reason: Displacement is the shortest distance between the initial and final position.

SECTION - I

Straight Objective Type

1. *Starting from rest the car travels distance s= 18 m*

we have $s = ut + \frac{1}{2}at^2$

$18 = 0.\ t + \frac{1}{2}a.t^2$

$\therefore\ 18 = \frac{1}{2}a.(3)^2 \Rightarrow a = 4m/s^2$

Hence (b) is the correct answer.

2. *Within 10 seconds the body finishes* $\frac{1}{2}$ *rotation.*

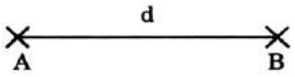
therefore $d = \frac{1}{2}(2\pi r)$

$= \frac{1}{2}(2 \times \frac{22}{7} \times 7m)$

$= 22m$

Hence (a) is the correct answer.

3.



The average speed $= \frac{\text{Total distance}}{\text{Total time}}$

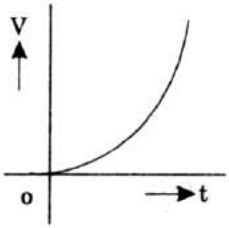
$= \frac{2d}{t_1 + t_2} = \frac{2d}{\frac{d}{40} + \frac{d}{60}} = 48$ kmph

Hence (d) is the correct answer.

4. *The average velocity* $= \frac{\text{Total distance}}{\text{Total time}}$ *here total displacement is*

zero, because it reaches the starting point. So its average velocity is also zero.
Hence (d) is the correct answer.

5.



In the adjacent graph, as the slope is gradually increasing, the acceleration of the body also gradually increases.
Hence (c) is the correct answer.

6. *As slope is gradually increasing, it represents uniform increase in velocity. So the body is said to be moving with uniform acceleration.*
Hence (b) is the correct answer.

7. *Because, the value of acceleration is maintained same for every value of time.*
Hence (d) is the correct answer.

8. *We have* $\upsilon = u + at$, *in case of body starting from rest* $u = 0$;
$\upsilon = at \Rightarrow V \alpha t \quad (\because \text{a is constant})$
Hence (a) is the correct answer.

9. *We know, the displacement covered by a body is a particular second is given by*

$$S_n = u + a\left(n - \frac{1}{2}\right)$$

in case of a body starting from rest $u = 0$

$S_n \alpha \left(n - 1/2\right)$

Hence (d) is the correct answer.

10. *We know* $s = ut + \frac{1}{2}at^2$

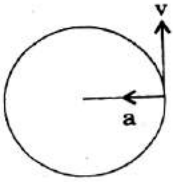
if $u = 0 \Rightarrow s \alpha t^2$

Hence (b) is the correct answer.

11. *Remains constant because g= constant*

Hence (d) is the correct answer.

12.



In uniform circular motion, the speed of the circulating body is constant, but du e to the continuous change in the direction body acquires acceleration. This acceleration is at right angles to the velocity.

Hence (c) is the correct answer.

13. *We know* $S_n = u + a\left(n - 1/2\right)$

given that $u = 0$;

$\therefore\ S_n = \frac{a}{2}(2n-1) \Rightarrow S_n \alpha (2n-1)$

Hence (c) is the correct answer.

14. $a - \dfrac{10\ ms^{-1} - 0\ ms^{-1}}{10s} = 1\ ms^{-2}$

Hence (a) is the correct answer.

15. *In the hand of the person, because the car is moving with uniform velocity.*

Hence (d) is the correct answer.

16. $s_1 = \dfrac{1}{2} \times 10 \times 10 = 50m$

$s_2 = 10 \times 10 = 100\,m$

$s_3 = \dfrac{1}{2} \times 20 \times 10 = 100\,m$

$\therefore\ s = s_1 + s_2 + s_3 = 250\,m$

Hence (c) is the correct answer.

17. $200 = 2u + \dfrac{1}{2}a(2)^2 \Rightarrow 200 = 2u + 2a \qquad \ldots(1)$

$420 = 6u + \dfrac{1}{2}a(36) \Rightarrow 420 = 6u + 18a \qquad \ldots(2)$

on solving eq. (1) & (2) $a = -150\ ms^{-2}$ *and* $u = 115\ cms^{-1}$

The final velocity

$v = u + at$

$= (115\ cm^{-1}) - (15\ cm^{-2})7$

Hence (a) is the correct answer.

18. $\upsilon = \sqrt{196 - 16x} \Rightarrow \upsilon^2 - 196 = -16x$

$\Rightarrow \upsilon^2 - (14)^2 = 2(-8)x$

on compering with $v^2 - u^2 = 2as$

$\Rightarrow a = -8\ ms^{-2}$

Hence (d) is the correct answer.

19. $t = \dfrac{600\,m + 200\,m}{20\,ms^{-1}} = 40\,s$

Hence (c) is the correct answer.

20. $Here\, \upsilon = \dfrac{2d}{t}$

$\Rightarrow d = \dfrac{\upsilon t}{2} = \left(1500\dfrac{m}{s}\right)3s \times \dfrac{1}{2}$

$\therefore\ d = 2250\,m = 2.25\,km$

Hence (d) is the correct answer.

21. $u = 0;\ v = 10\ ms^{-1};\ t = 7.2s$

$a = \dfrac{\upsilon - u}{t} = \dfrac{10\,ms^{-1}}{7.2\,s} = 1.389\,ms^{-2}$

Hence (c) is the correct answer.

22. $u = 0;\ a = 2\ ms^{-2};\ t = 60s$

$v = u + at$

$\Rightarrow \upsilon = 0 + 2\dfrac{m}{s^2} \times 60s = 120ms^{-1}$

Hence (c) is the correct answer.

23. $u = 40\,kmph = 40 \times \dfrac{5}{18} = 11.11ms^{-2}$

$d = u \times t$

$\Rightarrow d = \left(11.11ms^{-1}\right)\left(100\,s\right) \Rightarrow d = 1111m$

Hence (a) is the correct answer.

24. $u = 0\,ms^{-1}; a = 0.5\,ms^{-2}; t = 20\,s$

$s = ut + \dfrac{1}{2}at^2$

$$\Rightarrow s = 0 \times t + \frac{1}{2}\left(0.5\, ms^{-2}\right)\left(400\, s^2\right)$$

$$\Rightarrow s = 100\, m = 0.1 km$$

Hence (d) is the correct answer.

25. $u = 2\, ms^{-1}; a = 5\, ms^{-2}; t = 4s$

$$v = u + at$$

$$\upsilon = \left(2\frac{m}{s}\right) + \left(5\frac{m}{s^2}\right)(4s)$$

$$= 22 ms^{-1} = 22 \times \frac{18}{5} = 79.2\, kmph$$

Hence (b) is the correct answer.

26. $u = 2 ms^{-1}; a = \frac{1}{5} ms^{-2}; t = 100s$

$$S = ut + \frac{1}{2}at^2$$

$$\Rightarrow s = \left(2\frac{m}{s}\right)(100s) + \left(\frac{1}{2} \times \frac{1}{5}\frac{m}{s^2}\right)\left(100s \times 100s\right)$$

$$= 200m + 1000m = 1.2km$$

Hence (b) is the correct answer.

27. $u = 0\, ms^{-1}; a = \frac{1}{4} ms^{-2}; s = 200m$

$t = ?$

$$S = ut + \frac{1}{2}at^2 \Rightarrow s = \frac{1}{2}at^2 \Rightarrow t = \sqrt{\frac{2s}{a}}$$

$$\Rightarrow t = 40s$$

Hence (a) is the correct answer.

28. $u = 0\,ms^{-1}; t = 1\min = 60s;$

$s = 2.4\,km;\ a = ?$

$s = 2.4km;\ a = ?$

We have $s = ut + \frac{1}{2}at^2$

$= \frac{1}{2}at^2$

$2400\,m = \frac{1}{2} \times a \times 3600\,s$

$\therefore\ a = 1.33\ ms^{-2}$

Hence (d) is the correct answer.

29. *Here* $a = \frac{\upsilon - u}{t} \Rightarrow V = u + at$

Hence (b) is the correct answer.

30. $u = 0\ ms^{-1}$; *we have* $s = ut + \frac{1}{2}at^2$

$S = \frac{1}{2}at^2 \Rightarrow s\alpha t^2$

Hence (d) is the correct answer.

31. $u = 2ms^{-1}; v = 20ms^{-1}, t = 18s$

$\therefore\ a = \frac{\upsilon - u}{t}$

$= \frac{20\,ms^{-1} - 2\,ms^{-1}}{18\,s} \Rightarrow \alpha = 1\ ms^{-2}$

Hence (b) is the correct answer.

32. *Hint: Use* $\therefore a = \dfrac{\upsilon - u}{t}$

Hence (a) is the correct answer.

33. $u = 3ms^{-1}; v = 13ms^{-1}, s = 40m$

$$\therefore a = \frac{\upsilon^2 - u^2}{2s}$$

$$a = \left(\frac{169-9}{2\times 40m}\right) m^2 s^2$$

$$\therefore a = 2\ ms^{-2}$$

Hence (b) is the correct answer.

34. $u = 2ms^{-1}; \upsilon = 12ms^{-1};$

$$a = 2ms^{-2}$$

$$\therefore s = \frac{\upsilon^2 - u^2}{2a} \Rightarrow \frac{(144-4)m^2 s^{-2}}{4m^2 s^{-2}}$$

$$= 35m$$

Hence (c) is the correct answer.

35. $u = 0\ ms^{-1}; \upsilon = 90\,kmph;$

$$a = 5ms^{-2} = 25ms^{-1}$$

$$s = \frac{\upsilon^2 - u^2}{2a} \Rightarrow \frac{25\times 25}{2\times 5}$$

$$s = 62.5m$$

Hence (b) is the correct answer.

36. $a = \dfrac{\Delta V}{\Delta t}$; *rate of change of velocity.*

Hence (c) is the correct answer.

37. *We know* $S = ut + \frac{1}{2}at^2$

given that, $u = 0$

$\Rightarrow S = \frac{1}{2}at^2$

Hence (c) is the correct answer.

38. $u \longleftarrow s \longrightarrow v' \longleftarrow s \longrightarrow v$

$A \longleftarrow B \longrightarrow C$

$\longleftarrow 2s \longrightarrow$

here $a = \frac{v^2 - u^2}{2(2s)} = \frac{v^2 - u^2}{4s}$

let v' is the velocity at B.

$(v')^2 = u^2 + 2as$

$= u^2 + 2\left(\frac{v^2 - u^2}{4s}\right)s$

$= \frac{2u^2 + v^2 - u^2}{2}$

$\therefore \quad v' = \sqrt{\frac{v^2 + u^2}{2}}$

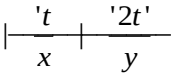
Hence (c) is the correct answer.

39. $v' = \sqrt{\frac{u^2 + v^2}{2}}$

$= \sqrt{\frac{16 + 484}{2}} = 15.8\, ms^{-1}$

Hence (b) is the correct answer.

40. $u = 0$



$s\, a\, \frac{1}{2} a t^2$

$s = \left(\frac{1}{2} a\right) t^2 \qquad s' = \left(\frac{1}{2} a\right) t^2$

$x = \left(\frac{1}{2} a\right) t^2 \qquad ...(1)$

$y = \left(\frac{1}{2} a\right) t^2 \cdot 4 \qquad ...(2)$

41. $200 = 2u + \frac{1}{2} a(4)$

$420 = 6u + \frac{1}{2} a(36)$

$\Rightarrow 200 = 2u + 2a \qquad ...(1)$

$\Rightarrow 420 = 6u + 18a \qquad ...(2)$

from eq. (1) $\times$ (2)

$6u + 6a = 600$

$\underline{6u + 18a = 420}$

$-12a = 180 \quad a = -15\ ms^{-2}$

From (1) $100\, m = u + (-15\ ms^{-2})$

$u = 115\ ms^{-1}$

We have $\upsilon = u + at$

$= 115\ ms^{-1} + (-15\ \text{ms}^{-2})(7)$

$\upsilon = 10\ ms^{-2}$

Hence (d) is the correct answer.

42. $\frac{n^2}{2n-1} = \frac{(20)^2}{2(20)-1} = 10.2564$

≈ 11 *planks are needed.*

Hence (b) is the correct answer.

43. $\frac{n^2}{2n-1} = \frac{(5)^2}{2(5)-1} = \frac{25}{9}$

≈ 3 *planks are needed.*

Hence (a) is the correct answer.

44. $\frac{a\left(n-\frac{1}{2}\right)}{\frac{1}{2}an^2} = \frac{an-\frac{a}{2}}{\frac{1}{2}an^2} = \frac{2na-a}{an^2}$

$= \frac{2n-1}{n^2} = \frac{2}{n} - \frac{1}{n^2}$

Hence (a) is the correct answer.

45. $a = \frac{40-20}{10} = 2ms^{-2}$

$20 = 0 + (2ms^{-2})t \Rightarrow t = 10s$

$\upsilon = u + at \Rightarrow \upsilon = 0 + (2ms^{-2})(6s)$

$\Rightarrow \upsilon = 12ms^{-1}$

Hence (b) is the correct answer.

46. $u = 0; v = 12ms^{-1}; t = 10s;$

$v^1 = 42ms^{-1}$

$\therefore\ a = \frac{42-12}{10} = 3\ ms^{-2}$

$$s = \frac{144 - 0^2}{2 \times 3} = \frac{144}{6} = 24\,m$$

$$s = 12 \times 10 + \left(\frac{1}{2} \times 3 \times 10 \times 10 \right)$$

$$= 120 + 150$$

$$= 270\,m$$

$\therefore$ *Total displacement = 294 m*

Hence (a) is the correct answer.

47. $u = 0\,ms^{-1}; v = 14\,ms^{-1}; t = 2s$

$$\Rightarrow\ a = \frac{14\,ms^{-1}}{2s} = 7ms^{-2}$$

$$\upsilon = 0 + \left(7\frac{m}{s^2} \right)(5s) \Rightarrow 35\,ms^{-1}$$

$$\upsilon = 35\,ms^{-1}$$

Hence (b) is the correct answer.

48. $u = 0; s = \frac{1}{2}at^2 \Rightarrow 36 = \frac{1}{2}(a)9$

$$\Rightarrow a = 8\ \text{ms}^{-2}$$

$$s = 0 + 8\left(5 - \frac{1}{2} \right) \Rightarrow s = 36m$$

Hence (b) is the correct answer.

49. $u = 0;\ 25 = \frac{1}{2}(a)(25) \Rightarrow a = 2\,ms^{-2}$

$$\therefore\ s = 2\left(10 - \frac{1}{2} \right)$$

$$\therefore\ s = 19\,m$$

Hence (d) is the correct answer.

50. $t = \dfrac{10\,m}{18\,kmph} = \dfrac{10\,m}{5\,ms^{-1}} = 2s$

Hence (b) is the correct answer.

51. $u = 10\,ms^{-1}$

distance covered within reaction time

$d = u \times t$

$\therefore\ d = (10m^{-1})(0.9s) = 9m$

$a = -5\,ms^{-2}$

$v = 0\,ms^{-1}$

$t = \dfrac{\upsilon - u}{a} = \dfrac{-10\,ms^{-1}}{-5\,ms^{-2}} = 2s$

$s = \left(10\,ms^{-1}\right)\left(2s\right) + \dfrac{1}{2}\left(-5\,ms^{-2}\right)\left(2s^2\right)$

$= 20m + \left(-10m\right)$

$= 10m$

$\therefore$ *Total displacement* $= 9m + 10m = 19m$

Hence (a) is the correct answer.

52. $u = 0;\ v = 10\ ms^{-1};\ t = 10\,s$

$\Rightarrow\ a = \dfrac{\upsilon - u}{t} = 1\ ms^{-2}$

Hence (b) is the correct answer.

53. $t = \dfrac{d}{\upsilon} = \dfrac{1260\,m}{100\,ms^{-1}} = 12.6\ \text{s}$

Hence (b) is the correct answer.

54. *Hint: follow the method of Q. No. 31*
Ans.: 21.75 m
Hence (a) is the correct answer.

55. $v^2 - u^2 = 2as$

$$\Rightarrow a = \frac{(0)^2 - (35)^2}{2 \times 200} = -3.06 ms^{-2}$$

Hence (c) is the correct answer.

SECTION - II
Assertion - Reason Questions

56. *Statement – 1 is correct,*
Because avg.,

$$\text{velocity} = \frac{\text{Total displacement}}{\text{Total time}}$$

Hence (d) is the correct answer.

57. *Statement – 1 is correct, and*
Statement – 2 is wrong.
Hence (d) is the correct answer.

58. *Because, both statements are correct and individual.*
Hence (b) is the correct answer.

59. *Because the statement – 2 is correct but not statement -.*
Hence (c) is the correct answer.

60. *Because a uniformly accelerated body covers unequal distances within equal intervals.*
Hence (c) is the correct answer.

61. *Both of the statements are correct and individual.*
Hence (b) is the correct answer.

62. *Both statements are correct and statement – 2 explains statement - 1*

Hence (a) is the correct answer.

63. *Both statements are correct and statement – 2 explains statement – 1.*

Hence (a) is the correct answer.

SECTION - III

Linked Comprehension Type

64. $s = \frac{1}{2}at^2 \Rightarrow s = \frac{1}{2}(0.2\ ms^{-2})(20s \times 20s)$

$= 40\,m$

Hence (d) is the correct answer.

65. $v = u + at$

$= 0 + (0.2\,ms^{-2})(20\,s)$

$= 4\,ms^{-1}$

Hence (b) is the correct answer.

66. $v^2 - u^2 = 2as$

$0 - (4\ ms^{-1}) = -2(0.4\ ms^{-2})s$

$\frac{16\ m^2s^{-2}}{0.8\ ms^{-2}} = s$

$\therefore\ s = 20\,m$

Hence (a) is the correct answer.

67. $a = \frac{\upsilon - u}{t} = \frac{15-0}{15} = 1\ ms^{-2}$

Hence (d) is the correct answer.

68. $S = \frac{1}{2} \times 1 \times 15 \times 15 = 112.5\, m$

Hence (b) is the correct answer.

69. $s_n = 0 + 1\left(15 - \frac{1}{2}\right) = 14.5m$

Hence (c) is the correct answer.

70. $u = 0\ ms^{-1}; a = 3\ ms^{-1}$

$v = (0) + (3 \times 7) = 21\ ms^{-1}$

Hence (c) is the correct answer.

71. $S = ut + \frac{1}{2} \times 3 \times 60 \times 60 = 5.4\ km$

Hence (a) is the correct answer.

72. $S_n = 0 + 3\left(60 - \frac{1}{2}\right) = 178.5\, m$

Hence (c) is the correct answer.

73. $u = 0; v = 100 ms^{-1}; a = 5 ms^{-2};$

$t = \frac{100\, ms^{-1} - 0}{5\, ms^{-2}} \Rightarrow t = 20s$

Hence (b) is the correct answer.

74. $S = \frac{1}{2} a \times t^2$

$= \frac{1}{2} \times 5 \frac{m}{s^2} \times 400\ s^2$

$= 1000\ m = 1\ km$

Hence (d) is the correct answer.

75. $v = 0 + (5ms^{-2})10s$

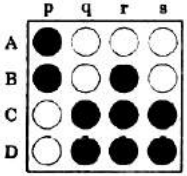
$v = 50\, ms^{-1}$

Hence (b) is the correct answer.

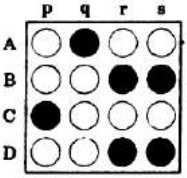
SECTION - IV

Matrix - Match Type

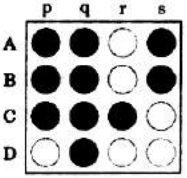
76.



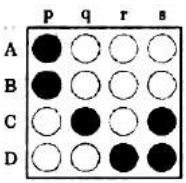
77.



78.



79.


p q r s
A
B
C
D