CBSE

MOTION IN A STRAIGHT LINE WS 7

Class 11 - Physics

Section A

1. A ball is dropped from top of a tower of 100 m height. Simultaneously another ball was thrown upward from the bottom of the tower with a speed of 50 m/s. They will cross each other (g = 10 m/s^2) after **[1]**

   a) 4 sec
   b) 3 sec
   c) 1 sec
   d) 2 sec

2. Jules Verne in 1865 proposed sending people to the Moon by firing a space capsule from 220-m-long cannon with a final velocity of 10.97 km/s. What would have been the unrealistically large acceleration experienced by the space travelers during launch? **[1]**

   a) 2.74×10^6 m/s^2
   b) 2.74×10^5 m/s^2
   c) 3.74×10^5 m/s^2
   d) 2.74×10^3 m/s^2

3. A stone thrown from the top of a 50 m tall building is given an initial velocity of 20.0 m/s straight upward. Determine the velocity in m/sec when the stone returns to the height from which it was thrown. g = 9.8 m/sec^2. **[1]**

   a) -20.0
   b) -15.0
   c) -30.0
   d) -25.0

4. A truck accelerates at 1 m / $\sec^2$ from rest. What is its velocity in m/s at a time of 2 sec? **[1]**

   a) 2
   b) 4
   c) 1
   d) 3

5. A jet lands on an aircraft carrier at 63 m/s. What is the displacement of the plane in m while it stopped in 2 s: **[1]**

   a) 57.0
   b) 60.0
   c) 68.0
   d) 63.0

6. A body dropped from a height h with an initial speed of zero reaches the ground with a velocity of 3 km/h. Another body of the same mass dropped from the same height h with an initial speed 4 km/h will reach the ground with a velocity of: **[1]**

   a) 5 km/h
   b) 4 km/h
   c) 12 km/h
   d) 3 km/h

7. A vehicle travels half the distance L with speed V_1 and the other half with speed V_2, then its average speed is **[1]**

   a) $\frac{2V_1+V_2}{V_1+V_2}$
   b) $\frac{V_1+V_2}{2}$
   c) $\frac{2V_1V_2}{V_1+V_2}$
   d) $\frac{L(V_1+V_2)}{V_1V_2}$

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

a) 4 m
b) 6 m
c) 2 m
d) 8 m

9. A truck on a straight road starts from rest, accelerating at 2.00 m/s^2 until it reaches a speed of 20.0 m/s. Then the truck travels for 20.0 s at a constant speed until the brakes are applied, stopping the truck in a uniform manner in an additional 5.00 s. How long in seconds is the truck in motion? **[1]**

a) 23.0
b) 37.3
c) 35.0
d) 32.0

10. A ball starts from rest and accelerates at 0.500 m/s^2 while moving down an inclined plane 9.00 m long. When it reaches the bottom, the ball rolls up another plane, where, after moving 15.0 m, it comes to rest. What is the acceleration in m/s^2 along the second plane? **[1]**

a) -0.345
b) -0.330
c) -0.3
d) -0.321

11. A ball rolls up a slope. At the end of three seconds its velocity is 20 cm/s, at the end of eight seconds, its velocity is 0. What is the average acceleration from the third to the eighth second? **[1]**

a) -5.0 cm/s^2
b) -6.0 cm/s^2
c) -2.5 cm/s^2
d) -4.0 cm/s^2

12. A truck on a straight road starts from rest, accelerating at 2.00 m/s^2 until it reaches a speed of 20.0 m/s. Then the truck travels for 20.0 s at a constant speed until the brakes are applied, stopping the truck in a uniform manner in an additional 5.00 s. What is the average velocity in m/s of the truck for the motion described? **[1]**

a) 15.7
b) 16.2
c) 154
d) 17.5

13. A jet lands on an aircraft carrier at 60 m/s. It stops in 2.0 s. What is the displacement of the plane when it stops? **[1]**

a) 60.0
b) 50
c) 45
d) 35

14. A body falling from rest describes distances s_1, s_2 and s_3 in the first, second and third seconds of its fall, then the ratio s_1: s_2: s_3 is: **[1]**

a) 1 : 2 : 3
b) 1 : 3 : 5
c) 1 : 1 : 1
d) 1 : 4 : 9

15. A stone thrown from the top of a building is given an initial velocity of 20.0 m/s straight upward. Determine the time in seconds at which the stone returns to the height from which it was thrown. g = 9.8 m/sec^2. **[1]**

a) 4.08
b) 3.45
c) 4.44
d) 5.32

16. The velocity of a particle at an instant is 10 m/s. After 3 s its velocity will become 16 m/s. The velocity at 2 s, before the given instant, will be: **[1]**

a) 1 m/s
b) 4 m/s

c) 6 m/s d) 2 m/s

17. A jet lands on an aircraft carrier at 63 m/s. What is its acceleration in m/s^2 if it stops in 2.0 s? **[1]**

a) -35 b) 34

c) -31.5 d) -33

18. A stone thrown from the top of a building is given an initial velocity of 20.0 m/s straight upward. Determine the time in seconds at which the stone reaches its maximum height. (Take g = 9.8 m/sec^2) **[1]**

a) 2.8 b) 2.04

c) 1.67 d) 2.7

19. The water drop falls 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]**

a) 4.00 m b) 3.75 m

c) 2.50 m d) 1.25 m

20. A player throws a ball upwards with an initial speed of 29.4 ms^{-1}. What are the velocity and acceleration of the ball at the highest point of its motion? **[1]**

21. Find the acceleration and velocity of a ball at the instant it reaches its highest point if it was thrown up with velocity v. **[1]**

22. A train moves with a speed of 30 kmh^{-1} in the first 15 minutes, with another speed of 40 kmh^{-1} in the next 15 minutes, and then with a speed of 60 kmh^{-1} in the last 30 minutes. Calculate the average speed of the train for this journey. **[1]**

23. A ball hits a wall with a velocity of 30 ms^{-1} and rebounces with the same velocity. What is the change in its velocity? **[1]**

Section B

24. **Fill in the blanks:** **[2]**

(a) When an object is projected upwards, its velocity at the top-most point is _____ even though the acceleration on it 9.8 m/s^2 (g). **[1]**

(b) Acceleration is 9.8 ms^{-2} (downwards) and velocity is _____ at the highest point if a ball was thrown up with velocity v. **[1]**

25. Derive the relation graphically: $s = ut + \frac{1}{2}at^2$, where symbols have their usual meaning. **[2]**

26. A body falling freely under gravity passes two points 30 m apart in 1s. Find from what point above the upper point it began to fall? Take g = 9.8 ms^{-2}. **[2]**

27. A balloon is ascending at the rate of 14 ms^{-1} at a height of 98 m above the ground when the food packet is dropped from the balloon. After how much time and with what velocity does it reach the ground? Take g = 9.8 ms^{-2}. **[2]**

28. A jet plane starts from rest with an acceleration of 3 ms^{-2} and makes a run for 35 s before taking off. What is the minimum length of the runway and what is the velocity of the jet at take-off? **[2]**

29. During a hard sneeze, your eyes might shut for 0.5 s. you are driving a car at 90 km/h during such a sneeze, how far does the car move during that time? **[2]**

30. A car A is travelling on a straight level road with a speed of 60 kmh^{-1}. It is followed by another car B which is **[2]**

moving with a speed of 70 kmh^{-1}. When the distance between them is 2.5 km, car B is given a deceleration of 20 kmh^{-2}. After what distance and time will car B catch up with car A?

31. A body covers a distance of 4 m is 3rd second and 12 min 5th second. If the motion is uniformly accelerated, how far will it travel in the next 3 seconds? **[2]**

32. A bus starts from rest with a constant acceleration of 5 ms^{-2}. At the same time, a car travelling with a constant velocity of 50 ms^{-1} overtakes the bus. **[2]**

    i. Find at what distance will the bus overtake the car?

    ii. How fast will the bus be travelling then?

33. A jet plane beginning its take-off moves down the runway at a constant acceleration of 4.00 m/s^2. **[2]**

    i. Find the position and velocity of the plane 5.00 s after it begins to move.

    ii. If the speed of 70.0 m/s is required for the plane to leave the ground, how long a runway is required?

34. Four balls are dropped from the top of a tower at intervals of a one-one second. The first ball reaches the ground after 4 s of dropping. What are the distances between first and second, second and third, third and fourth balls at this instant? **[2]**

35. A driver takes 0.20 second to apply the breaks (reaction time). If he is driving car at a speed of 54 kmh^{-1} and the breaks cause a deceleration of 6.0 ms^{-2} , find the distance travelled by car after he sees the need to put the breaks. **[2]**

36. A stone is dropped from the top of a cliff and is found to travel 44.1 m in the last second before it reaches the ground. What is the height of the cliff? **[2]**

37. A food packet is released from a helicopter which is rising steadily at 2 ms^{-1}. After two seconds: **[2]**

    i. What is the velocity of the packet?

    ii. How far is it below the helicopter? Take g = 9.8 ms^{-2}

38. The speed of a motor launch with respect to still water = 7 ms^{-1} and the speed of the stream is u = 3 ms^{-1}. When the launch began travelling upstream, a float was dropped from it. The launch travelled 4.2 km upstream, turned about and caught up with the float. How long is it before the launch reaches the float? **[2]**

39. A bullet travelling with a velocity of 16 ms^{-1} penetrates a tree trunk and comes to rest in 0.4 m. Find the time taken during the retardation. **[2]**

40. A car A moving at 10 ms^{-1} on a straight road, is ahead of car B moving in the same direction at 6 ms^{-1}. Find the velocity of A relative to B and vice versa. **[2]**

Section C

41. A stone thrown upwards from the top of a tower 85 m high, reaches the ground in 5 s. Find: **[3]**

    i. the greatest height above the ground

    ii. the velocity with which it reaches the ground and

    iii. the time taken to reach the maximum height. Take g = 10 ms^{-2}.

42. A ball is thrown vertically upwards with a velocity of 20 m/s from the top of a multistorey building. The height of the point from where the ball is thrown is 25 m from the ground. **[3]**

    i. How high will the ball rise? and

    ii. how long will it be before the ball hits the ground? Take g = 10 m/s^2.

43. Stopping distance of vehicles: When brakes are applied to a moving vehicle, the distance it travels before **[3]**

stopping is called stopping distance. It is an important factor for road safety and depends on the initial velocity (v_o) and the braking capacity, or deceleration, –a that is caused by the braking. Derive an expression for stopping distance of a vehicle in terms of v_o and a.

44. A tennis ball is dropped on to the floor from a height of 4 m. It rebounds to a height of 3 m. If the ball was in contact with the floor for 0.01 s, what was its average acceleration during contact? **[3]**

45. A food packet is released from a helicopter which is rising steadily at 2 ms^{-1}. The food packet falls on the ground after 6 s. Find the height of the helicopter when **[3]**

    i. the food packet was released from it, and

    ii. when the food packet just reached the earth.

46. In a car race, car A takes time t less than car B and passes the finishing point with a velocity v more than the velocity with which car B passes the point. Assuming that the cars start from rest and travel with constant accelerations a_1 and a_2, show that $v = t\sqrt{a_1 a_2}$. **[3]**

47. A rocket is fired vertically from the ground with a resultant vertical acceleration of 10 ms^{-2}. The fuel is finished in 1 minute and it continues to move up. What is the maximum height reached? **[3]**

Section D

Question No. 48 to 51 are based on the given text. Read the text carefully and answer the questions: **[4]**

2 friends started for a picnic spot, in two different cars. A drove his car at a constant velocity 60 km/h. B drove his car at a constant velocity 50 km/h.

The velocity of B relative to A is $v_B - v_A$

Similarly, the velocity of object A relative to object B is $v_A - v_B$

Their friend C was supposed to wait at a point on the road for a lift. Both of them forgot to pick up C. A and B reached the picnic spot within 2 hours and 2 hours 24 minutes respectively.

48. What was the velocity of B relative to A?

49. What is the velocity of A relative to B?

50. What are the velocities of A and B relative to C?

51. Draw the Velocity vs. time plot for A?

Section E

Question No. 52 to 56 are based on the given text. Read the text carefully and answer the questions: **[5]**

2 friends started for a picnic spot, in two different cars. A drove his car at a constant velocity 60 km/h. B drove his car at a constant velocity 50 km/h.

The velocity of B relative to A is $v_B - v_A$

Similarly, the velocity of object A relative to object B is $v_A - v_B$

Their friend C was supposed to wait at a point on the road for a lift. Both of them forgot to pick up C. A and B reached the picnic spot within 2 hours and 2 hours 24 minutes respectively.

52. What was the velocity of B relative to A?

    a) -55 km/h

    b) -10 km/h

    c) 10 km/h

    d) 55 km/h

53. What was the velocity of A relative to B?

a) -55 km/h

b) 55 km/h

c) -10 km/h

d) 10 km/h

54. What were the velocities of A and B relative to C?

a) 60 km/h, 50 km/h

b) Both 10 km/h

c) 50 km/h, 60 km/h

d) Both 55 km/h

55. How the distance of the picnic spot can be found from the appropriate graph?

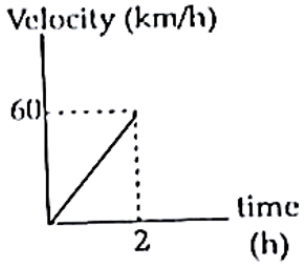
a) Length of the straight line is the required distance

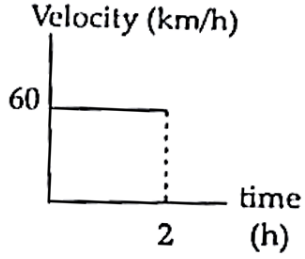
b) Distance of the origin from the end point of the line is the required distance

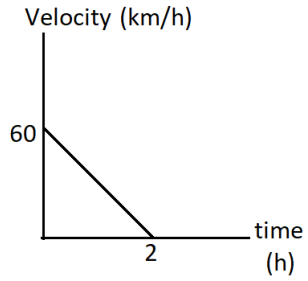
c) Half of the area under the line is the required distance

d) Area under the line is the required distance

56. Which one of the following shows the Velocity vs. Time Plot for A?

a) 

b) 

c) 

d) None of these

57. A ball is thrown upward with an initial velocity of 100 m/s. After how much time will it return? Draw velocity-time graph for the ball and find from the graph: **[5]**

i. Maximum height attained by the ball.

ii. Height of the ball after 15 s. (Take g = 10 ms^{-1})

58. A man is standing on the top of building 100 m high. He throws two balls vertically, One at t=0 and other after a time interval (less than 2 seconds). The later ball is thrown at a velocity of half the first. The vertical gap between first and second ball is + 15 m at t = 2s. The gap is found to remain constant. Calculate the velocity with which balls were thrown and the exact time interval between their throw. **[5]**

59. A hundred metre sprinter increases her speed from rest uniformly at the rate of 1 ms^{-2} upto three quarters of the total run and covers the last quater with uniform speed. How much time does she take to cover the first half and the second half of the run? **[5]**