CBSE

MOTION WS 5

Class 09 - Science

Section A

1. **Statement 1:** Reducing the initial velocity to half the initial value, the stopping distance of moving object decreases by a factor of 2 (for the same deceleration). **[1]**

   Statement 2: Stopping distance is proportional to the square of the initial velocity.

   a) Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.

   b) Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.

   c) Statement 1 is true but statement 2 is false.

   d) Statement 1 is false but statement 2 is true.

2. A particle is moving in a straight line with initial velocity u and uniform acceleration a. If the sum of the distances travelled in t^{th} and $(t + 1)^{th}$ seconds is 100 cm, then its velocity after t seconds in cm s^{-1} is **[1]**

   a) 50

   b) 80

   c) 30

   d) 20

3. A train starts from a station P and travels some distance with a uniform acceleration a_1, then it goes with uniform retardation a_2 for some more distance and come to rest at the station Q. If the distance between the stations P and Q is 4 km and the train takes 4 minutes to complete this journey, then $\frac{1}{a_1} + \frac{1}{a_2}$ = **[1]**

   a) 4 $m^{-1}S^2$

   b) 2 m^{-1} S^2

   c) 72 m^{-1} S^2

   d) 7.2 m^{-1} S^2

4. A body is thrown vertically upwards with velocity u, the greatest height h to which it will rise is **[1]**

   a) $\frac{u}{2g}$

   b) $\frac{u^2}{2g}$

   c) $\frac{u^2}{g}$

   d) $\frac{u}{g}$

5. A man walks on a straight road from his home to a market 5.5 km away with a speed of 5.5 km h^{-1}. Finding the market closed he instantly turns and walks back with a speed of 7.5 km h^{-1}. What is the average speed and average velocity of the man between t = 0 to t = 104 min? **[1]**

   a) 6.36 km h^{-1}, 6.36 km h^{-1}

   b) 0, 6.36 km h^{-1}

   c) 0, 0

   d) 6.36 km h^{-1}, 0

6. The speed of a train increases at a constant rate a from zero to v, and then remains constant for an interval, and finally decreases to zero at a constant rate p. If L be the total distance travelled, then the total time taken is **[1]**

   a) $\frac{L}{v} + \frac{1}{v}\left(\frac{1}{\alpha} + \frac{1}{\beta}\right)$

   b) $\frac{L}{v} + \frac{v}{2}\left(\frac{1}{\alpha} + \frac{1}{\beta}\right)$

   c) $\frac{L}{v} + \frac{2}{v}\left(\frac{1}{\alpha} + \frac{1}{\beta}\right)$

   d) $\frac{L}{v} + 2v\left(\frac{1}{\alpha} + \frac{1}{\beta}\right)$

7. Equation of motion can be used for a body having: **[1]**

a) uniform acceleration b) non-uniform acceleration

c) uniform motion d) non-uniform motion

8. A ball is dropped onto the floor from a height of 20 m. It rebounds to a height of 10 m. If the ball is in contact with the floor for 0.1 seconds, what is the average acceleration during contact? **[1]**

a) 142 m s^{-2} b) 338 m s^{-2}

c) 564 m s^{-2} d) 285 m s^{-2}

9. After jumping out from the plane, a parachutist falls 80 m without friction. When he opens up the parachute, he decelerates at 2 m s^{-2}. He reaches the ground with a speed of 4 m s^{-1}. How long did the parachutist spend his time in the air? (Take g = 10 m s^{-2}) **[1]**

a) 18 s b) 16 s

c) 4 s d) 22 s

10. The water drop falls at regular intervals from a tap 5 m above the ground. The third drop is leaving the tap at instant the first drop touches the ground. How far above the ground is the second drop at that instant? (Take g = 10 m S^{-2}) **[1]**

a) 2.50 m b) 1.25 m

c) 4.00 m d) 3.75 m

11. Two cars A and B race each other. The Car A ran for 2 min at a speed of 7.5 km/h, slept for 56 min and again ran for 2 min at a speed of 7.5 km/h. The average speed of the car A in the race is: **[1]**

a) 10 km/hr b) 5 km/hr

c) 0.5 km/hr d) 50 km/hr

12. Match the following with the correct response. **[1]**

(a) v	(i) $\frac{v-u}{t}$
(b) a	(ii) $v^2 - u^2$
(c) V_{av}	(iii) $\frac{v+u}{2}$
(d) 2aS	(iv) $\frac{s}{t}$

a) (a) - (iii), (b) - (ii), (c) - (iv), (d) - (i) b) (a) - (ii), (b) - (iv), (c) - (i), (d) - (iii)

c) (a) - (iv), (b) - (i), (c) - (iii), (d) - (ii) d) (a) - (i), (b) - (iii), (c) - (ii), (d) - (iv)

13. Match the following with the correct response. **[1]**

(a) I^{st} equation of motion	(i) $v^2 = u^2 + 2aS$
(b) II^{nd} equation of motion	(ii) v = u + at
(c) III^{rd} equation of motion	(iii) $-\left(\frac{v-u}{t}\right)$
(d) Retardation	(iv) $S = ut + \frac{1}{2}at^2$

a) (a) - (ii), (b) - (iv), (c) - (i), (d) - (iii)

b) (a) - (i), (b) - (iii), (c) - (ii), (d) - (iv)

c) (a) - (iv), (b) - (i), (c) - (iii), (d) - (ii)

d) (a) - (iii), (b) - (ii), (c) - (iv), (d) - (i)

14. Match the following with the correct response**:** **[1]**

(a) I equation of motion	(i) v = u + at
(b) II equation of motion	(ii) $v^2 = u^2 + 2as$
(c) III equation of motion	(iii) $S = ut + \frac{1}{2}at^2$
(d) Retardation	(iv) $-\left(\frac{v-u}{t}\right)$

a) (a) - (i), (b) - (iii),(c) - (ii), (d) - (iv)

b) (a) - (iii), (b) - (ii),(c) - (iv), (d) - (i)

c) (a) - (iv), (b) - (i),(c) - (iii), (d) - (ii)

d) (a) - (ii), (b) - (iv),(c) - (i), (d) - (iii)

15. Which of the following statement is correct? **[1]**

A. When a body starts from rest, u = 0

B. When a body comes to rest, v = 0

C. For a body under free fall, $a = -9.8 m/s^2$

D. For uniform velocity, a = 0

a) All of these

b) (B) and (C) are correct

c) (A) and (B) are correct

d) (A), (B) and (D) are correct

16. A particle accelerates from rest at a constant rate for some time and attains a constant velocity of 8 ms^{-1}. Afterward, it decelerates at a constant rate and comes to rest. If the total time taken is 4 second, the distance travelled is: **[1]**

a) 32 meter

b) 16 metre

c) 4 metre

d) insufficient data

Section B

17. Derive the second equation of motion, $s = ut + \frac{1}{2}at^2$ numerically. **[2]**

18. A body starts to slide over a horizontal surface with an initial velocity of 0.5 m/s. Due to friction, its velocity decreases at the rate of 0.05 m/s^2. How much time will it take for the body to stop? **[2]**

19. The distance between two stations is 200 km. A train travels for the first 100 km at a speed of 50 kmh^{-1}. How fast should the train travel the next 100 km so as to average 70 kmh^{-1} for the whole journey? **[2]**

20. A ball is gently dropped from a height of 20 m. If its velocity increases uniformly at the rate of 10 ms^{-2}, with what velocity will it strike the ground? After what time will it strike the ground? **[2]**

21. A stone is thrown in a vertically upward direction with a velocity of 5 ms^{-1}. If the acceleration of the stone during its motion is 10 ms^{-2} in the downward direction, what will be the height attained by the stone and how much time will it take to reach there? **[2]**

22. With the help of a graph, derive the relation v = u + at. **[2]**

23. The brakes applied to a car produce an acceleration of 6 ms^{-2} in the opposite direction to the motion. If the car takes 2s to stop after the application of brakes, calculate the distance it travels during this time. **[2]**

24. A motorboat starting from rest on a lake accelerates in a straight line at a constant rate of 3.0 ms^{-2} for 8.0 s. How far does the boat travel during this time? **[2]**

25. The driver of a train travelling at 40 ms^{-1} applies the brakes as a train enters a station. The train slows down at a rate of 2 ms^{-2}. The platform is 400 m long. Will the train stop in time? **[2]**

26. A farmer moves along the boundary of a square field of side 10 m. in 40 s. What will be the magnitude of displacement of the farmer at the end of 2 minutes 20 seconds from his initial position **[2]**

27. A stone is thrown in vertically upward direction with a velocity of 5 ms^{-1}. If the acceleration of the stone during its motion be 10 ms^{-2} in the downward direction what will be the height attained by the stone and how much time will it take to reach there? **[2]**

28. How will the equations of motion for an object moving with a uniform velocity change? **[2]**

29. A car starts from rest and moves along the X-axis with constant acceleration 5 ms^{-2} for 8 seconds. If it is continue with constant velocity, what distance will the car cover in 12 seconds since it started from the rest? **[2]**

30. During an experiment, a signal from a spaceship reached the ground station in five minutes. What was the distance of the spaceship from the ground station? The signal travels at the speed of light, that is 3×10^8 ms^{-1}. **[2]**

31. An object is dropped from rest at a height of 150 m and simultaneously another object is dropped from rest at a height 100 m. What is the difference in their heights after 2 s if both the objects drop with same accelerations. How does the difference in heights vary with time? **[2]**

32. A trolley, while going down an inclined plane, has an acceleration of 2 cms^{-2} . What will be its velocity 3s after the start? **[2]**

Section C

33. An iron ball of density 7800 k gm^{-3} and volume 200 cm^{-3} is totally immersed in water. **[3]**
    i. Calculate the weight of the iron ball in the air.
    ii. Calculate the upthrust.
    iii. Its apparent weight in water.
    iv. Its apparent density in water.

34. A train is travelling at a speed of 90 kmh^{-1}. Brakes are applied so as to produce a uniform retardation of 0.5 ms^{-2}. Find how far the train will go before it is brought to rest. **[3]**

35. A bus starting from rest moves with a uniform acceleration of 0.1 m s^{-2} for 2 minutes. Find: **[3]**
    a. the speed acquired.
    b. the distance travelled.

36. The driver of a car travelling along a straight road with a speed of 72 Km/h observes a signboard which give the speed limit to be 54 Km/h. The signboard is 70 m ahead, when the driver applies the brakes. Calculate the acceleration of the car which will cause the car to pass the signboard at the stated speed limit. **[3]**

37. A cheetah is the fastest land animal and can achieve a peak velocity of 100 kmh^{-1} up to distances less than 500 m . If a cheetah spots his prey at a distance of 100 m, what is the minimum time it will take to get its prey, if the average velocity attained by it is 90 kmh^{-1}? **[3]**

38. A stone is thrown in a vertically upward direction with a velocity of 5 ms^{-1}. If the acceleration of the stone during its motion is 10 ms^{-2}in the downward direction, what will be the height attained by the stone and how much time will it take to reach there? **[3]**

39. A body is dropped from a height of 320 m. The acceleration due to the gravity is 10 m/s^2. **[3]**
    (a) How long does it take to reach the ground?

(b) What is the velocity with which it will strike the ground?

40. Two trains A and B of length 400 m each are moving on two parallel tracks with uniform speed of 72 kmh^{-1} in the same direction with A ahead of B. The driver of B decides to overtake A and accelerates by 1 ms^{-2}. If after 50s, the guard of B just passes the driver of A, what was the original distance between them? **[3]**

41. The average time taken by a normal person to react to an emergency is one fifteenth of a second and is called the 'reaction time'. If a bus is moving with a velocity of 60 kmh^{-1} and its driver sees a child running across the road, how much distance would the bus had moved before he could press the brakes? The reaction time of the people increases when they are intoxicated. How much distance had the bus moved if the reaction time of the driver were 1/2 s under the influence of alcohol? **[3]**

Section D

42. The driver of train A travelling at a speed of 54 kmh^{-1} applies brakes and retards the train uniformly. The train stops in 5 seconds. Another train B is travelling on the parallel with a speed of 36 kmh^{-1}.Its driver applies the brakes and the train retards uniformly; train B stops in 10 seconds. Plot speed-time graphs for both the trains on the same axis. Which of the trains travelled farther after the brakes were applied? **[5]**

43. Derive an equation for velocity-time relation by graphical method. **[5]**

44. Derive the second equation of motion $S= ut +at^2$ graphically? **[5]**

45. Derive the third equation of motion ($v^2-u^2 = 2$ as) graphically. **[5]**

46. A driver of a car travelling at 52 km h^{-1} applies the brakes and accelerates uniformly in the opposite direction. The car stops in 5s. Another driver going at 3 km h^{-1} in another car applies his brakes slowly and stops in 10s. On the same graph paper, plot the speed versus time graphs for the two cars. Which of the two cars travelled further after the brakes were applied? **[5]**