CBSE Test Paper 03

Chapter 08 Motion

1. 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

2. Which of the following statements is correct? **(1)**

   a. speed and velocity are vector, distance and displacement are scalar
   b. speed distance are vector, velocity and displacement are vector
   c. speed and velocity are scalar, distance and velocity are vector
   d. speed distance are scalar, velocity and displacement are vector

3. Which of the following gives both direction and magnitude? **(1)**

   a. Unit Scalar
   b. Scalar
   c. Unit Vector
   d. Vector

4. Match the following with correct response. **(1)**

(1) Speed	(A) $\frac{Change\ of\ velocity}{Time\ taken}$
(2) Velocity	(B) $\frac{Distance\ covered}{Time\ taken}$
(3) Acceleration	(C) $\frac{Total\ distance\ covered}{Total\ time\ taken}$
(4) Average speed	(D) $\frac{Displacement}{Time\ taken}$

   a. 1-A, 2-C, 3-B, 4-D
   b. 1-C, 2-B, 3-D, 4-A
   c. 1-B, 2-D, 3-A, 4-C
   d. 1-D, 2-A, 3-C, 4-B

5. If two objects move in circular path of radii in the ratio of 1:3 and take same time to complete the circle,what is the ratio of their speeds? **(1)**

    a. 1 : 3
    b. 3:1
    c. $\frac{r_2}{r_1}$
    d. $\frac{r_1}{r_2}$

6. What is the relation between linear velocity and angular velocity? **(1)**

7. Define average velocity. **(1)**

8. Define the term "velocity". **(1)**

9. Define uniform speed. **(1)**

10. What is a reference point? **(1)**

11. Abdul while driving to school computes the average speed for his trip to be 20 kmh^{-1}. On his return trip along the same route, there is less traffic and the average speed is 40 kmh^{-1}. What is the average speed for Abdul's trip? **(3)**

12. A car moving with a certain velocity comes to a halt after travelling 62.5m at the retardation of 5m/s^2. Find the initial velocity of the car? **(3)**

13. What do you mean by average speed? What is its unit? **(3)**

14. 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)**

15. Derive the third equation of motion (v^2-u^2 = 2 as) graphically. **(5)**

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Answers

1. a. uniform acceleration

   Explanation: Relation among velocity, distance, time and acceleration is called equations of motion. There are three equations of motion. Equation of motion can be used for a body having uniform acceleration

2. d. speed distance are scalar, velocity and displacement are vector

   Explanation: speed distance are scalar because it can measure only magnitude , velocity and displacement are vector because it can measure both magnitude and direction

3. d. Vector

   Explanation: Any quantity that needs to be fully described by identifying its magnitude and direction is referred to as a vector quantity. By magnitude, we mean size of the quantity, such as length or strength. By direction, we mean where the vector is pointing or where it is being directed, such as left or right, north, south, east, or west, or even up or down.

4. c. 1-B, 2-D, 3-A, 4-C

   Explanation:

   i. Speed of a body is the distance travelled by it per unit time.
   ii. Velocity of a body is defined as the rate of change of its displacement with time.
   iii. Acceleration of a body is defined as the rate of change of its velocity with time.
   iv. The average speed of an object is the total distance traveled by the object divided by the elapsed time to cover that distance.

5. a. 1 : 3

   Explanation: Let the radius of circular path be r and 3r respectively.

   Let the speed of first and second object be v_1 and v_2 respectively.

   The length of the first track = $2\pi r$

Time taken by the first object = $\frac{2\pi r}{v_1}$

The length of the second track = 2π(3r) = 6 πr

Time taken by the second object t = $\frac{6\pi r}{v_2}$

Time taken by both object are same

$\frac{2\pi r}{v_1} = \frac{6\pi r}{v_2}$

$\frac{2}{v_1} = \frac{6}{v_2}$

$\frac{v_1}{v_2} = \frac{1}{3}$

6. Linear velocity = Angular velocity $\times$ Radius of circular path.

7. Average velocity is the ratio of the total displacement to the total time taken.
8. Velocity is defined as the ratio of the displacement to the time taken.
9. The speed of an object is said to be uniform speed if it travels equal distances in equal intervals of time.
10. A fixed point with respect to which the given object changes its position.

11. Let one way distance for his trip be S.

    Let t_1 be the time for his trip from home to school and t_2 be the time for his return trip.

    Then $t_1 = \frac{S}{V_1} = \frac{S}{20}h$ and $t_2 = \frac{S}{V_2} = \frac{S}{40}h$

    Therefore total time of trip is $T = t_1 + t_2 = \frac{S}{20} + \frac{S}{40} = \frac{3S}{40}h$

    Total distance covered = 2S

    Therefore average speed of Abdul $V_{av} = \frac{\text{total distance}}{\text{total time}} = \frac{25 \times 40}{35}$ = 26.7 kmh^{-1}

12. v (final velocity) = 0 (body comes to rest)

    s = 62.5m

    a = -5m/s^2 (retardation)

    u (initial velocity) = ?

    From 3rd equation of motion,

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

    $0^2 - u^2 = 2 \times (-5) \times 62.5$

    $-u^2 = -10 \times 62.5$

$u^2 = 625$,

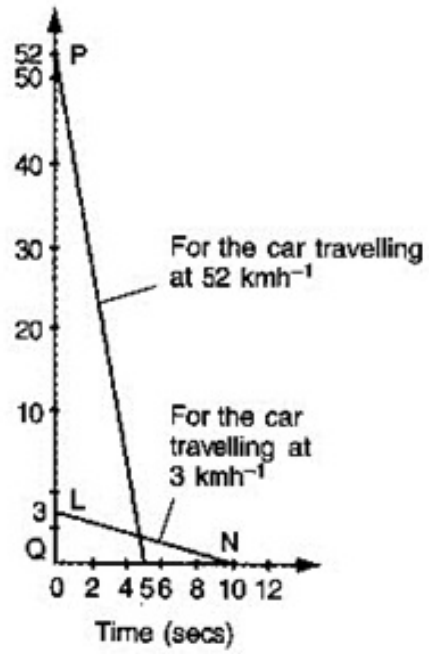
$u = \sqrt{625} = 25$m/s

Initial velocity of the car is 25m/s

13. Average speed is defined as the average distance travelled per unit time and is obtained by dividing the total distance travelled by the total time taken.

    The unit of average speed is the same as that of the speed, that is, ms^{-1}.

14. The speed time graph of both cars is shown below.



    i. Distance covered by car moving at 52 kmh^{-1}

    Or $52 \times \frac{5}{18} = 14.4\ ms^{-1}$

    = area of $\Delta PQR = \frac{1}{2} \times PQ \times QR = \frac{1}{2} \times 14.4 \times 5 = 36$ m

    ii. Distance covered by car moving at 3 kmh^{-1}

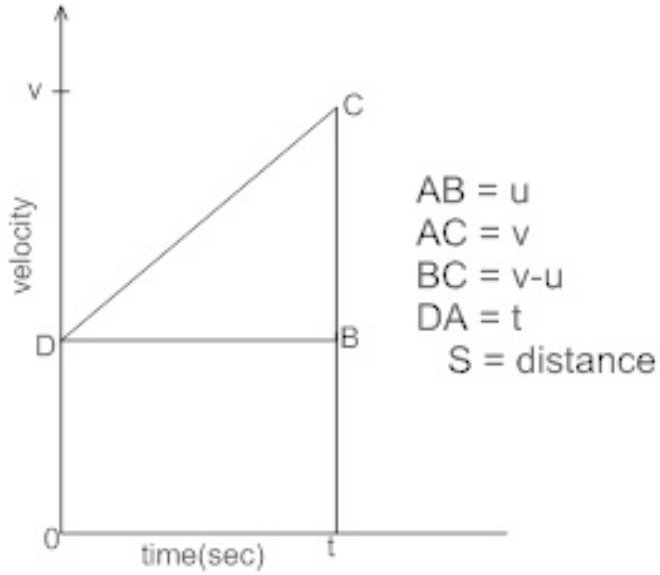
    or $3 \times \frac{5}{18} = 0.83\ ms^{-1}$

    = area of $\Delta LNQ = \frac{1}{2} \times LQ \times QN = \frac{1}{2} \times 0.83 \times 10 = 4.15$ m

    The car moving at 52 kmh^{-1} travels more distance on the application of brakes.

15. Let at time t=0, the body moves with an initial velocity u and time at 't' has final velocity 'v' and in time 't' covers a distance 's'

    Area under v-t graph gives the displacement



S = Area of ΔDBC + Area of rectangle OABD

S = $\frac{1}{2} \times base \times height + length \times breadth$

$S = \frac{1}{2} \times DB \times BC + OA \times AB$

$S = \frac{1}{2} \times t \times (v - u) + t \times u$ .....(i)

Now, v - u = at

$\frac{v-u}{a} = t$

put the value of 't' in equation (i)

$S = \frac{1}{2} \times (v - u) \frac{(v-u)}{a} + u \times \left(\frac{(v-u)}{a} \right)$

$S = \frac{(v-u)^2 2u(v-u)}{2a}$

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

$S = \frac{v^2-u^2}{2a}$

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