CBSE Test Paper 04

Chapter 08 Motion

1. The displacement of the body can be- **(1)**
   a. Zero
   b. All of these
   c. Positive
   d. negative
2. What is the ratio of distance to displacement? **(1)**
   a. Less than 1
   b. Greater than or equal to 1
   c. Equal to 1
   d. More than 1
3. A body moves on three-quarters of a circle of radius r. The displacement and distance travelled by it **(1)**
   a. displacement = 0, distance = $\frac{3\pi r}{2}$
   b. displacement = r, distance = 3r
   c. distance = 2r, displacement = $\frac{3\pi r}{2}$
   d. displacement = $\sqrt{2}r$ Distance = $\frac{3\pi r}{2}$
4. Which of the following statements is not true? **(1)**
   a. motion is a change of position
   b. motion is always uniform
   c. motion can be uniform or non-uniform
   d. motion can be described in terms of displacement
5. Which of the following physical quantity is not present in first equation of motion? **(1)**
   a. Displacement
   b. Velocity
   c. Time

d. Acceleration

6. What is essential to describe the position of an object? **(1)**
7. Under what condition will the displacement and distance have the same magnitude? **(1)**
8. What is the nature of the displacement time graph of a body moving with constant velocity? **(1)**
9. Is displacement a scalar or a vector quantity? **(1)**
10. When is the acceleration taken as negative? **(1)**
11. What happens when you shake a wet piece of cloth? Explain your observation. **(3)**
12. A train travels the first 15 km at a uniform speed of 30 kmh^{-1}, the next 75 km at a uniform speed of 50 kmh^{-1}, and the last 10 km at a uniform speed of 20 kmh^{-1}. Calculate the average speed for the entire train journey. **(3)**
13. Draw the graph for uniform retardation - **(3)**
    a. position - time graph
    b. velocity - time graph
    c. Acceleration- time graph
14. How will you show that the slope of the displacement-time graph gives the velocity of the body? **(5)**
15. Deduce the following equations of motion: **(5)**
    i. $S = ut + \left(\frac{1}{2}\right)at^2$
    ii. $v^2 = u^2 + 2aS$

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Answers

1. b. All of these

   Explanation: Displacement is the shortest distance travelled so it can be positive or negative or zero.

2. b. Greater than or equal to 1

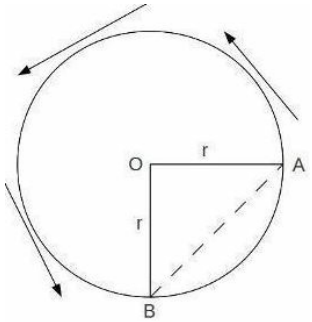
   Explanation: Distance is the actual length covered by a body and displacement is the shortest distance between initial and final position. So, distance will be equal or more than displacement.

3. d. displacement = $\sqrt{2}r$ Distance =

   Explanation: Distance covered is $\frac{3}{4}$ circumference.

   $\frac{3}{4} \times 2 \times \pi \times \mathrm{r} = \frac{3\pi \mathrm{r}}{2}$

   Displacement = Shortest Path

   If We Join Point A and B we get right angle triangle with Hypotenuse(displacement) and other two sides of a triangle with sides r.

   Displacement = $\sqrt{r^2 + r^2} = \sqrt{2r^2} = \sqrt{2}r$

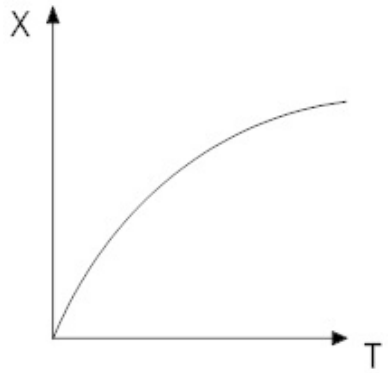
4. b. motion is always uniform

   Explanation: Motion can be non-uniform if there is a change in velocity.

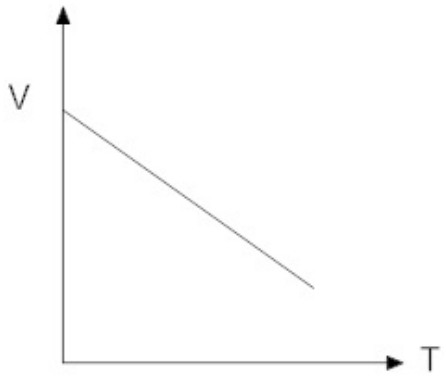
5. a. Displacement

   Explanation: The first equation of motion is v = u + at, where v is the final velocity and u is the initial velocity of the body and a is uniform acceleration. First equation of motion gives velocity acquired by body at any time t. So, in first equation of motion displacement is not present.

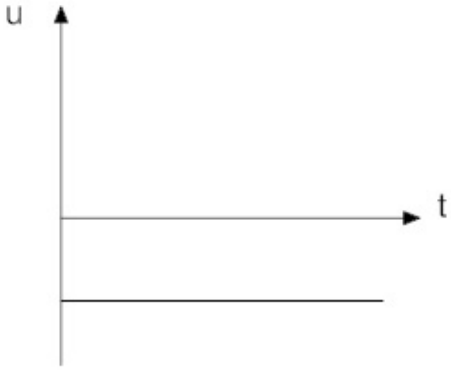
6. We need to specify a reference point called the origin.
7. When the object has uniform motion then displacement and distance have the same magnitude.
8. Straight line, passing through the origin is the nature of the displacement time graph of a body moving with constant velocity
9. Displacement is a vector quantity.
10. If the velocity of an object decreases, then the object is said to be moving with negative acceleration. It is also called retardation.
11. Initially, the piece of cloth and the loose water in it are in a state of rest. When the cloth is shaken, it is suddenly set into motion, but the loose water in it, on account of inertia of rest continues in its state of rest. Thus water comes out of cloth in the form of fine particles.
12. Given total distance travelled = 15 + 75 + 10 = 100 km
    Time taken in the first part of motion t_1 = $\frac{S}{V_1} = \frac{15}{30}$
    Time taken in the second part of motion t_2 = $\frac{S}{V_2} = \frac{75}{50}$
    Time taken in the third part of motion t_3 = $\frac{S}{V_3} = \frac{10}{20}$
    Total time taken t = $t_1 + t_2 + t_3$ = $\frac{15}{30} + \frac{75}{50} + \frac{10}{20} = 2.5h$
    Therefore,V_{av} = $\frac{Total\ dis\tan ce\ travelled}{Total\ time\ taken} = \frac{100}{2.5} = 40\ kmh^{-1}$
13. i. Position – time



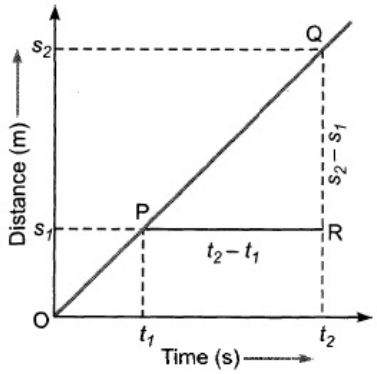
ii. Velocity – time



iii. Acceleration- time



14. Consider a body of mass 'm' moving with uniform velocity i.e. covering equal distance in equal interval of time. Graphically, it can be represented as follows:



From graph, Let a body covers distance s_1 and s_2 at times t_1 and t_2 respectively.

Now, Slope of line PQ = $\tan\theta = = \frac{QR}{PR} = \frac{s_2 - s_1}{t_2 - t_1} = \frac{\text{Displacement}}{\text{Time}}$

As $\frac{\text{Displacement}}{\text{Time}}$ is velocity, so the slope of the distance-time graph gives velocity of the body.

15. i. Consider the linear motion of a body with initial velocity 'u'. Let the body accelerate uniformly and acquire a final velocity 'v' after time 't'.

Then, Average velocity of body = $\frac{\text{Initial velocity} + \text{Final velocity}}{2} = \frac{u+v}{2}$

$\therefore$ The distance covered by the body in time 't' = S = Average velocity $\times$ Time taken

$\Rightarrow S = \frac{u+v}{2} \times t$

We know that, v =u +at

$\Rightarrow S = \frac{u+(u+at)}{2} \times t$

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

$\Rightarrow$ S = $ut + \frac{1}{2}at^2$ Which is required equation.

ii. We know that, S = $ut + \frac{1}{2}at^2$ ..... (1)

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

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

Putting the value of t in (1), we have

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

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

or 2aS = 2uv - $2u^2$ + v^2 + u^2 - 2uv

or v^2 - u^2 = 2aS. Which is required equation.