CBSE TEST PAPER-03

CLASS - XI PHYSICS (Kinematics)

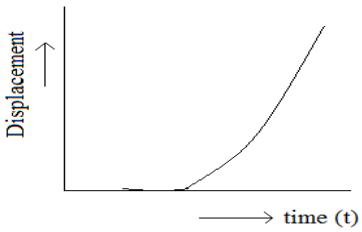
Topic: - Motion in Straight Line [ANSWERS]

Ans1: Distance and displacement have the same magnitude when the object moves in a straight line.

Ans2: A straight line inclined to time axis (x – axis)

Ans3: Velocity at P and T is positive
Velocity at Q and S is zero
Velocity at R is negative

Ans4: Graph is parabolic in shape



Ans5: $t = \sqrt{x} - 3$

$\sqrt{x} = t + 3$

$x = (t+3)^2$

(i) $\upsilon = \frac{dx}{dt} = 2(t+3)$

For $t = 3$ sec $\upsilon = 2(3+3) = 12 m/s$

(ii) For $t = 6$ sec $\upsilon = 2(6+3) = 18 m/s$

Ans6: $u = 4.9 m/s$ (*upward*)

$h = 245 m$

For packet (care of free fall) a = g = 9.8m/s² (downwards)

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

$245 = -4.9 \times t + \frac{1}{2}(9.8) \times t^2$

$4.9t^2 - 4.9t = 245$

$t = 7.6s \text{ or } -5.6s$ Since time cannot be negative

$\therefore$ t = 7.6s

Now $\upsilon = u + at$

$\upsilon = -4.9 + (9.8)(76)$ $\upsilon = 69.6 m/s$

Ans7: $u = 126km/hr = 35m/s$

$v = 0 \; s = 200m$

$v^2 - v^2 = 29s$

$$a = \frac{v^2 - v^2}{2s}$$

$$a = \frac{(0)^2 - (126)^2}{2 \times 200} = \frac{(0)^2 - (35)^2}{2 \times 200}$$

a = -3.06m/s² (Retardation)

Now V = u + at

$$t = \frac{V - v}{a} = \frac{0 - 35}{-3.06}$$

t = 11.4s

Ans8: Displacement of the particle in time (t)

S = area under $v - t$ graph

S = area OABC

S = area of rectangle AODC + area of Δ ADB

$$S = OA \times OC + \frac{1}{2} AD \times BD$$

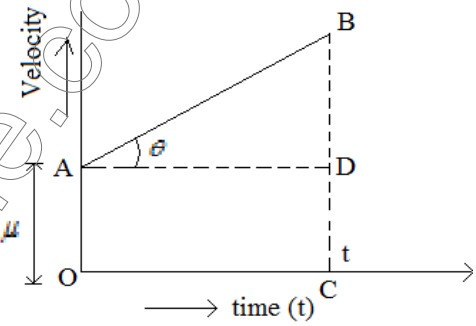
$$S = ut + \frac{1}{2}(AD) \times \left(\frac{AD \times DB}{AD}\right)$$

$$S = ut + \frac{1}{2}(AD)^2 \times \left(\frac{DB}{AD}\right)$$

$$S = ut + \frac{1}{2}(t)^2 \times \left(\frac{DB}{AD}\right)$$

$$S = ut + \frac{1}{2}(t)^2 \times (a) \qquad \left[\because a = \tan\theta = \frac{BD}{AD}\right]$$

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



Ans9: (a) Relative velocity $V\vec{AB}$ of body A with respect to body B is defined as the time rate of change of position of A wrt. B.

(b) (i) When two objects move in the same direction

$$V\vec{AB} = V\vec{A} - V\vec{B}$$

$A \rightarrow V\vec{A}$

$B \rightarrow V\vec{B}$

$\rightarrow V\vec{AB}$

(ii) When two objects move in the opposite direction

$$V\vec{AB} = \vec{VA} - (-V\vec{B})$$

$$V\vec{AB} = \vec{VA} + \vec{VB}$$

$A \rightarrow \vec{v_A}$

$\leftarrow v\vec{B}$

$\rightarrow V\vec{AB}$

(c) Velocity of the Jet plane V_J = 500km/hr velocity of gases wrt. Jet plane V_{gJ} = -1500km/hr (direction is opposite)

$V_{gJ} = V_g - V_J$

$V_g = V_{gJ} + V_J$

Velocity of the Vg = -1500 + 500 = -1000km/hr

(As hot gases also comes out in opposite direction of the Jet plane)

Ans10: We know

(i) $a = \frac{dv}{dt}$

$dv = adt$

Integrating $\int dv = \int adt$

$V = at + k ----(1)$

Where K is constant of integration

$when\ t = 0\ \vartheta = u$

$\Rightarrow K = u$

$\Rightarrow \boxed{V = at + u}$

(ii) $\upsilon^2 - v^2 = 2as$

We know $a = \frac{dv}{dt}$

Multiply and Divide by dx

$a = \frac{dv}{dt} \times \frac{dx}{dx}$

$a = \frac{dv}{dx} \times \vartheta$

$adx = vdv$

$\left(\because \frac{dx}{dt} = v\right)$

Integrating within the limits

$a \int_{\lambda o}^{x} dx = \int_{v}^{\vartheta} \upsilon dv$

$a(x - x_o) = \frac{\upsilon^2}{2} - \frac{v^2}{2}$

$as = \frac{\upsilon^2 - v^2}{2} \left(\because (x - x_o) = \text{s} = \text{displacement}\right)$

$\boxed{\upsilon^2 - v^2 = 2as}$