DPP

DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 9

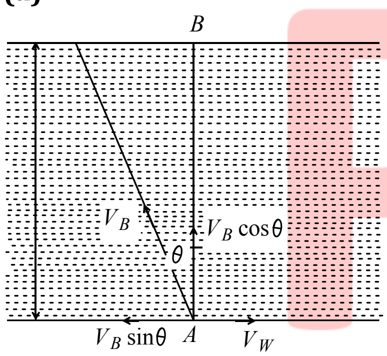
Topic :- MOTION IN A STRAIGHT LINE

1 **(a)**

$S_n = u + \frac{a}{2}(2n - 1) = \frac{a}{2}(2n - 1)$ because $u = 0$

Hence $\frac{S_4}{S_3} = \frac{7}{5}$

2 **(a)**



From figure, $V_B \sin\theta = V_W$

$\sin\theta = \frac{V_W}{V_B} = \frac{1}{2} \Rightarrow \theta = 30°$ $[\because V_B = 2V_W]$

Time taken to cross the river,

$t = \frac{D}{V_B\cos\theta} = \frac{D}{V_B\cos 30°} = \frac{2D}{V_B\sqrt{3}}$

3 **(c)**

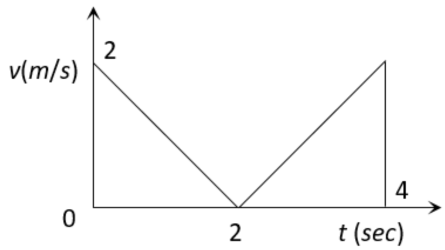
For same direction relative velocity $= |v_1 - v_2|$

Distance covered, $d = \frac{(v_1 - v_2)^2}{2a}$

For no collision, $d > \frac{(v_1 - v_2)^2}{2a}$

4 **(b)**

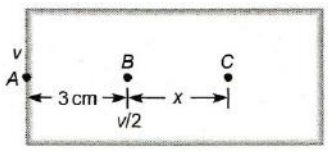
The velocity time graph for given problem is shown in the figure.



Distance travelled $S =$ Area under curve $= 2 + 2 = 4m$

5 **(c)**

Let initial velocity of body at point A is v, AB is 3 cm.



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

$$\left(\frac{v}{2}\right)^2 = v^2 - 2a \times 3$$

$$a = \frac{v^2}{8}$$

Let on penetrating 3 cm in a wooden block, the body moves x distance form B to C.

So, for B to C

$$u = \frac{v}{2}, v = 0,$$

$$s = x, a = \frac{v^2}{8} \qquad \text{(deceleration)}$$

$$\therefore (0)^2 = \left(\frac{v}{2}\right)^2 - 2 \cdot \frac{v^2}{8} \cdot x$$

$$x = 1$$

6 **(c)**

Mass does not affect maximum height

$H = \frac{u^2}{2g} \Rightarrow H \propto u^2$, So if velocity is doubled then height will become four times.i.e.$H = 20 \times 4 = 80m$

7 **(c)**

Given, $s = 2$ m, $u = 80$ ms^{-1}, $v = 0$

From $\qquad v^2 = u^2 - 2as$

$\therefore \qquad (0)^2 = (80)^2 - 2 \times a \times 2$

Or $\qquad a = \frac{80 \times 80}{4} = 1600 \text{ ms}^{-2}$

8 **(c)**

Instantaeneous velocity $= v = \frac{\Delta x}{\Delta t}$

By using the data from the table

$v_1 = \frac{0 - (-2)}{1} = 2m/s, \quad v_2 = \frac{6 - 0}{1} = 6m/s$

$v_3 = \frac{16 - 6}{1} = 10m/s$

So, motion is non-uniform but accelerated

9 **(c)**

Average velocity is defined as the displacement divided by time.

In the given graph, displacement is zero.

Hence, Average velocity $= \frac{\text{total displacement}}{\text{total time}} = \frac{0}{t} = 0$

10 **(c)**

Let body reaches the ground in t sec.

$\therefore$ Velocity of body after $(t - 2)$ sec from equation of motion.

$v = u + \mathrm{g}t'$

And $t' = t - 2$

$\therefore v = \mathrm{g}(t - 2)$

Distance covered in last two sec

$\mathrm{h}' = \mathrm{g}(t - 2) \times 2 + \frac{1}{2}\mathrm{g}(2)^2$

$60 = 20(t - 2) + 20$

Or $t = 4$ s

Hence, height of tower is given buy

$\mathrm{h} = ut + \frac{1}{2}\mathrm{g}t^2$

$\mathrm{h} = \frac{1}{2}\mathrm{g}t^2 [\therefore u = 0]$

$= \frac{1}{2} \times 10 \times (4)^2 = 80$ m.

11 **(a)**

$x = \frac{1}{2}gt^2, 100 - x = 25x - \frac{1}{2}gt^2;$

Adding $25t = 100$ or $t = 4$ s

12 **(d)**

$S \propto u^2 \Rightarrow \frac{S_1}{S_2} = \left(\frac{1}{4}\right)^2 = \frac{1}{16}$

13 **(b)**

Speed can never be negative. Hence (b) is correct.

14 **(d)**

$x = 8 + 12t + t^3$

$v = 0 + 12 - 3t^2 = 0$

$3t^2 = 12$

$t = 2\ sec$

$a = \frac{dv}{dt} = 0 - 6t$

$a[t = 2] = -12\ m/s^2$

Retardation $= 12\ m/s^2$

15 **(d)**

$u = 72\ kmph = 20\ m/s, v = 0$

By using $v^2 = u^2 - 2as \Rightarrow a = \frac{u^2}{2s} = \frac{(20)^2}{2 \times 200} = 1\ m/s^2$

16 **(a)**

$S_1 = \frac{1}{2}ft^2, S_2 = -v_0t - \frac{1}{2}gt^2$, Clearly, $(S_1 - S_2) \propto t$

17 **(a)**

$\tan(90° - \theta) = \frac{20}{15}$

$\therefore \cot\theta = \frac{20}{15} = \frac{4}{3}$

$\Rightarrow \theta = 37°$

$\therefore\ \theta = 37° + 23°$

$= 60°$

18 **(a)**

Let us calculate relative deceleration by considering relative velocity

Using, $v^2 - u^2 = 2aS, 0^2 - 80^2 = 2 \times a \times 2000$

or $a = -\frac{80 \times 80}{4000} = -\frac{64}{40}\text{ms}^{-2} = -1.6\text{ms}^{-2}$

Deceleration of each train is $\frac{1.6}{2}\text{ms}^{-2}$ *ie*, 0.8 ms^{-2}

19 **(b)**

The time of fall is independent of the mass

20 **(c)**

Distance travelled by the particle is

$x = 40 + 12t - t^3$

We know that, speed is rate of change of distance i.e.

$v = \frac{dx}{dt}$

$\therefore v = \frac{d}{dt}(40 + 12t - t^3) = 0 + 12 - 3t^2$

But final velocity $v = 0$

$\therefore 12 - 3t^2 = 0$

$\Rightarrow t^2 = \frac{12}{3} = 4 \Rightarrow t = 2s$

Hence, distance travelled by the particle before coming to rest is given by

$x = 40 + 12(2) - (2)^3 = 40 + 24 - 8 = 64 - 8 = 56m$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	A	A	C	B	C	C	C	C	C	C
Q.	11	12	13	14	15	16	17	18	19	20
A.	A	D	B	D	D	A	A	A	B	C