DPP
DAILY PRACTICE PROBLEMS

Class : XIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 2

Topic :- MOTION IN A STRAIGHT LINE

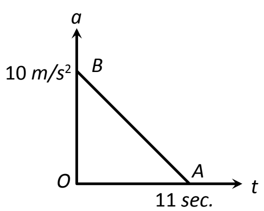
1 **(c)**

$S_n = u + \frac{a}{2}(2n-1) \Rightarrow 1.2 = 0 + \frac{a}{2}(2 \times 6 - 1)$

$\Rightarrow a = \frac{1.2 \times 2}{11} = 0.218\ m/s^2$

2 **(b)**

The area under acceleration time graph gives change in velocity. As acceleration is zero at the end of 11 *sec*



i.e. $v_{\max} =$ Area of ΔOAB

$= \frac{1}{2} \times 11 \times 10 = 55\ m/s$

3 **(c)**

$h = 0 + \frac{1}{2}gt^2 \Rightarrow t^2 \propto h$

$\therefore \frac{t_1}{t_2} = \sqrt{\frac{h_1}{h_2}} = \sqrt{\frac{16}{25}} = \frac{4}{5}$

4 **(b)**

$x = \alpha t^3, y = \beta t^3$

$$v_x = \frac{dx}{dt} = 3\alpha t^2$$

$$v_y = \frac{dy}{dt} = 3\,\beta t^2$$

Resultant velocity, $v = \sqrt{v_x^2 + v_y^2}$

$$= \sqrt{9\alpha^2 t^4 + 9\beta^2 t^4} = 3t^2\sqrt{\alpha^2 + \beta^2}$$

5 **(b)**

Velocity at the time of striking the floor,

$u = \sqrt{2gh_1} = \sqrt{2 \times 9.8 \times 10} = 14 m/s$

Velocity with which it rebounds

$v = \sqrt{2gh_2} = \sqrt{2 \times 9.8 \times 2.5} = 7\ m/s$

$\therefore$ Change in velocity $\Delta v = 7 - (-14) = 21 m/s$

$\therefore$ Acceleration $= \frac{\Delta v}{\Delta t} = \frac{21}{0.01} = 2100 m/s^2$(upwards)

6 **(b)**

For one dimensional motion along a plane

$S = ut + \frac{1}{2}at^2 \Rightarrow 9.8 = 0 + \frac{1}{2}g \sin\ 30° t^2 \Rightarrow t = 2\text{sec}$

7 **(b)**

$S_{3^{\text{rd}}} = 10 + \frac{10}{2}(2 \times 3 - 1) = 35\ m$

$S_{2^{\text{nd}}} = 10 + \frac{10}{2}(2 \times 2 - 1) = 25\ m \Rightarrow \frac{S_{3^{\text{rd}}}}{S_{2^{\text{nd}}}} = \frac{7}{5}$

8 **(b)**

Average velocity is that uniform velocity with which the object will cover the same displacement in same interval of time as it does with its actual variable velocity during that time interval.

Here, total distance covered

$$= (3\text{ ms}^{-1} \times 20\text{ s}) + (4\text{ ms}^{-1} \times 20\text{ s}) + (5\ ms^{-1} \times 20\text{ s})$$

$$= (60 + 80 + 100) = 240\text{ m}$$

Total time taken $= 20 + 20 + 20 = 60$ s

$\therefore$ Average velocity $= \frac{240}{60} = 4\text{ ms}^{-1}$

9 **(a)**

As the train are moving in the same direction. So the initial relative speed $(v_1 - v_2)$ and by applying retardation final relative speed becomes zero

From $v = u - at \Rightarrow 0 = (v_1 - v_2) - at \Rightarrow t = \frac{v_1 - v_2}{a}$

10 **(b)**

If acceleration is variable (depends on time) then

$$v = u + \int (f)dt = u + \int (a\,t)dt = u + \frac{a\,t^2}{2}$$

11 **(a)**

Let initial ($t = 0$) velocity of particle $= u$

For first 5 sec of motion $s_5 = 10\ metre$

$$s = ut + \frac{1}{2}at^2 \Rightarrow 10 = 5u + \frac{1}{2}a(5)^2$$

$2u + 5a = 4$

For first 8sec of motion $s_8 = 20\ metre$

$$20 = 8u + \frac{1}{2}a(8)^2 \Rightarrow 2u + 8a = 5$$

By solving $u = \frac{7}{6}m/s$ and $a = \frac{1}{3}m/s^2$

Now distance travelled by particle in Total 10 sec

$$s_{10} = u \times 10 + \frac{1}{2}a(10)^2$$

By substituting the value of u and a we will get $s_{10} = 28.3\ m$

so the distance in last 2 $sec = s_{10} - s_8$

$= 28.3 - 20 = 8.3m$

12 **(d)**

Given, $a = 1$ m/s, $s = 48$ m

By equation of motion

$$48 = 10t + \frac{1}{2}at^2$$

$$t = 8\ s$$

13 **(c)**

$$\frac{dv}{dt} = bt \Rightarrow dv = bt\ dt \Rightarrow v = \frac{bt^3}{2} + K_1$$

At $t = 0, v = v_0 \Rightarrow K_1 = v_0$

We get $v = \frac{1}{2}bt^2 + v_0$

Again $\frac{dx}{dt} = \frac{1}{2}bt^2 + v_0$

$$\Rightarrow x = \frac{1}{2}\frac{bt^3}{3} + v_0t + K_2$$

At $t = 0, x = 0 \Rightarrow K_2 = 0$

$$\therefore x = \frac{1}{6}bt^3 + v_0t$$

14 **(b)**

Let initial velocity of body a point A is v, AB is 40 cm.

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

$\Rightarrow \quad \left(\frac{v}{2}\right)^2 = v^2 - 2a \times 40$

Or $\quad a = \frac{3v^2}{320}$

Let on penetrating 40 cm in a wooden block, the body moves x distance from B to C.

So, for B to C

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

$$s = x, a = \frac{3v^2}{320} \text{(deceleration)}$$

$\therefore \quad (0)^2 = \left(\frac{v}{2}\right)^2 - 2 \times \frac{3v^2}{320} \times x$

Or $\quad x = \frac{40}{3} \text{ cm}$

15 **(d)**

Since, acceleration is in the direction of instantaneous velocity, so particle always moves in forward direction.

Hence, (d) is correct.

16 **(b)**

$H_{\max} \propto u^2$, It body projected with double velocity then maximum height will become four times *i.e.* 200 m

17 **(d)**

The equation of motion

$$\left(\frac{u}{2}\right)^2 = u^2 - 2g\,(AO)$$

$$2g \times AO = u^2 - \frac{u^2}{4} = \frac{3u^2}{4}$$

$$AO = \frac{3u^2}{8g}$$

When particle will reach at point B

$$\left(\frac{u}{3}\right)^2 = u^2 - 2g(OB)$$

$$OB = \frac{8u^2}{18\text{g}}$$

When particle will reach at point C

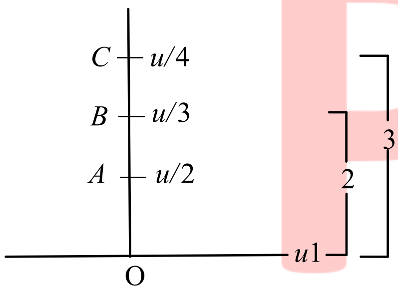
$$\left(\frac{u}{4}\right)^2 = u^2 - 2\text{g}\,(OC)$$

$$OC = \frac{15u^2}{32\text{g}}$$

$$AB = OB - OA = \frac{u^2}{\text{g}}\left[\frac{8}{18} - \frac{3}{8}\right] = \frac{5u^2}{72\text{g}}$$

$$BC = OC - OB = \frac{u^2}{\text{g}}\left[\frac{15}{32} - \frac{8}{18}\right]$$

The ratio, $\frac{AB}{BC} = \frac{20}{7}$



18 **(d)**

From first equation of motion, we have

$$v = u + at$$

Given, $u = 0$, $a_1 = 2\ \text{ms}^{-2}$

$$t = 10\ \text{s},$$

$\therefore \quad v_1 = 2 \times 10 = 20\ \text{ms}^{-1}$

In the next 30 s, the constant velocity becomes

$$v_2 = v_1 + a_2 t_2$$

Given, $v_1 = 20\ \text{ms}^{-1}, a_2 = 2\ \text{ms}^{-2}, t_2 = 30\ \text{s}$

$\therefore \qquad v_2 = 20 + 2 \times 30 = 80\ \text{ms}^{-1}$.

When it decelerates, then

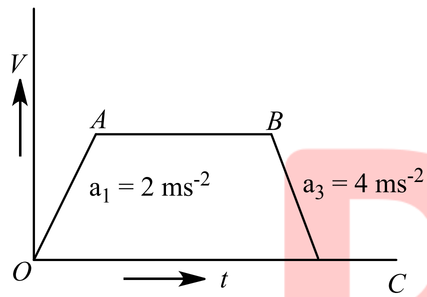
$$v_3^2 = u^2 - 2a_3 s$$

Here, $v_3 = 0$ (train stops), $v_2 = 80\ \text{ms}^{-1}$,

$$a_3 = 4\ \text{ms}^{-2}$$

$$0 = (80)^2 - 2 \times 4 \times s$$

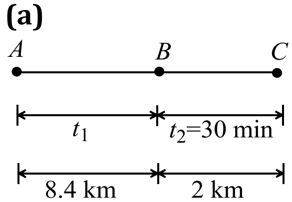
Or $\qquad s = \frac{80 \times 80}{8} = 800$ m.



19 **(a)**

Distance between the balls = Distance travelled by first ball in 3 seconds – Distance travelled by second ball in 2 seconds $= \frac{1}{2}g(3)^2 - \frac{1}{2}g(2)^2 = 45 - 20 = 25\ m$

20 **(a)**



Average speed $\bar{v} = \frac{\text{Total distance travelled}}{\text{Total time taken}}$

$$= \frac{8.4km + 2km}{t_1 + t_2} = \frac{10.4\ km}{\left(\frac{8.4\ km}{70\ km/h}\right) + \frac{1}{2}h}$$

$$= \frac{10.4\ km}{0.12h + 0.5h} = 16.8\ km/h$$

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