Chapter 1 Motion in a Straight Line

Assignment 1 Solution

Class 11

PRERNA EDUCATION

DPP
DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 1

TOPIC :- MOTION IN A STRAIGHT LINE

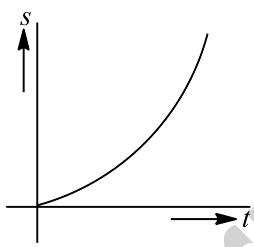
2 **(a)**

The equation of motion

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

$$= 0 + \frac{1}{2}at^2 = \frac{1}{2}at^2$$

The graph plot is as shown.



3 **(b)**

Let the initial velocity of ball be u

Time of rise $t_1 = \frac{u}{g+a}$ and height reached $= \frac{u^2}{2(g+a)}$

Time of fall t_2 is given by

$$\frac{1}{2}(g-a)t_2^2 = \frac{u^2}{2(g+a)}$$

$$\Rightarrow t_2 = \frac{u}{\sqrt{(g+a)(g-a)}} = \frac{u}{(g+a)}\sqrt{\frac{g+a}{g-a}}$$

$\therefore t_2 > t_1$ because $\frac{1}{g+a} < \frac{1}{g-a}$

4 **(b)**

$$v = u + at = u + \left(\frac{F}{m}\right)t = 20 + \left(\frac{100}{5}\right) \times 10 = 220\ m/s$$

5 **(d)**

If t_1 and t_2 are the time, when body is at the same height then,

$$h = \frac{1}{2}gt_1t_2 = \frac{1}{2} \times g \times 2 \times 10 = 10\ g$$

6 **(b)**

Relative velocity of one train $w.r.t.$ other

$= 10 + 10 = 20m/s$

Relative acceleration$=0.3 + 0.2 = 0.5m/s^2$

If train crosses each other then from $s = ut + \frac{1}{2}at^2$

$As, s = s_1 + s_2 = 100 + 125 = 225$

$$\Rightarrow 225 = 20t + \frac{1}{2} \times 0.5 \times 0.5 \times t^2 \Rightarrow 0.5t^2 + 40t - 450 = 0$$

$$\Rightarrow t = \frac{-40 \pm \sqrt{1600 + 4.(005) \times 450}}{1} = -40 \pm 50$$

$\therefore t = 10sec$ (Taking +ve value)

7 **(a)**

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

8 **(b)**

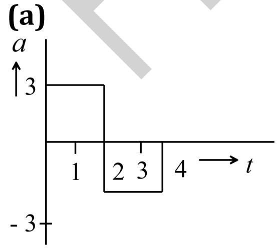
The velocity of balloon at height h, $v = \sqrt{2\left(\frac{g}{8}\right)h}$

When the stone released from this balloon, it will go upward with velocity, $= \frac{\sqrt{gh}}{2}$ (Same as that of balloon). In this condition time taken by stone to reach the ground

$$t = \frac{v}{g}\left[1 + \sqrt{1 + \frac{2gh}{v^2}}\right] = \frac{\sqrt{gh}/2}{g}\left[1 + \frac{2gh}{gh/4}\right]$$

$$= \frac{2\sqrt{gh}}{g} = 2\sqrt{\frac{h}{g}}$$

9 **(a)**



Taking the motion from 0 to 2 s

$u = 0, a = 3ms^{-2}, t = 2s, v = ?$

$v = u + at = 0 + 3 \times 2 = 6ms^{-1}$

Taking the motion from 2 s to 4 s

$v = 6 + (-3)(2) = 0 ms^{-1}$

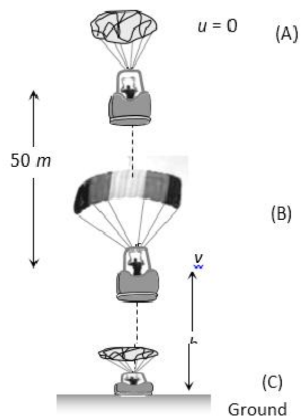
10 **(a)**

$$H_{\max} = \frac{u^2}{2g} \Rightarrow H_{\max} \propto \frac{1}{g}$$

On planet B value of g is 1/9 times to that of A. So value of $H_{\max}$ will become 9 times *i.e.* $2 \times 9 = 18\ metre$

11 **(a)**

After balling out from point A parachutist falls freely under gravity. The velocity acquired by it will 'v'



From $v^2 = u^2 + 2as = 0 + 2 \times 9.8 \times 50 = 980$

[As $u = 0, a = 9.8 m/s^2, s = 50\ m$]

At point B, parachute opens and it moves with retardation of 2 m/s^2 and reach at ground (point C) with velocity of 3 m/s

For the part 'BC' by applying the equation $v^2 = u^2 + 2as$

$v = 3m/s, u = \sqrt{980}\ m/s, a = -2m/s^2, s = h$

$\Rightarrow (3)^2 = \left(\sqrt{980}\right)^2 + 2 \times (-2) \times h \Rightarrow 9 = 980 - 4h$

$$\Rightarrow h = \frac{980 - 9}{4} = \frac{971}{4} = 242.7 \cong 243\ m$$

So, the total height by which parachutist bail out $= 50 + 243 = 293\ m$

12 **(d)**

Acceleration due to gravity is independent of mass of body

13 **(b)**

Distance average speed $= \frac{2v_1v_2}{v_1+v_2} = \frac{2 \times 2.5 \times 4}{2.5+4}$

$$= \frac{200}{65} = \frac{40}{13} km/hr$$

14 **(d)**

$S \propto u^2$. If u becomes 3 times then S will become 9 times

$i.e. 9 \times 20 = 180m$

15 **(d)**

Average speed $= -\frac{\text{Total distance}}{\text{Total time}} = \frac{x}{t_1+t_2}$

$= \frac{x}{\frac{x/3}{v_1} + \frac{2x/3}{v_2}} = \frac{1}{\frac{1}{3 \times 20} + \frac{2}{3 \times 60}} = 36\ km/hr$

16 **(d)**

$\because v = 0 + na \Rightarrow a = v/n$

Now, distance travelled in $n\ sec. \Rightarrow S_n = \frac{1}{2}an^2$ and

distance travelled in $(n-2)sec \Rightarrow S_{n-2} = \frac{1}{2}a(n-2)^2$

$\therefore$ Distance travelled in last 2 seconds,

$= S_n - S_{n-2} = \frac{1}{2}an^2 - \frac{1}{2}a(n-2)^2$

$\frac{a}{2}\left[n^2 - (n-2)^2\right] = \frac{a}{2}[n + (n-2)][n - (n-2)]$

$= a(2n-2) = \frac{v}{n}(2n-2) = \frac{2v(n-1)}{n}$

17 **(c)**

When packet is released from the balloon, it acquires the velocity of balloon of value 12 m/s. Hence velocity of packet after 2 sec, will be

$v = u + gt = 12 - 9.8 \times 2 = -76\ m/s$

18 **(b)**

Distance covered =Area enclosed by $v - t$ graph

= Area of triangle $= \frac{1}{2} \times 4 \times 8 = 16\ m$

19 **(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.$H = 20 \times 4 = 80m$

20 **(c)**

Distance covered in a particular time is

$s_n = u + \frac{1}{2}\text{g}(2\text{n} - 1)$

$s_1 = 0 + \frac{1}{\text{g}}(2 \times 1 - 1) = \frac{\text{g}}{2}$

$$s_2 = 0 + \frac{1}{2}g(2 \times 2 - 1) = \frac{3}{2}g$$

And $s_3 = 0 + \frac{1}{2}\ g(2 \times 3 - 1) = \frac{5}{2}\ g$

Hence, the required ration is

$s_1 : s_2 : s_3 = \frac{g}{2} : \frac{3}{2}g : \frac{5}{2}g \qquad = 1 : 3 : 5$

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