DPP

DAILY PRACTICE PROBLEMS

CLASS : XITH

DATE :

Solutions

SUBJECT : PHYSICS

DPP NO. : 10

Topic :- MOTION IN A STRAIGHT LINE

1 **(a)**

Slope of velocity-time graph measures acceleration. For graph (a) slope is zero. Hence $a = 0$ *i.e.* motion is uniform

2 **(c)**

Initial velocity $u = \tan 45° = 1$

Velocity after 2s, $v = \tan 60° = \sqrt{3}$

$\therefore$ Average acceleration, $a_{av} = \frac{v - u}{t} = \frac{\sqrt{3} - 1}{2}$.

3 **(c)**

Distance covered by bus in 100 s

$$= 100 \times 10 = 1000 \text{ m}$$

Distance to be covered by scooterist

$$= 1000 + 1000 = 2000 \text{ m}$$

$\therefore$ Speed of scooterist $= \frac{2000}{100} = 20 \text{ ms}^{-1}$

4 **(b)**

$\vec{v} = \vec{u} + \vec{a}t$

$v = (2\hat{i} + 3\hat{j}) + (0.3\hat{i} + 0.2\hat{j}) \times 10$

$= 5\hat{i} + 5\hat{j}$

$|\vec{v}| = 5\sqrt{2}$

5 **(a)**

Height reached $= \frac{1}{2} \times 132 \times 1200\text{m} = 66 \times 1200\text{m}$

6 **(d)**

Since $x = 1.2t^2$ which is in form $x = \frac{1}{2}at^2$

Thus the motion is uniformly accelerated

9 **(d)**

Let the body after time $t/2$ be at x from the top, then

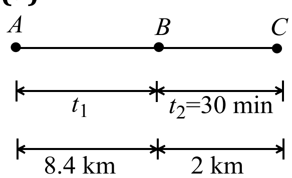
$x = \frac{1}{2} g \frac{t^2}{4} = \frac{gt^2}{8}$ ...(i)

$h = \frac{1}{2} gt^2$ ...(ii)

Eliminate t from (i) and (ii), we get $x = \frac{h}{4}$

$\therefore$ Height of the body from the ground $= h - \frac{h}{4} = \frac{3h}{4}$

10 **(a)**



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

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

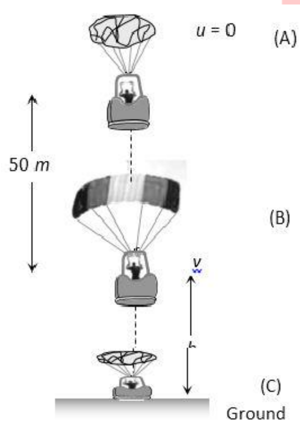
$= \frac{10.4\ km}{0.12h + 0.5h} = 16.8\ km/h$

11 **(c)**

Vertical component of velocities of both the balls are same and equal to zero. So $t = \sqrt{\frac{2h}{g}}$

12 **(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 $u = 0, a = 9.8m/s^2, s = 50\ m$]

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 $v^2 = u^2 + 2as$

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

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

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

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

13 **(c)**

$$v = \frac{dx}{dt} = 0 + 12t - 3t^2 = 0$$

$$\Rightarrow \qquad t = 2\ \text{s}$$

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

$$x = 40 + 12(2) - (2)^3$$

$$= 40 + 24 - 8 = 64 - 8$$

$$= 56\ \text{m}$$

14 **(a)**

$\vec{r} = 20\hat{i} + 10\hat{j}\ \therefore r = \sqrt{20^2 + 10^2} = 22.5\ m$

15 **(d)**

Because acceleration due to gravity is constant so the slope of line will be constant *i.e.*, velocity time curve for a body projected vertically upwards is straight line

16 **(a)**

$\sqrt{x} = t + 1$

Squaring both sides, we get

$x = (t+1)^2 = t^2 + 2t + 1$

Differentiating it w.r.t time t, we get

$$\frac{dx}{dt} = 2t + 2$$

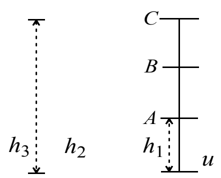
Velocity, $v = \frac{dx}{dt} = 2t + 2$

17 **(d)**

$$A \Rightarrow \frac{u^2}{4} - u^2 = -2gh_1$$

$$B \Rightarrow \frac{u^2}{9} - u^2 = -2gh_2$$

$$C \Rightarrow \frac{u^2}{16} - u^2 = -2gh_3$$



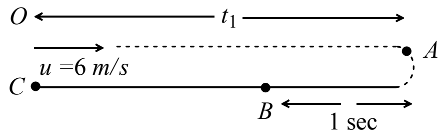
$$\therefore AB = \frac{u^2}{2g}\left\{\frac{8}{9} - \frac{3}{4}\right\} = \frac{u^2}{2g} \cdot \frac{5}{36}$$

$$BC = \frac{u^2}{2g}\left\{\frac{15}{16} - \frac{8}{9}\right\} = \frac{u^2}{2g} \cdot \frac{7}{144}$$

$$\therefore \frac{AB}{BC} = \frac{5}{36} \times \frac{144}{7} = \frac{20}{7}$$

18 **(b)**

Let the particle moves toward right with velocity 6 m/s. Due to retardation after time t_1 its velocity becomes zero



From $v = u - at \Rightarrow 0 = 6 - 2t_1 \Rightarrow t_1 = 3sec$

But retardation work on it for 4 sec.It means after reaching point A direction of motion get reversed and acceleration works on the particle for next one second.

$S_{OA} = ut_1 - \frac{1}{2}at_1^2 = 6 \times 3 - \frac{1}{2}(2)(3)^2 = 18 - 9 = 9m$

$S_{AB} = \frac{1}{2} \times 2 \times (1)^2 = 1m$

$\therefore S_{BC} = s_{oa} - s_{aB} = 9 - 1 = 8m$

Now velocity of the particle at pint B in return journey $v = 0 + 2 \times 1 = 2m/s$

In return journey from B to C, particle moves with constant velocity $2m/s$ to cover the distance $8m$.

Time taken $= \frac{\text{Distance}}{\text{Velocity}} = \frac{8}{2} = 4\ sec$

Total time taken by particle to return at point O is

$\Rightarrow T = t_{OA} + t_{AB} + t_{BC} = 3 + 1 + 4 = 8\ sec$

19 **(b)**

$v^2 = u^2 + 2as$

$a = \frac{v^2 - u^2}{2s} = \frac{(20)^2 - (10)^2}{2 \times 135} = \frac{300}{270} = \frac{10}{9} m/s^2$

From first equation of motion

$v = u + at \Rightarrow t = \frac{v - u}{a} = \frac{20 - 10}{10/9} = \frac{10}{10/9} = 9\ sec$

20 **(b)**

$u = 0, v = 180\ km\ \text{h}^{-1} = 50\ ms^{-1}$

Time taken $t = 10s$

$a = \frac{v - u}{t} = \frac{50}{10} = 5\ ms^{-2}$

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

$= 0 + \frac{1}{2} \times 5 \times (10)^2 = \frac{500}{2} = 250\ m$

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