DPP
DAILY PRACTICE PROBLEMS

CLASS : XITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 8

Topic :- MOTION IN A STRAIGHT LINE

1 **(d)**

$S = 3 - 4t + 5t^2$

Velocity $\frac{ds}{dt} = -4 + 10\,t$

Hence, initial velocity will be

$$\left|u = \frac{ds}{dt}\right|_{t=0} = -4 \text{ unit}$$

2 **(d)**

Slope of displacement time graph is negative only at point time E

3 **(c)**

Assume that the motion is along the positive direction of x-axis. For simplicity, let us take the beginning of the braking to be a t time $t = 0$, at position x_0

Therefore, $x - x_0 = v_0\left(\frac{v - v_0}{a}\right) + \frac{1}{2}a\left(\frac{v - v_0}{a}\right)^2$

Solving for a and substituting known data then yield

$$a = \frac{v^2 - v_0}{2(x - x_0)}$$

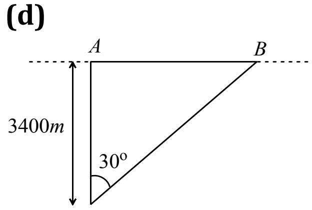
Here, $v_0 = 100\text{kmh}^{-1} = 27.78\text{ms}^{-1}, x - x_0 = 88.0$

And $v = 80\text{kmh}^{-1} = 22.22\text{m}^{-1}$

$$\therefore\ a = \frac{(22.22)^2 - (27.78)^2}{2(88.0)}$$

$$= -1.58\text{ms}^{-2}$$

4 **(d)**



O is the observation point at the ground. A and B are the positions of aircraft for which $\angle$

$AOB = 30°$. Time taken by aircraft from A to B is $10s$

ΔAOB

$$\tan 30° = \frac{AB}{3400}$$

$$AB = 3400 \tan 30° = \frac{3400}{\sqrt{3}} m$$

$\therefore$ Speed of aircraft,

$$v = \frac{AB}{10} = \frac{3400}{10\sqrt{3}} = 196.3\ ms^{-1}$$

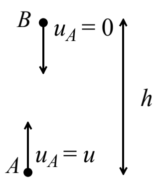
5 **(a)**

$$\text{h} = ut - \frac{1}{2}gt^2 \Rightarrow 96 = 80t - \frac{32}{2}t^2$$

$$\Rightarrow t^2 - 5t + 6 = 0 \Rightarrow t = 2sec \text{ or } 3\ sec$$

6 **(a)**

At time t



Velocity of A, $v_A = u - gt$ upward

Velocity of B, $v_B = gt$ downward

It we assume that height h is smaller than or equal to the maximum height reached by A, then at every instant v_A and v_B are in opposite directions

$\therefore V_{AB} = v_A + V_B$

$= u - gt + gt$ [Speeds in opposite directions get added]

$= u$

7 **(a)**

Displacement $= (2 \times 4 - 2 \times 2 + 2 \times 4) = 12\text{m}$

$= 2 \times 4 + 2 \times 2 + 2 \times 4 = 20\text{m}$

9 **(b)**

$$v^2 = u^2 + 2g\text{h} \Rightarrow (3u)^2 = (-u)^2 + 2g\text{h} \Rightarrow \text{h} = \frac{4u^2}{g}$$

10 **(d)**

$$a = \frac{dv}{dt} = \frac{dv}{dx}\frac{dx}{dt} = v\frac{dv}{dx} = -\alpha x^2 \text{ [Given]}$$

$$\Rightarrow \int_{v_0}^{0} v dv = \alpha \int_{0}^{S} x^2\, dx \Rightarrow \left[\frac{v^2}{2}\right]_{v_0}^{0} = -\alpha\left[\frac{x^3}{3}\right]_0^S$$

$$\Rightarrow \frac{v_0^2}{2} = \frac{\alpha S^3}{3} \Rightarrow S = \left(\frac{3v^2}{2\alpha}\right)^{\frac{1}{3}}$$

11 **(a)**

$h = ut + \frac{1}{2}gt^2$

$\therefore \quad 30 = -25t + \frac{10}{2}t^2$

Or $\quad t^2 - 5t - 6 = 0$

Or $\quad (t - 6)(t + 1) = 0$

$\therefore \quad t = 6$ s

12 **(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 $= 12\ m/s^2$

13 **(d)**

$(S' \propto t^2$. Now, $S'_1 : S'_2 : S'_3 :: \frac{1}{4} : 1 : \frac{9}{4}$ or $1:4:9$
For successive intervals,
$S_1 : S_2 : S_3 :: 1 : (4 - 1) : (9 - 4)$
or $S_1 : S_2 : S_3 :: 1:3:5$

14 **(b)**

For vertically upward motion, $h_1 = v_0 t - \frac{1}{2}gt^2$ and for vertically downward motion, $h_2 = v_0 t + \frac{1}{2}g\,t^2$

$\therefore$ Total distance covered in t sec $h = h_1 + h_2 = 2v_0 t$

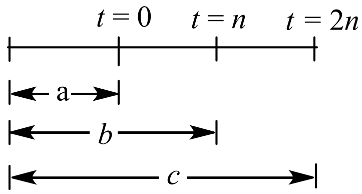
15 **(a)**

An aeroplane files 400 m north and 300 m south so the net displacement is 100 m towards north
Then it files 1200 m upwards so $r = \sqrt{(100)^2 + (1200)^2}$
$= 1204\ m \simeq 1200\ m$
The option should be 1204 m, because this value mislead one into thinking that net displacement is in upward direction only

16 **(a)**

$b - a = un + \frac{1}{2} An^2$

$2b - 2a = 2un + An^2$

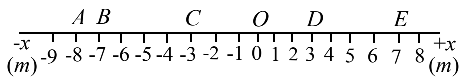


Again, $c - a = u(2n) + \frac{1}{2}A(2n)^2$

Subtracting, $c - a - 2b + 2a = An^2$

$A = \frac{c - 2b + a}{n^2}$

17 **(b)**



(i) The displacement of the main from A to E is $\Delta x = x_2 - x_1 = 7m - (-8m) = +15m$ directed in the positive x-direction

(ii) The displacement of the man from E to C is $\Delta x = -3m - (7m) = -10m$ directed in the negative x-direction

(iii) The displacement of the man from B to D is $\Delta x = 3m - (-7m) = +10m$ directed in the positive x-axis

18 **(a)**

For the given condition initial height $\mathrm{h} = d$ and velocity of the ball is zero. When the ball moves downward its velocity increases and it will be maximum when the ball hits the ground & just after the collision it becomes half and in opposite direction. As the ball moves upward its velocity again decreases and becomes zero at height $d/2$. This explanation match with graph (A)

19 **(c)**

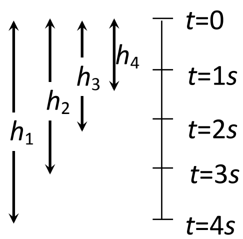
$y = a + bt + ct^2 - dt^4$

$\therefore v = \frac{dy}{dt} = b + 2ct - 4dt^3$ and $a = \frac{dv}{dt} = 2c - 12dt^2$

Hence, at $t = 0$, $v_{\text{initial}} = b$ and $a_{\text{initial}} = 2c$

20 **(a)**

For first marble, $\mathrm{h}_1 = \frac{1}{2}g \times 16 = 8g$



For second marble, $\mathrm{h}_2 = \frac{1}{2}g \times 9 = 4.5g$

For third marble, $h_3 = \frac{1}{2}g \times 4 = 2g$

For fourth marble, $h_4 = \frac{1}{2}g \times 1 = 0.5g$

$\therefore h_1 - h_2 = 8g - 4.5g = 3.5g = 35m.$

$h_2 - h_3 = 4.5g - 2g = 2.5g = 25m$ and $- h_4 = 2g - 0.5g = 1.5g = 15m$

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