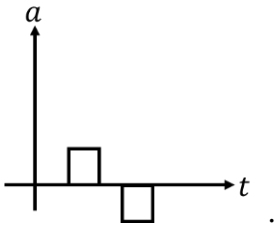
Solutions

S1. Ans. (b)
Initially, the body has zero velocity and zero slope. Hence the acceleration would be zero initially. After that, the slope of v-t curve is constant and positive. After some time, velocity becomes constant and acceleration is zero. After that, the slope of v-t curve is constant and negative.



S2. Ans. (d)
Average speed $= \left(\frac{4v^2}{3v}\right)$
$= \frac{4v}{3}$

S3. Ans. (d)
Let height of bridge $= h$
Displacement of ball, $S = -h$
$S = ut + \frac{1}{2}at^2$
$-h = 4 \times 4 + \frac{1}{2}(-10)(4)^2$
$\Rightarrow h = 64\ m$

S4. Ans. (d)
The slope of displacement time graph gives velocity so,
$v_1 = \tan 30°$
$v_2 = \tan 45°$
So, $\frac{v_1}{v_2} = \frac{\tan 30°}{\tan 45°} = \frac{1}{\sqrt{3}\times 1} = 1 : \sqrt{3}$

S5. Ans. (c)
Distance travelled by a body during free fall is given by
$s = ut + \frac{1}{2}at^2$
Here, $u = 0$ and $a = g$
$\therefore S \propto t^2$
Here for 1st second,
$S_1 = Kt^2 = K$
For 2nd second,
$S_2 = K(2)^2 = 4K$
For 3rd second
$S_3 = K(3)^2 = 9K$
For 4th second,
$S_4 = K(4)^2 = 16K$
Distance covered in 2 seconds, $4K - K = 3K$
Distance covered in 3rd seconds, $9K - 4K = 5K$
Distance covered in 4th seconds, $16K - 9K = 7K$
$\therefore$ Ratio of distances travelled by the freely falling body will be 1 : 3 : 5 : 7.

S6. Ans. (b)
Hint: Between t = 0 to t = 1 s
v = u + at ⇒ 6 = 0 + a ×1
a = 6 m/s^2
Average speed = $\frac{Total\ distance}{Total\ time}$
$= \frac{3X}{3} = X\ m/s$
Where X = 0 + $\frac{1}{2} \times 6 \times (1)^2 = 3m$
$\therefore$ Average speed = 3 m/s
Average velocity = $\frac{Total\ diplacement}{Total\ time}$
$= \frac{X}{3} = \frac{3}{3} = 1\ m/s$

S7. Ans. (b)
Hint: $V_1 =$ Preeti's velocity
$V_2 =$ Escalator's velocity
$t = \frac{distance}{speed} \Rightarrow t = \frac{\ell}{V_1+V_2}$
$= \frac{\ell}{\frac{\ell}{t_1}+\frac{\ell}{t_2}} = \frac{t_1 t_2}{t_2+t}$

S8. Ans. (b)
Hint: $X_p(t) = at + bt^2$
$X_Q(t) = ft - t^2$
$V_P = a + 2bt \qquad V_Q = f - 2t$
As $V_P = V_Q$
a + 2bt = f -2t
$\Rightarrow t = \frac{f-a}{2(1+b)}$

S9. Ans. (c)
Hint: $v = At + Bt^2$
$\frac{dx}{dt} = At + Bt^2$
$\int_0^x dx = \int_1^2 (At + Bt)^2 dt$
$x = \frac{A}{2}(2^2 - 1^2) + \frac{B}{3}(2^3 - 1^3) = \frac{3A}{2} + \frac{7B}{3}$

S10. Ans. (a)

Hint: $v = \beta x^{-2n}$

So, $\frac{dv}{dx} = -2n\beta x^{-2n-1}$

Now $a = v\frac{dv}{dx} = (\beta x^{-2n})(-2n\beta x^{-2n-1})$

$\Rightarrow a = -2n\beta^2 x^{-4n-1}$

S11. Ans. (c)

Hint: $AB = h_1 = \frac{1}{2}g(5)^2$

$\Rightarrow h_1 = 125\ m\ (\because \mu = 0)$

$h_2 = BC = \frac{1}{2}g(10^2 - 5^2) \Rightarrow h_2 = 375\ m$

$h_3 = CD = \frac{1}{2}g[15^2 - 10^2]$

$h_3 = 625m$

$h_1 : h_2 : h_3$

$125 : 375 : 625 = 1 : 3 : 5$