F12-14

Soln

$v = 30t$ for $0 \le t \le 5s$

$v = -15t + 225$ for $5s \le t \le 15secs$

$\therefore v = \frac{ds}{dt}$

$ds = v\,dt$ — (1)

The equation for the distance travelled between $0 \le t \le 5s$

is $v = 30t$

$ds = v\,dt$

$ds = 30t\,dt$

$\int_0^s ds = \int_0^t 30t\,dt$

$\int_0^s ds = \int_0^{5sec} 30t\,dt$

$s = \left[30 \times \frac{t^2}{2}\right]_0^5$

$= 15 \times (5)^2$

$s = 375m$

Equation for distance travelled $5s \le t$ 15s

$\int_{375}^{s} ds = \int_5^t (-15t + 225t)\,dt$

$[s]_{375}^{s} \left[\frac{-15t^2}{2} + 225\right] - \left[-\frac{15 \times 5^2}{2} + 225 \times 5\right]$ - (2)

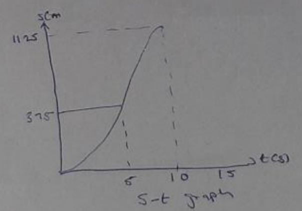
$s - 375 = (-7.3t^2 + 225t) - 937.5$

$s = (-7.5t^2 + 225t - 562.5)\,m$ - (3)

Sub $t = 15sec$ in eqn (3)

$s = (-7.5(15)^2 + 225 \times 15 - 562.5)m$

$s = 1125m$



F12-11

$v\,dv = a\,ds$

$v = 0.25s$

$\frac{dv}{ds} = 0.25$

$dv = 0.25ds$

$a\,ds = (0.25s) \cdot (0.25ds)$

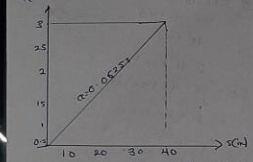
$a = 0.25s \times 0.25$

$a = 0.0625s$

at $s = 40$

$a = 0.0625(40)$

$a = 2.5 m/s^2$



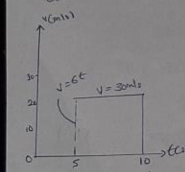
This graph represent a-s graph for given v-s graph.

F12-12

Solution

$0 \le t \le 5s,\ s = 3t^2$

$v = \frac{ds}{dt} = 30m/s$



$v = \frac{\Delta s}{\Delta t}$

$\therefore = \frac{225 - 25}{10 - 5} = 40m/s$

a-t graph

$0 \le t \le 5s,\ v = 6t\ (m/s)$

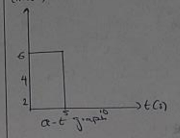
$a = \frac{dv}{dt}$

$= 6m/s^2$

$5 < t \le 10s,\ v = 30m/s$

$a = \frac{dv}{dt} = 0$

(m/s^2)



F12-13

at $0 \le t \le 5$,

$dv = a\,dt$

$\int_0^v dv = \int 20\,dt$

$v = 20t$

at $t = 5s$,

$v = 20(5) = 100m/s$

at $5 \le t \le t$

$a = -10$

$\int_{100}^{v} dv = \int_5^t -10\,dt$

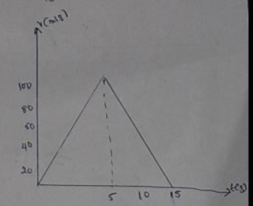
$v\Big|_{100}^{v} = -10t\Big|_5^t$

$v - 100 = -10t + 50$

$v = -10t + 150$

at $t = t'$, $v = 0$

$t = \frac{0 - 150}{-10} = 15$



NAME: AUDI FATIMAH

MATRIC: 18/ENG05/004

DEPT: BIOMEDICAL

MECHANICS

c). The slope of s-t curve is given velocity,

From the s-t curve,

$s = 0.5t^3$ . . . . $0 \le t \le 6$

$s = 108m$ . . . . $6 \le t \le 10$

$\therefore$ for time interval, $0 \le t \le 6$,

$v = \frac{ds}{dt} = \frac{d}{dt}(0.5t^3)$

$v = 0.5 \times 3t^2$

$\because \frac{d}{dt}(t^n) = nt^{n-1}$ *

$v = 1.5t^2$ .. $0 \le t < 6$

at $t = 0$,

$v = 0$

at $t = 6sec$, $v = 1.5 \times 6^2 = 54m/s$

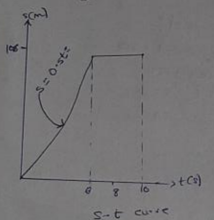
During time interval.

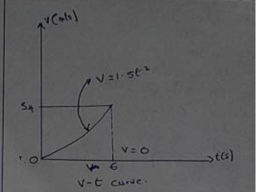
$6 < t \le 10$

Displacement, $s = 108$

s is constant

$\therefore v = \frac{ds}{dt} = 0$ . . . $6 < t \le 10$





F12-10

Given $v = -4t + 80$

$\frac{ds}{dt} = -4t + 80$

$ds = (-4t + 80)\,dt$

$\int ds = \int(-4t + 80)\,dt$

$s = -2t^2 + 80t + c$

Also given $s = 0$ for $t = 0$

$s = -2t^2 + 80t$

$t = 40s$

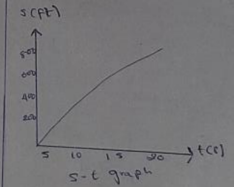
5) $\frac{ds}{dt} = 0 \Rightarrow -4t - 80$

$t = 20s$

$s|_{t=20} = -2 \times (20)^2 + 80$

$= -800 + 1600$

$= 800ft$



$\frac{dv}{dt} = a = -4$