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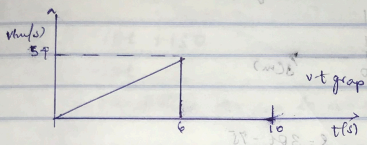
18/Eng/Gol/004
Chemical Engineering

1) Given that $s = 0.5t^3 m$

$v = \frac{ds}{dt}$, $v = 1.5t^2$

So at $t = 6$; $v = 1.5(6)^2 = 54 m/s$

$s_2 = 108m$; $v = \frac{ds}{dt} = 0$; $v = 0 m/s$



2) Given that ; $v = -4t + 80$

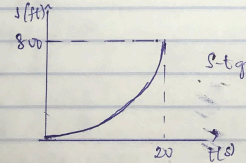
$s = \int v\,dt$

$s = \int_0^{20} -4t + 80\,dt$

$s = [-2t^2 + 80t]_0^{20}$ ∴ at $t = 20$

$s = [-2(20)^2 + 80(20)]$

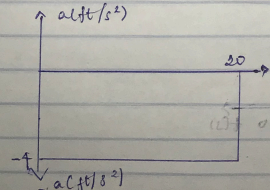
$s = -800 + 1600$ ∴ $s = 800 ft$



$v = (-4t + 80) ft/s$

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

$a = -4 ft/s^2$



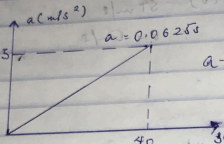
3) $v = (0.25s)\ m/s$

$a = v\left(\frac{dv}{ds}\right)$ $\therefore a = 0.25s(0.25)$

$a = 0.0625s)\ m/s^2$

at $s = 40m$ ~~at~~

$a = (0.0625 \times 40) \therefore a = 2.5\ m/s^2$

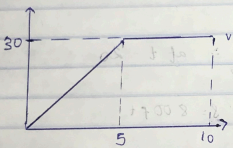


a-s graph

4) $s = 3t^2$ $s = 30t - 75$

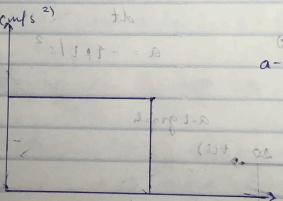
$v = 6t$ $v = 30\ m/s$

at $t = 5$ $v = 6 \times 5$; $v = 30\ m/s$



$v = (6t)\ m/s$ $v = 30m/s$

$a = 6m/s^2$ $a = 0\ m/s^2$



a-t graph

5 $a = 20m/s^2$

$\int dv = \int a \cdot dt$

$\int_0^v dv = \int_0^t$

at $t = 5s$

$v = 100\ m/s$

$\int_{100} dv =$

$v - 100 = -10$

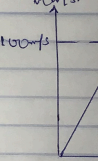
$v - 100 = -$

at $v = 0$

$0 = -$

$\therefore -150 = -$

$t = 15s$



6 $v = 30t$

$\int ds = \int v\,dt$

$\int_0^5 ds =$

$5 = 15$

at $t = 5$

$v = -15t$

$\int^5 ds$

375

$s - 3$

$s - 375 =$

5 $a = 20 m/s^2$ $a = -10 m/s^2$

$\int dv = \int a \cdot dt$

$\int_0^v dv = \int_0^t 20 \cdot dt$; $v = 20t$

at $t = 5s$

$v = 100 m/s$

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

$v - 100 = -10(t-5)$

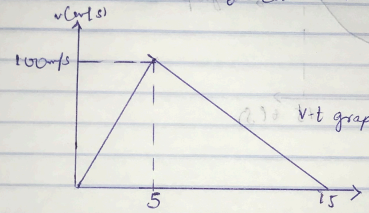
$v - 100 = -10t + 50$ $\therefore v = (-10t + 150)\ m/s$

at $v = 0$

$0 = -10t + 150$

$\therefore -150 = -10t$

$t = 15$ sec (time for car to come to rest)



6 $v = 30t$

$\int ds = \int v dt$

$\int_0^5 ds = \int_0^t (30t)\, dt$

$5 = 15t^2$

at $t = 5s$ $\therefore s = 15(5)^2$ $\therefore s = 375 m$

$v = -15t + 225$

$\int_{375}^{s} ds = \int_6^t (-15t + 225)\, dt$

$s - 375 = \left(\frac{-15t^2}{2} + 225t\right)_5^t$

$s - 375 = \left(\frac{-15t^2}{2} + 225t\right) - \left(\frac{-15(5)^2}{2} - 225(5)\right)$

$$s - 375 = \left(\frac{-15t^2}{2} + 225t\right) - 937.5$$

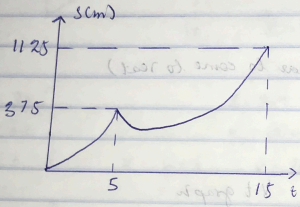
$$s = \frac{-15t^2}{2} + 225t - 937.5 + 375$$

$$s = \frac{-15t^2}{2} + 225t - 562.5$$

at $t = 15s$

$$s = \frac{-15(15)^2}{2} + 225(15) - 562.5$$

$s = 1125m$ (total distance covered)



s-t graph.