

AKA PEACE OTOGHENE

.18/ENGO1/002

CHEMICAL ENGINEERING

1.  $V = (4t - 3t^2) \text{ m/s}$

when  $t=0 \text{ secs}$ ,  $S=0$ ,  $t=4 \text{ s}$ ,  $S=?$

$$\int_0^S ds = \int_0^4 V dt$$

$$\int_0^S ds = \int_0^4 (4t - 3t^2) dt$$

$$S = \left[ \frac{4t^2}{2} - \frac{3t^3}{3} \right]_0^4$$

$$S = [2t^2 - t^3]_0^4$$

$$S = 2(4)^2 - 4^3$$

$$S = -32 \text{ m}$$

2.  $V = (0.5t^3 - 8t) \text{ m/s}$

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

$$a = (0.5t^3 - 8t)$$

$$a = 1.5t^2 - 8$$

when  $t=2 \text{ s}$

$$a = 15(2)^2 - 8$$

$$a = -2 \text{ m/s}^2$$

3.  $a = (4t^2 - 2) \text{ m/s}^2$

when  $t=0$ ,  $S=2 \text{ m}$ .

when  $t=2 \text{ s}$ ,  $S=2 \text{ m}$ .

when  $t=4 \text{ s}$ ,  $S=?$

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

$$V = \int a \, dt$$

$$V = \int (4t^2 - 2) \, dt$$

$$V = \frac{4t^3}{3} - 2t + C_1 \quad \text{--- (1)}$$

$$S = \int V \, dt$$

$$S = \frac{4}{3} \cdot \frac{1}{4} t^4 - \frac{2t^2}{2} + C_1 t + C_2$$

$$S = \frac{1}{3} t^4 - t^2 + C_1 t + C_2 \quad \text{--- (2)}$$

When  $t=0$ ,  $S=-2$ .

$$-2 = \frac{1 \cdot 0^4}{3} - 0^2 + C_1 \cdot 0 + C_2$$

$$C_2 = -2$$

When  $t=2$ ,  $S=-20$  and  $C_2=-2$

$$-20 = \frac{1(2)^4}{3} - 2^2 + C_1 \cdot 2 + (-2)$$

$$-20 = \frac{16}{3} - 4 + 2C_1 - 2$$

$$-20 + 2 - \frac{16}{3} + 4 = 2C_1$$

$$-19.33 = 2C_1$$

$$C_1 = \frac{-19.33}{2}$$

$2 = -9.67$  Putting  $C_1 = -9.67$  &  $C_2 = -2$  in equ (2)

$$S_{at\ 4} = \frac{1(4)^4}{3} - 4^2 + (-9.67 \times 4) + (-2)$$

$$S = 85.33 - 16 + (-38.64) - 2$$

$$S = 28.69 \text{ m.}$$

$$Ques \quad ds = v dt$$
$$dt = \frac{ds}{v} \text{ --- (1)}$$

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

$$dt = \frac{dv}{a} \text{ --- (2)}$$

Equating 1 and 2.

$$\frac{ds}{v} = \frac{dv}{a}$$

$$a = \frac{v dv}{ds}$$

$$dv = (20 - 0.05s^2) ds$$

$$dv = -0.15 ds$$

$$a = \frac{(20 - 0.05s^2) \cdot [-0.15] ds}{ds}$$

$$a = -20 + 0.05s^3$$

$$a(s) = -2[15] + 0.05[15]^3$$

$$a = -13.125 \text{ m/s}^2$$