

# MECHANICS

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MATRIC NO.: 18/ENG01/015

DEPT. : CHEMICAL

ENGINEERING

COURSE. : ENGINEERING

MECHANICS

ENG234

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1)  $v = (4t - 3t^2) \text{ms}^{-1}$   
When  $s = \int v dt$   $t = 4$   
When  $s = 0$   $t = 0$

$\therefore ds = \int v dt$   
 $= \int (4t - 3t^2) dt$   
 $= \frac{4t^2}{2} - \frac{3t^3}{3}$   
 $ds = 2t^2 - t^3 \quad k$

$ds = 2t^2 - t^3$   
 $s_2 - s_1 = 2t^2 - t^3$   
 $s = \int_0^4 (2t^2 - t^3) dt$   
 $= (2t^3/3 - t^4/4) \Big|_0^4$   
 $= (2(4)^3/3 - (4)^4/4) - (0)$   
 $= 32t^3/3 - 64$   
 $s = 32 \text{ms}$

2)  $v = (0.5t^3 - 8t) \text{ms}^{-1}$   $t = 20$   
 $a = \frac{dv}{dt}$   
 $= \frac{d(0.5t^3 - 8t)}{dt}$   
 $a = 1.5t^2 - 8$   
When  $t = 20$   
 $a = 1.5(20)^2 - 8$   
 $= 2000 \text{ms}^{-2}$  (Retardation)

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

$$v = (20 - 0.05t^3) \text{ m/s}$$

$$\frac{dv}{ds} = -0.15$$

$$dv = -0.15 ds$$

$$dv = 0.15 ds$$

$$\Rightarrow ds = \frac{1}{0.15} dv$$

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

$$a = \frac{dv}{dt} \Rightarrow -0.15 ds = \frac{dv}{dt}$$

$$\text{but } \frac{ds}{dt} = v = (20 - 0.05t^3) \text{ m/s}$$

$$\therefore a = -0.15 \frac{ds}{dt}$$

$$= -0.15 \times (20 - 0.05t^3)$$

$$a = -3 + 0.0075t^3$$

$$\text{but } t = 15 \text{ m}$$

$$a = -3 + 0.0075(15)^3$$

$$= -3 + 16.875$$

$$= 13.875 \text{ m/s}^2$$

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

$$a = \frac{dv}{dt} \quad \text{and} \quad a = \frac{d^2s}{dt^2}$$

$$\therefore v = \int a dt$$

$$= \int (4t^2 - 2) \text{ m/s}^2 dt$$

$$v = \left( \frac{4t^3}{3} - 2t + C \right) \text{ m/s}$$

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

$$s = \int v dt$$

$$= \int (3t^3 - 2t + c) dt \text{ ms}^{-1}$$

$$s = \left( \frac{3}{4}t^4 - t^2 + ct + k \right) \text{ ms}^{-1}$$

at  $t=0$   $s=2$  (negative because it is to the left)

$$s = \frac{3}{4}t^4 - t^2 + Ct + k$$

$$-2 = \frac{3}{4}(0)^4 - (0)^2 + C(0) + k$$

$$\therefore k = -2$$

$$\therefore s = \frac{3}{4}t^4 - t^2 + Ct - 2$$

At  $t=20$   $s=20m$

$$-20 = \frac{3}{4}(20)^4 - (20)^2 + C(20) - 2$$

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

$$C = \frac{-19.67}{2}$$

$$= -9.667m$$

$$s = \frac{3}{4}t^4 - t^2 - 9.67t - 2$$

When  $t=4$

$$s = \frac{3}{4}(4)^4 - (4)^2 - 9.67(4) - 2$$

$$= 28.7m$$