

AKA PEACE OTAOGHENE 18/ENG01/002

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181ENG011002

CHEMICAL ENGINEERING

ENGINEERING MECHANICS (ENG 234)

1. $S = 0.5t^3$

at $0 < t < 6 \text{ sec}$

$$V = \frac{ds}{dt} = 1.5t^2 \text{ m/s}$$

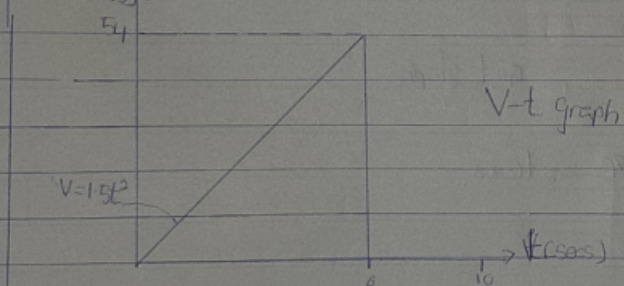
$$\frac{dV}{dt} = 1.5(6)^2 = 54 \text{ m/s}^2$$

$6 < t < 10 \text{ sec}$

$$S = 108$$

$$V = \frac{ds}{dt} = 0 \text{ m/s}$$

Var. $\frac{ds}{dt}$



2. $V = -4t + 80$

$$S \equiv \int_0^t ds = \int_0^t dt$$

$$S = \int_0^{20} (-4t + 80) dt$$

$$S = \left[-2t^2 + 80t \right]_0^{20}$$

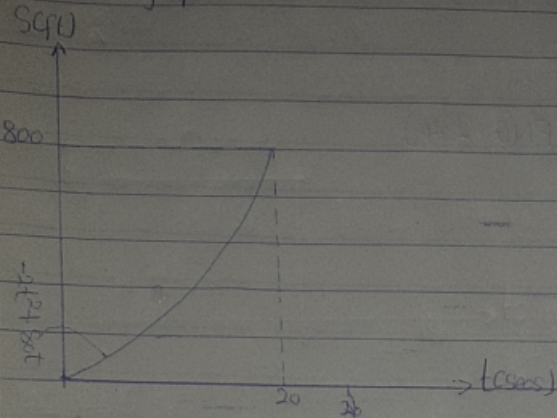
$0 < t < 20 \text{ sec}$

$$S = \left[-2(20)^2 + 80(20) \right]$$

$$S = -800 + 1600$$

$$S = 800 \text{ ft}$$

S-t graph

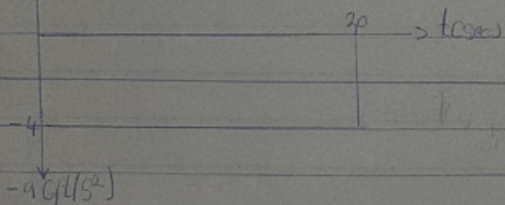


$$V = (-4 + 80t) \text{ m/s}$$

$$0 < t < 20 \text{ s}$$

$$a = \frac{dv}{dt} = -4 \text{ m/s}^2$$

a-t graph



3. $V = (0.25S) \text{ m/s}$

$$a \, ds = v \, dv$$

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

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

$$a = (0.25s)(0.25)$$

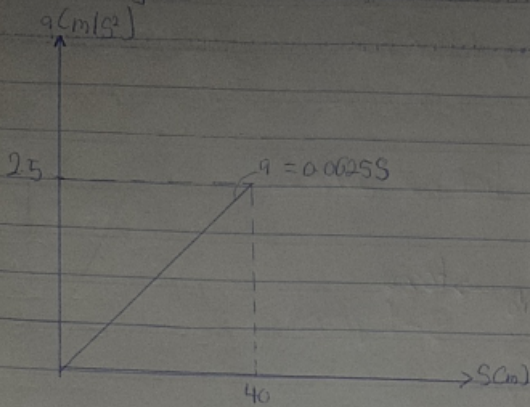
$$a = 0.0625 \text{ m/s}^2$$

$$\text{At } S = 40 \text{ m}$$

$$a = 0.0625 \times 40$$

$$a = 2.5 \text{ m/s}^2$$

a - S graph



$$4 \quad S = 3t^2$$

$$0 \leq t \leq 5 \text{ sec}$$

$$V = \frac{dS}{dt} = 6t$$

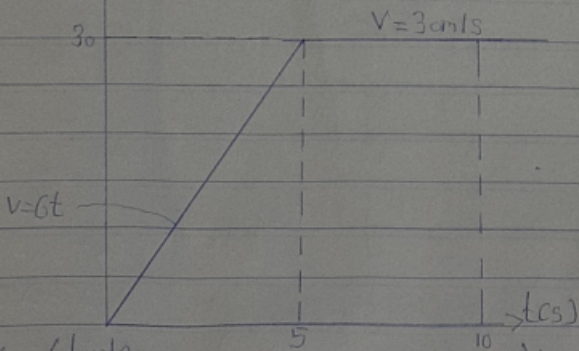
$$V = 6 \times 5 = 30 \text{ m/s}$$

$$5 \leq t \leq 10 \text{ sec}$$

$$S = 30t - 75$$

$$V = 30 \text{ m/s}$$

V (m/s)



V-t graph

$$V = 6t \text{ m/s}$$

$$0 \leq t \leq 5 \text{ sec}$$

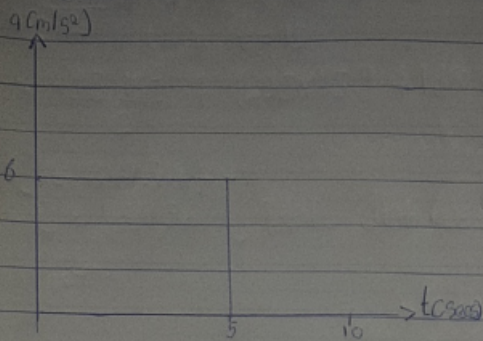
$$a = \frac{dV}{dt} = 6 \text{ m/s}^2$$

$$V = 30 \text{ m/s}$$

$$5 \leq t \leq 10 \text{ sec}$$

$$a = \frac{dV}{dt} = 0 \text{ m/s}^2$$

$a-t$ graph.



5 $0 \leq t \leq 5$ sec

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

$$dv = a dt$$

$$\int_0^v dv = \int_0^t 2 dt$$

$$v = 2t$$

When $t = 5$

$$v = 2 \times 5$$

$$= 10 \text{ m/s}$$

5 $5 \leq t \leq 10$ sec

$$a = -10 \text{ m/s}^2$$

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

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

$$v - 10 = -10t - (-10 \times 5)$$

$$v - 10 = -10t + 50$$

$$v = -10t + 60$$

When $v = 0$

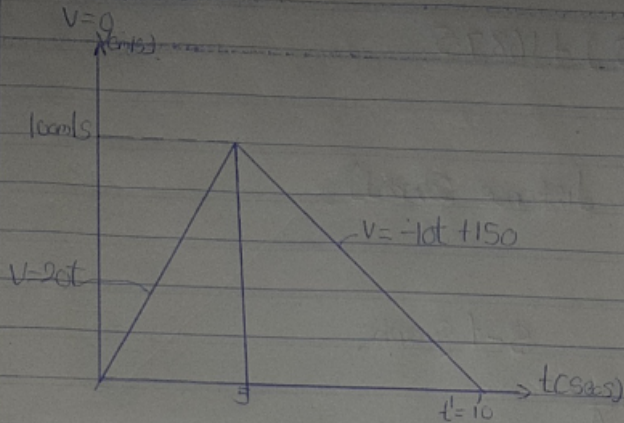
$$0 = -10t + 60$$

$$10t = 60$$

$$t = \frac{60}{10} = 6 \text{ Sec}$$

$$5 < t < 15 \quad t' = 15 \text{ Secs}$$

$$V = -10t + 150$$



$$6 \quad 0 < t < 15 \text{ Secs}$$

$$0 < t < 5 \text{ Secs} \quad V = 30t$$

$$\int_0^5 ds = \int_0^5 v dt$$

$$\int_0^5 ds = \int_0^5 30t dt$$

$$S = 15t^2$$

$$S = 15(5)^2$$

$$S = 375 \text{ m}$$

$$5 < t < 15 \text{ Secs} \quad V = -15t + 225$$

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

$$S - 375 = \left[\frac{-15t^2}{2} + 225t \right]_5^t$$

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

$$S - 375 = \left[\frac{-15t^2}{2} + 225t \right] + 1312.5$$

$$S - 375 = \frac{-15t^2}{2} + 225t + 1312.5$$

$$S = \frac{-15t^2}{2} + 225t + 1312.5 + 375$$

$$S = -15t^2 + 225t + 1687.5$$

when $t = 15$

$$S = \frac{-15(15)^2 + (225 \times 15) + 1687.5}{2}$$

$$S = 3375m$$

$S = 3375m$ (Total distance covered)

