

Fig 12-7

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Petroleum engineering

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

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

$$v = \frac{4}{3} t^3 - 2t + C_1$$

$$s = \int \left(\frac{4}{3} t^3 - 2t + C_1 \right) dt$$

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

$$\text{at } t = 0, s = -2 = C_2$$

$$\text{at } t = 2, s = -20, \Rightarrow C_1 = -9.70$$

$$\text{at } t = 4$$

$$s(4) = \frac{1}{3} (4)^4 - (4)^2 + (-9.7)(4) + (-9.7)$$

$$= 28.7 \text{ m}$$

FIG 12-3 (1)

$$v = (4t - 3t^2)$$

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

$$(4t - 3t^2) = \frac{ds}{dt}$$

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

$$\int_{t_1}^{t_2} (4t - 3t^2)dt$$

$$= \int_{s_1}^{s_2} ds$$

$$\left[4 \times \frac{t^2}{2} - 3 \times \frac{t^3}{3} \right]_{t_1}^{t_2} = [s]_{s_1}^{s_2}$$

$$\left[2 \times t^2 - t^3 \right]_{t_1}^{t_2} = s_2 - s_1$$

$$\left[2 \times t^2 - t^3 \right]_4^0 = s_2 - 0$$

$$s_2 = [2 \times 4^2 - 4^3] + 0$$

$$s_2 = 32 \text{ m}$$

FIG 12-4 (2)

$$v = 0.5t^3 - 8t$$

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

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

$$t = 2$$

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

FIG 12-8 (3)

$$v = (20 - 0.05s^2) \text{ m/s}$$

$$dt = \frac{ds}{v} \text{ and } dt = \frac{dv}{a}$$

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

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

$$dv = -2 \times 0.05s ds$$

$$= -0.1s ds$$

$$a = (20 - 0.05s^2) \cdot (-0.1s) ds$$

$$a = -2s + 0.005s^3$$

$$a(s=15) = -2 \times 15 + 0.005 \times 15^3$$

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