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Soln:

I.

$$v = (4t - 3t^2) \text{ m/s} \quad t = 0, s = 0; t = 4$$

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

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

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

$$s = \left[\frac{4t^2}{2} - \frac{3t^3}{3} \right] + C$$

$$s = [2t^2 - t^3] + C$$

$$s = 2(4)^2 - (4)^3 - [0]$$

$$s = 32 - 64$$

$$s = -32 \text{ m} \quad \therefore s = 32 \text{ m}$$

\therefore The position of particle is to the left of the origin.

2. $v = (0.5t^3 - 8t) \text{ m/s}$, $t = 2 \text{ s}$, $a = ?$

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

$$a = \frac{d}{dt} (0.5t^3 - 8t)$$

$$a = (1.5t^2 - 8) \text{ m/s}^2$$

$$\text{at } t = 2 \text{ s}$$

$$= 1.5(2)^2 - 8$$

$$= (1.5 \times 4) - 8$$

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

\therefore This implies that the particle is decelerating.

$$8. a = (4t^2 - 2)$$

$$a = \frac{dv}{dt} = (4t^2 - 2)$$

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

$$\int \frac{dv}{v} = \int (4t^2 - 2) dt$$

$$v = \left[\frac{4t^3}{3} - 2t + C_1 \right] \text{ m/s.}$$

$$\therefore v = \frac{ds}{dt} = \left(\frac{4t^3}{3} - 2t + C_1 \right) \text{ m/s.}$$

~~$$\frac{ds}{dt} = \left[\frac{4t^3}{3} - 2t + C_1 \right]$$~~

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

$$s = \left[\frac{4t^4}{2 \times 4} - \frac{2t^2}{2} + C_1 t + C_2 \right] \text{ m.}$$

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

$$\text{At } t=0, s = -2 \text{ m.}$$

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

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

$$\therefore C_2 = -2 //$$

$$\text{At } t=2, s = -20 \text{ m.}$$

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

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

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

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

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

$$2C_1 = -19.33$$

$$C_1 = -9.67 //$$

$$C_2 = -2 //$$

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

$$s = \frac{1}{3} t^4 - t^2 - 9.67t - 2 //$$

$$At = 4s, S = ?$$

$$S = \frac{1}{2} (4)^2 = (4)^2 - 9.67 (4) - 2.$$

$$S = \frac{256}{2} - 16 - 38.668 - 2$$

$$S = \frac{256}{2} = -56.668$$

$$S = 28.667m$$

$$4. V = (20 - 0.055t^2)$$

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

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

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

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

$$\therefore a = (20 - 0.055t^2)(-0.15)$$

$$At = 15m$$

$$a = (20 - 0.055(15)^2)(-0.15)$$

$$a = (8.75)(-0.15)$$

$$a = -13.125 m/s^2$$

$$a = -13.13 m/s^2$$

\therefore The particle is decelerating.