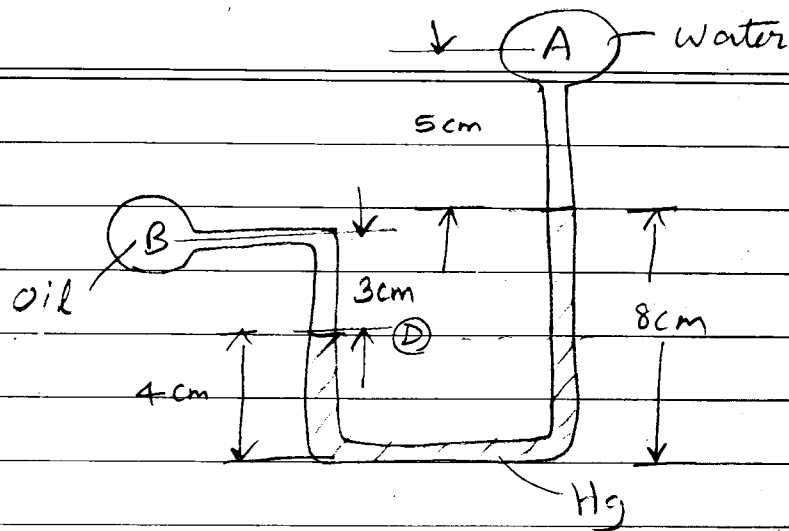


①



At point D :

$$p_B + \rho_{oil} \times 0.03 \text{ m} \times g$$

$$= p_A + \rho_w \times 0.05 \text{ m} \times g$$

$$+ \rho_{Hg} \times 0.04 \text{ m} \times g$$

$$p_B = (1.013 \times 10^5 + 1000 \times 0.05 \times 9.8 + 13.56 \times 10^3 \times 0.04 \times 9.8 - 800 \times 9.8 \times 0.03) \text{ Pa}$$

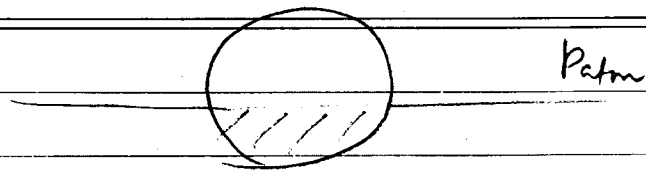
$$= 106870.32 \text{ Pa}$$

$$= 106.87 \text{ kPa}$$

Correct answer :

Ⓒ

2



$$\text{Given } V_{\text{sub}} = 0.4 V_{\text{tot}}$$

$$\text{buoyancy force} = \rho_w V_{\text{sub}} g \quad (\text{upward})$$

$$\text{weight of the sphere} = \rho_s V_{\text{tot}} g \quad (\text{downward})$$

$$\text{Floating} \Rightarrow \rho_w V_{\text{sub}} g = \rho_s V_{\text{tot}} g$$

$$\Rightarrow \frac{\rho_s}{\rho_w} = \frac{V_{\text{sub}}}{V_{\text{tot}}}$$

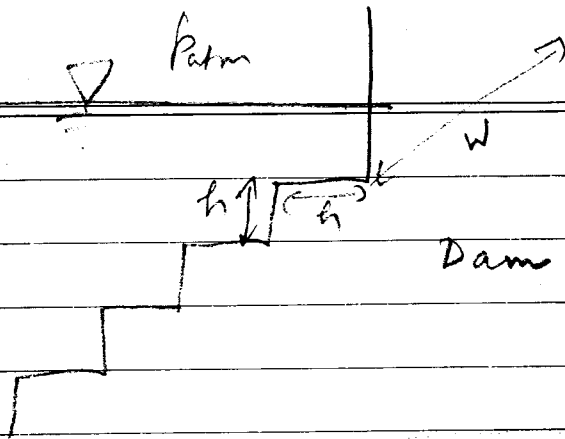
$$\rho_s = \rho_w \left(\frac{V_{\text{sub}}}{V_{\text{tot}}} \right) \rightarrow 0.4$$

$$\rho_s = 0.4 \times 1000 \text{ kg/m}^3$$

$$\rho_s = 400 \text{ kg/m}^3$$

Correct answer: (A)

③



Vertical hydrostatic force

$$= hW (P_{atm} + \rho g h) + (P_{atm} + \rho g 2h) \\ + (P_{atm} + \rho g 3h) + (P_{atm} + \rho g 4h)$$

$$= hW [4 P_{atm} + \rho g 10 h]$$

$$= 0.3 \times 3 [4 \times 0.13 \times 10^5 + 1000 \times 9.8 \times 10 \times 0.3]$$

$$= 391140 \text{ N} = \underline{\underline{391.14 \text{ kN}}}$$

Correct Answer (D) ✓

4

$$\underline{v} = x \underline{i} - y \underline{j}$$

$$v_x = x \quad v_y = -y$$

$$\frac{\partial v_x}{\partial t} = 0 \quad \frac{\partial v_x}{\partial x} = 1 \quad \frac{\partial v_x}{\partial y} = 0$$

$$\frac{\partial v_y}{\partial t} = 0 \quad \frac{\partial v_y}{\partial x} = 0 \quad \frac{\partial v_y}{\partial y} = -1$$

$$a_x = \frac{Dv_x}{Dt} = \underbrace{\frac{\partial v_x}{\partial t}}_0 + v_x \frac{\partial v_x}{\partial x} + v_y \frac{\partial v_x}{\partial y}$$

$$a_x = x(1) + (-y) \cdot 0$$

$$a_x = x$$

$$a_y = \frac{Dv_y}{Dt} = \underbrace{\frac{\partial v_y}{\partial t}}_0 + v_x \frac{\partial v_y}{\partial x} + v_y \frac{\partial v_y}{\partial y}$$

$$= x \cdot 0 + (-y)(-1)$$

$$= y$$

$$\underline{a} = x \hat{i} + y \hat{j}$$

$$\underline{a}(1,1) = \hat{i} + \hat{j}$$

Correct answer (A)

4