

2013 Q9.

(a) Density = $\frac{\text{mass}}{\text{Volume}}$ $\rho = \frac{m}{V} \Rightarrow m = \rho V$

$$m_A + m_B = M_{\text{mixture}}$$

$$\Rightarrow 800V_1 + 900V_2 = 880(V_1 + V_2)$$

$$\Rightarrow 800V_1 + 900V_2 = 880V_1 + 880V_2$$

$$\Rightarrow 20V_2 = 80V_1$$

$$\Rightarrow V_2 = 4V_1$$

$$\text{Mass of mixture} = 0.44 \text{ kg}$$

$$\Rightarrow 880(V_1 + V_2) = 0.44$$

$$\Rightarrow 880(V_1 + 4V_1) = 0.44$$

$$\Rightarrow 880(5V_1) = 0.44$$

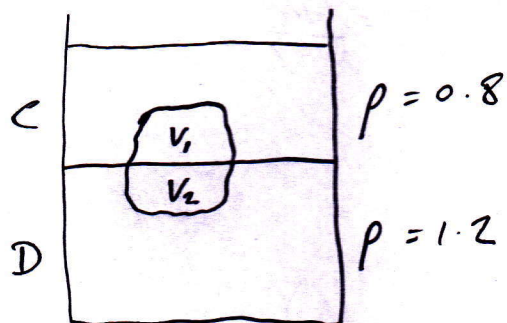
$$\Rightarrow 4400V_1 = 0.44$$

$$\Rightarrow V_1 = 0.0001 \text{ m}^3 \quad (= 100 \text{ cm}^3)$$

$$\text{Similarly } V_2 = 0.0004 \text{ m}^3 \quad (= 400 \text{ cm}^3)$$

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(b)



$$w = V\rho g$$

$$w = w_1 + w_2 \quad \text{or} \quad B_c + B_D$$

$$(V_1 + V_2)\rho g = V_1 800g + V_2 1200g$$

$$\Rightarrow V_1 \rho g + V_2 \rho g = V_1 800g + V_2 1200g$$

$$\Rightarrow V_1(\rho - 800) = V_2(1200 - \rho)$$

$$\Rightarrow \frac{V_1}{V_2} = \frac{1200 - \rho}{\rho - 800}$$

The fraction of the object immersed is

$$\frac{V_2}{V_1 + V_2} = \frac{1}{\frac{V_1 + V_2}{V_2}} = \frac{1}{\frac{V_1}{V_2} + 1} = \frac{1}{\frac{V_1}{V_2} + 1}$$

$$= \frac{1}{\frac{1200 - \rho}{\rho - 800} + 1} = \frac{1}{\frac{1200 - \rho + \rho - 800}{\rho - 800}} = \frac{1}{\frac{400}{\rho - 800}}$$

$$= \frac{\rho - 800}{400} \Rightarrow a = 400$$