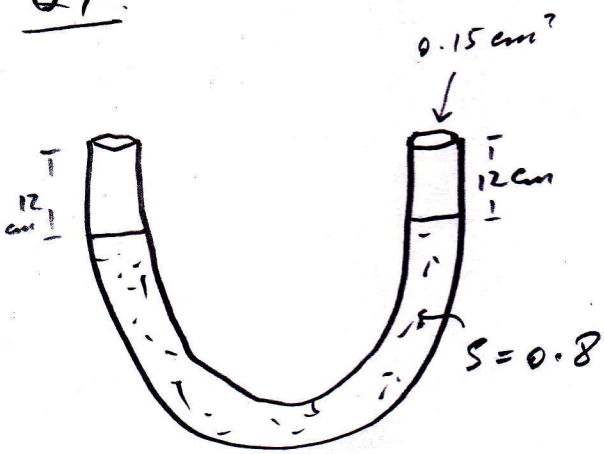
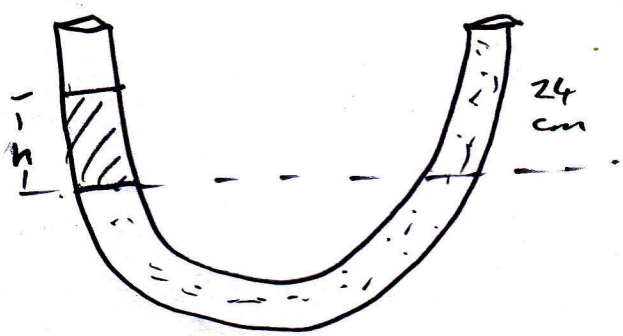
2011 Q9

(a)





Pressure at a point $= h\rho g$

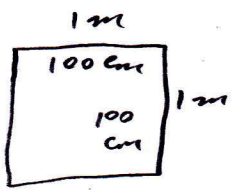
$\Rightarrow \quad 1000gh = 800g(0.24)$

$\Rightarrow \quad h = 0.192\ m$

Volume $= h \times$ Area

Area $= 0.15\ cm^2$

$= 0.15 \times 10^{-4}\ m$



$\Rightarrow 1\ m^2 = 10000\ cm^2$

$\Rightarrow$ Volume $= 0.192 \times 0.15 \times 10^{-4}$

$= 0.0288 \times 10^{-4}$

$= 2.88 \times 10^{-6}\ m^3$

(b)

S_A = Rel. Density of liquid A

S_c = Rel. Density of the cylinder.

Liquid A:

$$B_A = W$$

$$\Rightarrow \frac{\frac{1}{3} W S_A}{S_c} = W$$

$$\Rightarrow \frac{1}{3} S_A = S_c$$

$$\Rightarrow S_A = 3 S_c$$

Liquid B:

$$B_B = W$$

$$\Rightarrow \frac{\frac{3}{5} W S_B}{S_c} = W$$

$$\Rightarrow \frac{3}{5} S_B = S_c$$

$$\Rightarrow S_B = \frac{5 S_c}{3}$$

A + B Mixture:

$$B_M = W$$

$$\Rightarrow \frac{y W S_M}{S_c} = W$$

$$\Rightarrow S_M = \frac{S_c}{y}$$

Let y = fraction of the cylinder in the mixture.

$$S_A V + S_B V = S_M (2V)$$

$$\Rightarrow S_A + S_B = 2 S_M$$

$$\Rightarrow 3 S_c + \frac{5}{3} S_c = \frac{2}{y} S_c$$

$$\Rightarrow \frac{14}{3} S_c = \frac{2}{y} S_c$$

$$\Rightarrow 14 y = 6 \quad \Rightarrow y = \frac{3}{7}$$