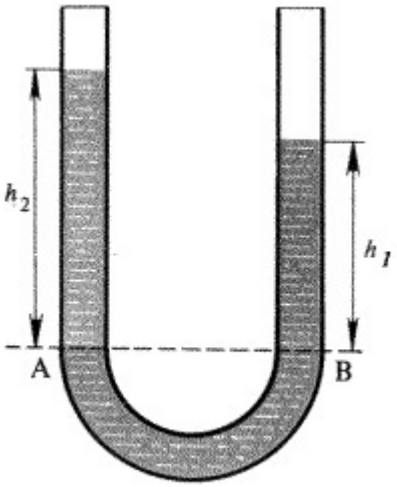
U-shaped tube of cross-sectional area of 2 cm^2 has a certain amount of water in it. 9 cm^3 of kerosene is poured in one limb and the level difference of water becomes 3.6 cm. Find the volume of benzene to be poured in the other limb so that the water level in both limbs is the same (water's density = 1000 kg/m^3, benzene's density = 900 kg/m^3).

Solution: According to the Pascal's law, pressures in communicating vessels are equal to each other:



$\rho_1 \cdot g \cdot h_1 = \rho_2 \cdot g \cdot h_2$ where ρ_1, h_1 and ρ_2, h_2 are the corresponding densities and level differences of water and kerosene, kg/m^3 and cm, respectively. When we will pour such volume of the benzene in the second limb, that the water level in both limbs will be the same, we can write a new equation: $\rho_2 \cdot g \cdot h_2 = \rho_3 \cdot g \cdot h_3$, where ρ_2, h_2 and ρ_3, h_3 are the corresponding densities and level heights of kerosene and benzene, kg/m^3 and cm, respectively. Comparing these two equations, we can make a conclusion that $\rho_1 \cdot g \cdot h_1 = \rho_3 \cdot g \cdot h_3$;

$$h_3 = \frac{\rho_1 \cdot h_1}{\rho_3} = \frac{1000 \cdot 3.6}{900} = 4 \text{ cm};$$

Then, volume of benzene is: $V = A \cdot h_3 = 2 \cdot 4 = 8$ cm^3, where A is the cross-sectional area, cm^2.

Answer: 8 cm^3.