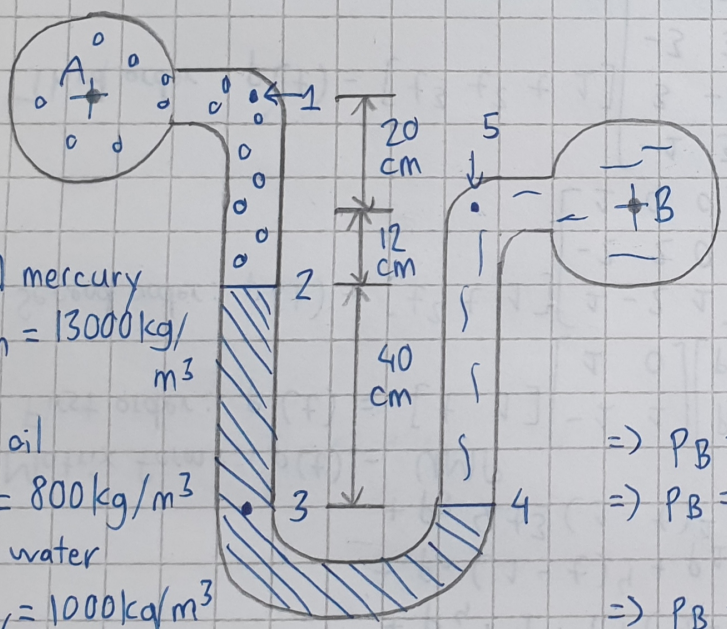
Nguyen Xuan Binh 887799 Round 1 Exercise 2

An U-manometer has oil, mercury, and water as shown in the diagram. What's the pressure difference between the pipes A and B with the given dimensions?



mercury
$\rho_m = 13000 kg/m^3$

oil
$\rho_o = 800 kg/m^3$

water
$\rho_w = 1000 kg/m^3$

We have:

$A \to 1: \Delta p = 0$

$1 \to 2: \Delta p = \rho_o g (0.2 + 0.12) m$

$2 \to 3: \Delta p = \rho_m g\, 0.4m$

$3 \to 4: \Delta p = 0$

$4 \to 5: \Delta p = -\rho_w g (0.4 + 0.12) m$

$5 \to B: \Delta p = 0$

$\Rightarrow p_B = p_A + \rho_o g\, 0.32 + \rho_m g\, 0.4 - \rho_w g\, 0.52$

$\Rightarrow p_B = p_A + (9.81 m/s^2)(800 \cdot 0,32 + 13000 \cdot 0,4 - 1000 \cdot 0,52)$

$\Rightarrow p_B = p_A + 48422.16 Pa$

$\Rightarrow p_B$ is more than $p_A \approx 48.422 kPa$