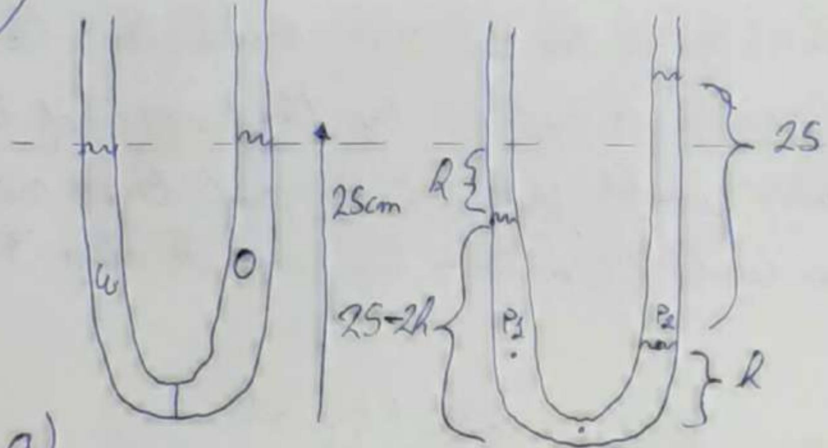
1).



a).

$P_1 = P_2$

$\cancel{P_0} + \rho_w \cdot \cancel{g} \cdot (25 - 2h) = \cancel{P_0} + \rho_o \cdot \cancel{g} \cdot 25$

$\rho_w \cdot 25 - \rho_w \cdot 2 \cdot h = \rho_o \cdot 25 \rightarrow h = \dfrac{25 \cdot (\rho_w - \rho_o)}{2}$

$h = 2{,}5$ cm

Watch column: 22,5 cm

Oil column: 27,5 cm

b).

i). If both liquids had the same density, it could be treated like the same liquid, therefore the columns would be the same, 25 cm.

II) If the density of the oil was much less, the flow of water would be affected by the pressure of the oil, so the water would just get to equilibrium normally. One column would be 12,5cm high and the other 37,5cm.

2). $r = 4{,}1\,mm$ $\rho = 1{,}03 \cdot 10^3$ $F = 1{,}5\,N$

$F = P \cdot A$ $P = \rho \cdot g \cdot h$

$\downarrow$

$F = \rho \cdot g \cdot h \cdot A \rightarrow 1{,}5 = \rho \cdot g \cdot h \cdot \pi R^2$

$$h = \frac{1{,}5}{\rho \cdot g \cdot h \cdot \pi R^2} = \underline{2{,}8\,m}$$

3). $m_{wood} = 45\,N$ $r = 0{,}15\,m$ $\rho = 0{,}850\,g/cm^3$ $h = \cancel{75{,}0}$ $0{,}75\,m$

a). $F = P \cdot A \rightarrow P = F/A \rightarrow P = \dfrac{45}{0{,}15^2 \cdot \pi} \rightarrow \underline{P_1 = 636\,Pa}$

b) $P_2 = F/A = \dfrac{45 + 83}{0{,}15^2 \cdot \pi} \rightarrow \underline{P_2 = 1810\,Pa}$

I). $P_{before} = P_1 + \rho \cdot h \cdot g = 636 + 0{,}85 \cdot 0{,}75 \cdot 9{,}8 = 642\,Pa$

$P_{after} = P_2 + \rho \cdot h \cdot g = 1810 + 0{,}85 \cdot 0{,}75 \cdot 9{,}8 = 1816\,Pa$

$\Delta P = 1816 - 642 = \underline{1174\,N}$

II). $P_{before} = P_1 + \rho \cdot g \cdot h = 636 + 0{,}85 \cdot 0{,}375 \cdot 9{,}8 = 639\,Pa$

$P_{after} = P_2 + \rho \cdot g \cdot h = 1810 + 0{,}85 \cdot 0{,}375 \cdot 9{,}8 = 1813\,Pa$

$\Delta P = 1813 - 639 = \underline{1174\,N}$

4).

~~a). This ability tells me that a fish is capable of changing its density to go to the desired depth.~~

a). Since the fish can move freely without effort, we can deduce that the two opposite forces acting on it; the buoyant force and the weight, are the same. And from the Archimedes principle this means that the fish has the same density as the water.

b). $\rho_{water} = 1030\,kg/m^3$

As we said before $\rho_{fluid} = \rho_{fish} = \dfrac{m_{fish}}{V_{fish}} \rightarrow m_{fish} = \rho_{fish} V_{fish}$

$F_B = w_{displaced\ body} = w_{fish} = m_{fish} \cdot g$

$F_B = 2{,}75\,kg \cdot 9{,}8 = 26{,}95\,N \rightarrow$ Before inflating

$\Delta F_B = \rho_{fish} \cdot g \cdot \Delta V_{fish} = \rho_{fish} \cdot g \cdot (1{,}1 - 1) = 0{,}1\,\rho_{fish}\,g$

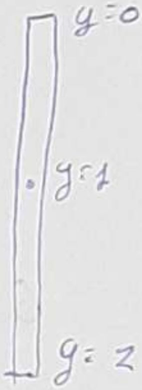
$F_B = 26{,}95\,N + 0{,}1 \cdot 26{,}95\,N = \underline{29{,}645\,N}$

c).

External = FB − m·g = 29,645 − 26,95

External = 2,695 N The fish will go up.

5). Hight = 2 m Width = 4 m



- We evaluate in two parts since it's divided in two.

$$\text{Torque} = \int_2^1 \int \rho \cdot g \cdot dy \cdot dA - \int_1^0 \int \rho \cdot g \cdot dy \cdot dA$$

$$= \rho \cdot g \left[\frac{y^4}{4} \Big|_2^1 - \frac{y^4}{4} \Big|_1^0 \right]$$

$$= \rho \cdot g \cdot \left[\frac{1}{4} - \frac{16}{4} + \frac{1}{4} \right] = 1000 \cdot 9{,}8 \cdot -\frac{7}{2}$$

Torque = −34300 N·m