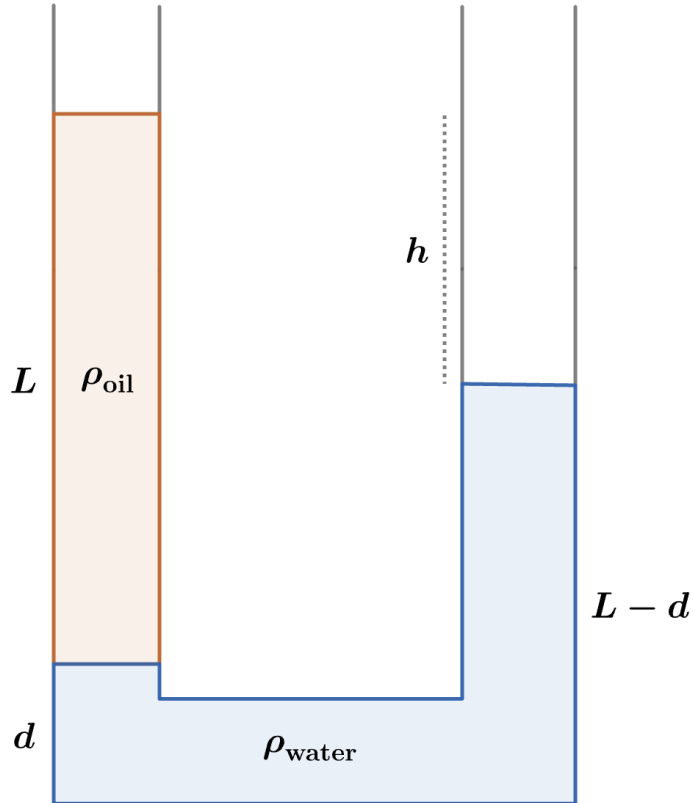# 2015 F=ma Exam: Problem 20

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We compute the pressure at the bottom of the U-tube in two ways: through the left side and through the right side. From the left side,

$$P_{\text{bot}} = P_0 + \rho_{\text{oil}}gL + \rho_{\text{water}}gd$$

From the right side,

$$P_{\text{bot}} = P_0 + \rho_{\text{water}}g(L - d)$$

Since these are equal, we have

$$\rho_{\text{oil}}gL + \rho_{\text{water}}gd = \rho_{\text{water}}g(L - d)$$
$$\rho_{\text{oil}}L = \rho_{\text{water}}(L - 2d)$$

We are given $\rho_{\text{oil}} = \rho_{\text{water}}/2$ so

$$\frac{L}{2} = L - 2d$$

$$2d = \frac{L}{2}$$

$$d = \frac{L}{4}$$

Finally, the height difference h between both sides is

$$h = (L + d) - (L - d) = 2d = 2\left(\frac{L}{4}\right) = \frac{L}{2}$$

so the answer is $\boxed{B}$.

$$\frac{L}{2} = 2$$

$$2d = \frac{L}{2}$$