2016 F=ma Exam: Problem 2

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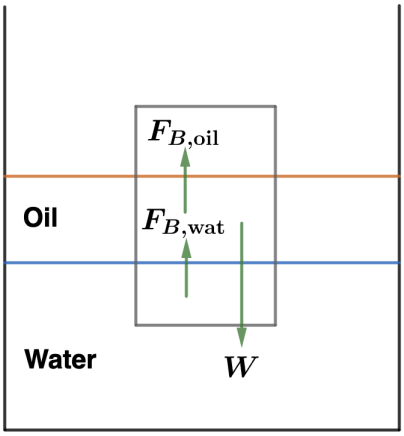
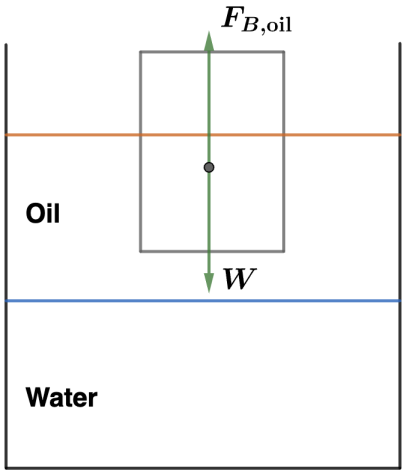


Before additional oil is added, we balance forces on the cylinder. The buoyant forces from the oil and water must equal the weight:

$$W = F_{B,\text{oil}} + F_{B,\text{water}}$$
$$\rho_{\text{obj}} V g = \rho_{\text{wat}} \left(\frac{V}{3}\right) g + \rho_{\text{oil}} \left(\frac{V}{3}\right) g$$

Thus, the density of the object is

$$\rho_{\text{obj}} = \frac{1}{3}(\rho_{\text{wat}} + \rho_{\text{oil}})$$



Once the cylinder is only in oil, recall the ratio of densities yields the fraction of the object submerged in the fluid:

$$f_{\text{sub}} = \frac{\rho_{\text{obj}}}{\rho_{\text{oil}}} = \frac{1}{3}\left(\frac{\rho_{\text{wat}}}{\rho_{\text{oil}}} + 1\right) = \frac{1}{3}\left(\frac{1000}{800} + 1\right) = \frac{3}{4}$$

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