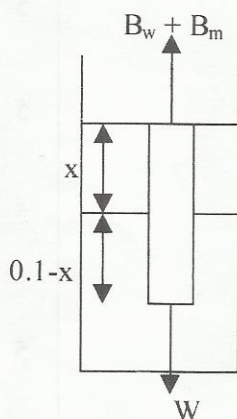9. (a) A uniform cylinder of height 10 cm floats vertically with half of its height immersed in a container of mercury. The relative density of mercury is 13.6. Water is then poured on top of the mercury until the cylinder is covered.

How far does the cylinder rise?

$$B = W$$

$$\frac{\frac{1}{2} W(13.6)}{s} = W$$

$$s = 6.8$$

$$B_w + B_m = W$$

$$\frac{\frac{xW}{0.1}(1)}{6.8} + \frac{\frac{(0.1-x)W}{0.1}(13.6)}{6.8} = W$$

$$\Rightarrow \quad x = 0.054$$

Cylinder rises $0.004\,\text{m}$ or $0.4\,\text{cm}$.

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OR

$$B = W$$

$$13600\left(\tfrac{1}{2}V\right)g = \rho V g$$

$$\rho = 6800$$

$$B_w + B_m = W$$

$$1000(Ax)g + 13600A(0.1-x)g = 6800A(0.1)g$$

$$\Rightarrow \quad x = 0.054$$

Cylinder rises $0.004\,\text{m}$ or $0.4\,\text{cm}$.

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