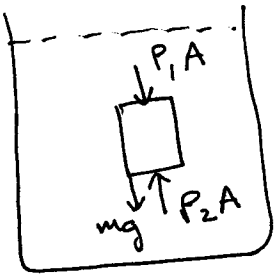

if $\rho_{object} \neq \rho_{fluid}$ then

$$P_2A - P_1A - mg \neq 0$$

$$P_2A - P_1A = B \quad \text{(Buoyant force)}$$
(points up)

From lecture 25, $P_2A - P_1A$ = weight of fluid
$= \rho_{fluid} V_{fluid} g$

where V_{fluid} is the volume of fluid displaced by the object.

$$\Rightarrow \boxed{B = \rho_{fluid} V_{fluid} g}$$

Always true for buoyant force.

for completely submerged object:

$$V_{fluid} = V_{object}$$

for floating object:

$$V_{fluid} \neq V_{object}$$

But since its floating, it is in equilibrium.

$$\Rightarrow B - mg = 0 \Rightarrow B = mg$$

$$\Rightarrow \rho_{fluid} V_{fluid} g = \rho_{object} V_{object} g$$

$$\Rightarrow \frac{\rho_{object}}{\rho_{fluid}} = \frac{V_{fluid}}{V_{object}}$$