3.6 35.0 wt% H₂SO₄ has \( \rho = 1.2563 \text{ g/ml} @ 25^\circ \text{C} \)

(Note wt% ≠ vol% or mole%)

What volume (L) contains 195.5 kg H₂SO₄?

\[
V(L) = \frac{1.2563 \text{ kg}}{35.0 \text{ kg H}_2\text{SO}_4} = \frac{195.5 \text{ kg H}_2\text{SO}_4}{100 \text{ kg}}
\]

\[V = 4.45 \text{ L}\]

Note: least precise number is density in this problem w/ 3 sig. fig.

If pure component densities used

\[
\rho_{\text{mix}} = 0.35 \times 1.8255 + 0.65 \times 1.00 = 1.289 \text{ g/ml}
\]

\[
\text{error} \frac{1.289 - 1.256}{1.256} \approx 3 \%
\]

What is mol% of 35.0 wt% H₂SO₄

\[
\text{MW H}_2\text{SO}_4 = 98.08
\]

Basis 100g

\[
\begin{array}{ccc}
\text{Comp.} & \text{wt%} & \text{mol} & \text{mol %} & \text{Note how different wt% and mol% can be!} \\
\text{H}_2\text{SO}_4 & 35 & 0.357 & 8.99 & \\
\text{H}_2\text{O} & 65 & 3.611 & 91.0 & \\
\end{array}
\]

\[
3.968
\]
Archimedes' principle: mass of block = mass of liquid displaced

\[ V_b \times 2.26 = \frac{45.8}{V_b} \times 1 + \frac{54.2}{V_b} \times P_{oil} \]

Look at that! Only \( P_{oil} \) unknown!

\[ P_{oil} = 3.32 \text{ g/ml} \]

Now, if the weight of a flask is 124.8 g and 35.3 cm\(^3\) of oil is added, the total weight is

\[ 124.8 \text{ g} + \frac{35.3 \text{ ml}}{3.32 \text{ g/ml}} = 242.0 \text{ g} \]
3.10 50 L bags

CaCO₃ void fraction 0.30 L void/L
\[ p = 2.93 \text{ g/mL} \]

a. \[ \rho_b = \frac{2.93 \text{ g/mL}}{0.70 \text{ mL solid/mL}} = 2.05 \text{ g/mL} \]

b. Weight of bag = \[ \frac{50 \text{ L}}{2.05 \text{ kg/L}} = 10.3 \text{ kg} \]

Assumptions: bag fills completely

bag has negligible weight

c. If particle size goes down, void space decreases.

Bags will be only partly full.