

## Exercise 1.82

A 32.65-g sample of a solid is placed in a flask. Toluene, in which the solid is insoluble, is added to the flask so that the total volume of solid and liquid together is 50.00 mL. The solid and toluene together weigh 58.58 g. The density of toluene at the temperature of the experiment is 0.864 g/mL. What is the density of the solid?

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### Solution

Find what mass of toluene is in the flask by subtracting 32.65 g from the total.

$$\text{Mass of Solid} + \text{Mass of Toluene} = \text{Total Mass}$$

$$\text{Mass of Toluene} = \text{Total Mass} - \text{Mass of Solid}$$

$$= 58.58 \text{ g} - 32.65 \text{ g}$$

$$= 25.93 \text{ g}$$

Then determine how much volume this mass of toluene takes up.

$$\text{Toluene Volume} = \frac{\text{Toluene Mass}}{\text{Toluene Density}}$$

$$= \frac{25.93 \text{ g}}{0.864 \frac{\text{g}}{\text{mL}}}$$

$$\approx 30.0 \text{ mL}$$

Find what volume of solid is in the flask by subtracting 30.0 mL from the total.

$$\text{Volume of Solid} + \text{Volume of Toluene} = \text{Total Volume}$$

$$\text{Volume of Solid} = \text{Total Volume} - \text{Volume of Toluene}$$

$$= 50.00 \text{ mL} - 30.0 \text{ mL}$$

$$\approx 20.0 \text{ mL}$$

Therefore, the density of the solid is

$$\text{Solid Density} = \frac{\text{Solid Mass}}{\text{Solid Volume}} = \frac{32.65 \text{ g}}{20.0 \text{ mL}} \approx 1.63 \frac{\text{g}}{\text{mL}}$$