

Exercise 1.35

(a) A sample of tetrachloroethylene, a liquid used in dry cleaning that is being phased out because of its potential to cause cancer, has a mass of 40.55 g and a volume of 25.0 mL at 25 °C. What is its density at this temperature? Will tetrachloroethylene float on water? (Materials that are less dense than water will float.) (b) Carbon dioxide (CO₂) is a gas at room temperature and pressure. However, carbon dioxide can be put under pressure to become a “supercritical fluid” that is a much safer dry-cleaning agent than tetrachloroethylene. At a certain pressure, the density of supercritical CO₂ is 0.469 g/cm³. What is the mass of a 25.0-mL sample of supercritical CO₂ at this pressure?

Solution**Part (a)**

Since 1 mL = 1 cm³, the density of tetrachloroethylene is

$$\text{density} = \frac{\text{mass}}{\text{volume}} = \frac{40.55 \text{ g}}{25.0 \text{ cm}^3} \approx 1.62 \frac{\text{g}}{\text{cm}^3},$$

which is greater than that of water (1.00 g/cm³). Therefore, tetrachloroethylene will not float.

Part (b)

Since 1 mL = 1 cm³, the mass of tetrachloroethylene is

$$\text{mass} = \text{density} \times \text{volume} = 0.469 \frac{\text{g}}{\text{cm}^3} \times 25.0 \text{ cm}^3 \approx 11.7 \text{ g}.$$