Exercise 1.68

Ethyl chloride is sold as a liquid (see photo) under pressure for use as a local skin anesthetic. Ethyl chloride boils at 12 °C at atmospheric pressure. When the liquid is sprayed onto the skin, it boils off, cooling and numbing the skin as it vaporizes. (**a**) What changes of state are involved in this use of ethyl chloride? (**b**) What is the boiling point of ethyl chloride in degrees Fahrenheit? (**c**) The bottle shown contains 103.5 mL of ethyl chloride. The density of ethyl chloride at 25 °C is 0.765 g/cm^3. What is the mass of ethyl chloride in the bottle?

Solution

Part (a)

Ethyl chloride goes from a liquid to a gas.

Part (b)

Use the formula,

$$°F = \frac{9}{5}(°C) + 32,$$

to calculate the temperature in Fahrenheit.

$$°F = \frac{9}{5}(12) + 32 \approx 54 \ °F$$

Part (c)

The mass of ethyl chloride is obtained by multiplying the density with the volume.

$$\text{Mass} = \text{Density} \times \text{Volume}$$

$$= \left(0.765 \ \frac{\text{g}}{\text{cm}^3}\right)(103.5 \ \text{mL})$$

$$= \left(0.765 \ \frac{\text{g}}{\cancel{\text{cm}^3}}\right)\left(103.5 \ \cancel{\text{mL}} \times \frac{1 \ \cancel{\text{cm}^3}}{1 \ \cancel{\text{mL}}}\right)$$

$$\approx 79.2 \ \text{g}$$