

There are the following data on the bottle of concentrated hydrochloric acid:

Density: 1.18 g/cm³

M.W.: 36.46 g/mol

Concentration: 38.0%

What is its molarity?

Solution:

(38.0%) means: 38 g of 100 g of this solution is pure hydrochloric acid.

$$\text{mole} = \frac{\text{mass}}{\text{M.W.}} = \frac{38.0 \text{ g}}{36.46 \frac{\text{g}}{\text{mole}}} = 1.042 \text{ mole}$$

Next, the volume of 100.0 g of HCl solution:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

$$\text{volume} = \frac{\text{mass}}{\text{density}} = \frac{100.0 \text{ g}}{1.18 \frac{\text{g}}{\text{cm}^3}} = 84.746 \text{ cm}^3$$

$$\text{molarity} = \frac{\text{mole}}{\text{L}}$$

$$\text{molarity} = \frac{1.042 \text{ mol}}{84.746 \text{ mL}} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 12.3 \text{ M}$$