

Answer on Question #62109 - Chemistry - General Chemistry

Question

Calculate the molarity of 37.5% HCl solution.

Solution:

The definition of concentration by mass is:

$$\omega = \frac{m_{HCl}}{m_{sol}}$$

, where m_{HCl} is the mass of HCl and m_{sol} is the mass of solution.

The definition of molarity is:

$$c = \frac{\nu_{HCl}}{V_{sol}}$$

, where ν_{HCl} is the amount of HCl and V_{sol} is the volume of solution.

Let's transform expression for molarity:

$$c = \frac{\nu_{HCl}}{V_{sol}} = \frac{m_{HCl}/M_{HCl}}{m_{sol}/\rho_{sol}} = \frac{m_{HCl} \cdot \rho_{sol}}{m_{sol} \cdot M_{HCl}} = \omega \cdot \frac{\rho_{sol}}{M_{HCl}}$$

ρ_{sol} – density of solution

M_{HCl} - molar mass of HCl

There is no information about density in the statement of this task, so I assume that $\rho_{sol} = 1180 \text{ g/L}$. In this way:

$$c = \omega \cdot \frac{\rho_{sol}}{M_{HCl}} = 0.375 \cdot \frac{1180}{36.5} = 12.12 \left(\frac{\text{mol}}{\text{L}} \right) = 12.12 \text{ M}$$

Answer: The molarity of 37.5% HCl solution is 12.12 M