

Practice 5-1

A 5.00 mL sample of solution has 3.8×10^{-5} g of calcium ion. Calculate the concentration in each of the following units: a) % (m/v) b) ppt c) ppm.

Answer

$$\text{a) \% (m/v)} = \frac{\text{g of solute}}{\text{mL of solution}} \times 100$$

$$\% \text{ (m/v)} = \frac{3.8 \times 10^{-5} \text{ g}}{5.00 \text{ mL}} \times 100 = 7.6 \times 10^{-4} \% \text{ (m/v)}$$

$$\text{b) Parts Per Thousand (ppt)} = \frac{\text{g of solute}}{\text{mL of solution}} \times 1000$$

$$\text{ppt} = \frac{3.8 \times 10^{-5} \text{ g}}{5.00 \text{ mL}} \times 1000 = 7.6 \times 10^{-3} \text{ ppt}$$

$$\text{c) Parts Per Million (ppm)} = \frac{\text{g of solute}}{\text{mL of solution}} \times 10^6$$

$$\text{ppm} = \frac{3.8 \times 10^{-5} \text{ g}}{5.00 \text{ mL}} \times 10^6 = 7.6 \text{ ppm}$$

Practice 5-2

Calculate the number of grams of KCl in 150.0 mL of a 6.80% (m/v).

Answer

$$150.0 \text{ mL solution} \times \frac{6.80 \text{ g KCl}}{100 \text{ mL solution}} = 10.2 \text{ g of KCl}$$

Practice 5-3

How many mL of a 3.0% (m/v) H₂O₂ solution would contain 7.8 g of H₂O₂?

Answer

$$7.8 \text{ g H}_2\text{O}_2 \times \frac{100 \text{ mL solution}}{3.0 \text{ g H}_2\text{O}_2} = 260 \text{ mL solution}$$

Practice 5-4

What is the molarity of a solution made by dissolving 22.50 g of Mg(NO₃)₂ in enough water to make 450.0 mL of solution?

Answer

$$22.50 \text{ g Mg(NO}_3)_2 \times \frac{1 \text{ mol Mg(NO}_3)_2}{148.33 \text{ g Mg(NO}_3)_2} = 0.1517 \text{ mol Mg(NO}_3)_2$$
$$M = \frac{0.1517 \text{ mol Mg(NO}_3)_2}{0.4500 \text{ L}} = 0.3371 \text{ M}$$

Practice 5-5

Calculate the volume, in liters, of 3.00 M NaOH containing 0.456 mol of NaOH.

Answer

$$0.456 \text{ mol NaOH} \times \frac{1 \text{ L solution}}{3.00 \text{ mol NaOH}} = 0.152 \text{ L solution}$$

Practice 5-6

An aqueous solution contains 75 ppm Cu^{2+} . What volume of this solution is needed to prepare 350.0 mL of a solution that is 18 ppm Cu^{2+} ?

Answer

$$C_1 \times V_1 = C_2 \times V_2$$
$$V_1 = \frac{C_2 \times V_2}{C_1} \quad V_1 = \frac{18 \text{ ppm} \times 350.0 \text{ mL}}{75 \text{ ppm}} = 84 \text{ mL}$$

Practice 5-7

To what volume should you dilute 75.0 mL of a 10.0 M HCl solution to obtain a 1.20 M HCl solution?

Answer

$$C_1 \times V_1 = C_2 \times V_2$$
$$V_2 = \frac{C_1 \times V_1}{C_2} \quad V_2 = \frac{10.0 \text{ M} \times 75.0 \text{ mL}}{1.20 \text{ M}} = 625 \text{ mL}$$

Practice 5-8

What is the osmolarity of each of the following solutions?

- a) 0.25 M NaBr b) 0.15 M Na_2SO_4 c) 0.25 M NaBr + 0.15 M Na_2SO_4

Answer

Osmolarity = molarity x i

a) $0.25 \text{ M} \times 2 = 0.50 \text{ osmol}$ ($\text{NaBr} \rightarrow \text{Na}^+ + \text{Br}^-$)

b) $0.15 \text{ M} \times 3 = 0.45 \text{ osmol}$ ($\text{Na}_2\text{SO}_4 \rightarrow 2\text{Na}^+ + \text{SO}_4^{2-}$)

c) $(0.25 \text{ M} \times 2) + (0.15 \text{ M} \times 3) = 0.95 \text{ osmol}$