

Solve each of the following problems. Be sure to round for significant figures and include units.

1. What is the molarity of a solution in which 12.6g of Lithium Hydroxide (LiOH) is dissolved in 1.7L of solution.

1 mol of LiOH has a mass of 23.95g

$$\begin{array}{ccc} 1 \text{ mol} & \xrightarrow{\quad} & 23.95\text{g} \\ ? & \xrightarrow{\quad} & 12.6\text{g} \end{array}$$

$$= \frac{12.6\text{g} \times 1}{23.95\text{g}}$$

$$= 0.5261 \text{ mols of LiOH}$$

$$\text{Litres of solution} = 1.7\text{L}$$

$$\text{Molarity} = \frac{\text{Mols of Solute}}{\text{Liters of solution}}$$

$$= \frac{0.5261}{1.7}$$

$$= 0.3095 \text{ mol/Litre}$$

- 2) Calculate the volume of a 7.5 M solution containing 85.0 of Silver nitrate (AgNO_3)

1 mol of AgNO_3 has a mass of 169.87g

$$\begin{array}{ccc} 1 \text{ mol} & \rightarrow & 169.87\text{g} \\ ? & \rightarrow & 85.0\text{g} \end{array}$$

$$= \frac{85.0 \times 1}{169.87}$$

$$= 0.5004 \text{ mol of AgNO}_3$$

$$\begin{aligned}
 \text{Volume} &= \frac{\text{Moles}}{\text{Molarity}} \\
 &= \frac{0.5004}{7.5} \\
 &= 0.0667 \text{ L}
 \end{aligned}$$

3. What is the Molarity of a solution in which 1.67g of sodium Hydroxide (NaOH) are dissolved in 125 ml of solution

$$\begin{aligned}
 \text{Volume } 125 \text{ ml} \\
 1 \text{ Ml} &\rightarrow 0.001 \text{ L}
 \end{aligned}$$

$$\begin{array}{c}
 \times \\
 125 \text{ Ml} \rightarrow ?
 \end{array}$$

$$= 125 \times 0.001$$

$$= 0.125 \text{ L}$$

1 mol of NaOH Contains 40.00g

$$\begin{array}{c}
 1 \text{ mol} \rightarrow 40 \text{ g} \\
 ? \xrightarrow{\times} 1.67 \text{ g}
 \end{array}$$

$$= \frac{1.67 \times 1}{40}$$

$$= 0.0418 \text{ moles}$$

$$\text{Molarity} = \frac{\text{moles}}{\text{Volume}}$$

$$= \frac{0.0418}{0.125}$$

$$= 0.334 \text{ mol / litre}$$

4. How many grams of Potassium Chloride (KCl) are required to make 2.0 L of 3.0 M solution?

$$\begin{aligned}\text{Moles in a solution} &= \text{Molarity} \times \text{volume} \\ &= 3 \times 2 \\ &= 6 \text{ moles}\end{aligned}$$

$$\begin{array}{ccc} 1 \text{ mole} & \xrightarrow{\quad} & 74.55 \text{ g of KCl} \\ 6 \text{ moles} & \xrightarrow{\quad} & ? \end{array}$$

$$\begin{aligned}&= \frac{74.55 \times 6}{1} \\ &= 447.3 \text{ g}\end{aligned}$$

5. What is the volume of a 0.500 M solution containing 333 g of Manganese (II) Chloride (MnCl_2)?

1 mol of MnCl_2 has a mass of 125.84 g

$$\begin{array}{ccc} 1 \text{ mol} & \xrightarrow{\quad} & 125.84 \text{ g} \\ ? & \xrightarrow{\quad} & 333 \text{ g} \end{array}$$

$$= \frac{333}{125.84} = 2.6462 \text{ moles}$$

$$\text{Volume} = \frac{\text{moles}}{\text{molarity}}$$

$$\begin{aligned}&= \frac{2.6462}{0.500} \\ &= 5.292 \text{ L}\end{aligned}$$

6. What Mass of Iron (II) Sulfate (FeSO_4) is needed to make 200 mL of 0.25M solution?

$$1 \text{ Litre} \rightarrow 1000 \text{ ml}$$

$$? \rightarrow 200 \text{ ml}$$

$$= \frac{200}{1000} = 0.2 \text{ L}$$

Number of moles in solution = Molarity $\times$ volume

$$= 0.25 \times 0.2$$

$$= 0.05 \text{ moles}$$

1 mol of FeSO_4 contains 151.91g

$$1 \text{ mol} \rightarrow 151.91 \text{ g}$$

$$0.05 \text{ moles} \xrightarrow{x} ?$$

$$= 0.05 \times 151.91$$

$$= 7.5955 \text{ g}$$

7. Using the solubility graph next page answer the following questions

(a) What is the solubility of NH_4Cl at 70°C ?
60g / 100g H_2O

(b) Which substance is least soluble at 40°C ?
 NH_3

(c) How many grams of KCl can be dissolved in 300g of water at 80°C ?
at 80°C solubility is 50g / 100g H_2O

$$\frac{300 \times 50}{100} = 150 = 150 \text{ g KCl}$$

(d) At 30°C , 45g of NH_4Cl is placed in 100g of water. Most of the substance dissolves but some remains on the bottom undissolved. Is the solution saturated, unsaturated or supersaturated?

Saturated

(e)

(e) At 40°C , 30g of KNO_3 completely dissolves in 100g of water. Is the solution saturated, unsaturated, or supersaturated?

Unsaturated

8. Determine the percent by volume of a solution in which 29 mL of hydrochloric acid (HCl) are dissolved in 85 mL of water.

29 mL of HCl dissolves in 85 mL of water

$$\text{Percentage by volume} = \frac{\text{volume of water}}{\text{Total volume of solution}}$$

$$= \frac{29}{85} \times 100\%$$

$$= 0.3411 \times 100\%$$

$$= 34.11\%$$

9. Determine the percent by mass of a solution in which 83g of KCl are dissolved in 168g of water?

$$\text{Percentage by mass} = \frac{\text{mass of solute}}{\text{Total mass of solution}} \times 100\%$$

$$= \frac{83}{168} \times 100\%$$

$$= 49.40\%$$

10. What volume of Concentrated 18M HCl is needed to prepare 355 mL of a 5.0M solution?

$$\text{moles} = \text{molarity} \times \text{volume}$$

$$= 5 \times (355 \times 0.001)$$

$$= 1.675 \text{ moles HCl}$$

What volume of stock would contain this many moles of HCl

$$\text{Volume} = \frac{\text{moles}}{\text{molarity}} = \frac{1.675}{18}$$

$$= 0.0931 \text{ L}$$

$$1 \text{ L} \rightarrow 1000 \text{ mL}$$

$$0.0931 \text{ L} = ?$$

$$= \frac{0.0931 \times 1000}{1}$$

$$= 93.10 \text{ mL}$$

11. The solubility of a solute is 1.5 g/L at 2.5 atm .
What will the solubility be at 3.9 atm ?

$$\frac{S_1}{P_1} = \frac{S_2}{P_2} ; \frac{1.5}{2.5} = \frac{S_2}{3.9}$$

$$S_2 = \frac{1.5}{2.5} \times 3.9$$

$$= 2.34 \text{ g/L}$$