

Unit III – Assignment 1 – Solubility

1. Define *solubility*. **(2 marks)**
 2. Write chemical equations to represent the equilibria for saturated solutions of the following chemicals: **(3 marks)**
 - a. Syrup, $C_{12}H_{22}O_{11(s)}$
 - b. Milk of magnesia, $Mg(OH)_{2(s)}$
 - c. Washing soda, $Na_2CO_{3(s)}$
 3. A 100.0 mL sample of 0.600 M $Ca(NO_3)_2$ is diluted by adding 400.0 mL of water. Calculate the concentration of ions in the resulting solution. **(2 marks)**
 4. Determine the molar concentration of each ion from the solubility of the following saturated solutions:
 - a. Rock phosphorus, $Ca_3(PO_4)_{2(s)}$ at 1.4×10^{-7} mol/L at $25^\circ C$ **(3 marks)**
 - b. Rock salt, $NaCl_{(s)}$ at 32.2 g/100 mL at $25^\circ C$ **(4 marks)**
 5. A 100 ml solution containing 0.2 M Al^{3+} , 0.2 M NH_4^+ and 0.2 M Mg^{2+} is added to a 100 ml solution containing 0.2 M S^{2-} , 0.2 M Cl^- and 0.2 M OH^- . Identify the ions that do **not** form a precipitate. **(2 marks)**
 6. Write a balanced chemical equation for the equilibrium in a saturated solution of an ionic compound with low solubility. **(2 marks)**
 7. Write an equation that describes the equilibrium present in a saturated solution of $Cu_3(PO_4)_2$. **(2 marks)**
 8. A 1.0 M solution of sodium sulphite is added to a 1.0 M solution of copper(II) chloride resulting in the formation of a precipitate.
 - a) Identify the precipitate. **(1 mark)**
 - b) Write the complete ionic equation for the reaction. **(1 mark)**
 - c) Identify all spectator ions. **(1 mark)**
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9. Write the net ionic equation representing the reaction that occurs when equal volumes of 0.20 M H_2SO_4 and 0.20 M $\text{Ba}(\text{NO}_3)_2$ are mixed together. **(2 marks)**
10. Write the net ionic equation representing the reaction that occurs when 50.0 mL of 0.20 M ZnSO_4 and 50.0 mL of 0.20 M BaS are combined. **(2 marks)**
11. Write the formula equation, complete ionic, and net ionic equations for the following double replacement reactions: **(6 marks)**
- $\text{Na}_2\text{CO}_{3(aq)}$ and $\text{CaCl}_{2(aq)}$
 - $\text{Fe}(\text{NO}_3)_{3(aq)}$ and $\text{NaOH}_{(aq)}$
12. a) Identify a compound that could be used to precipitate both the $\text{Mg}^{2+}_{(aq)}$ and $\text{Ca}^{2+}_{(aq)}$ from “hard water”. **(1 mark)**
b) Write the net ionic equations for the reactions. **(2 marks)**
13. A solution contains 0.20 M Cl^- and 0.20 M SO_4^{2-} .
- Identify a cation that could be added to the solution to give a precipitate with only one of these anions. **(1 mark)**
 - Write the net ionic equation for the precipitation reaction in part a). **(1 mark)**
14. Write an experimental design to determine whether one or both of $\text{Ag}^+_{(aq)}$ or $\text{Ba}^{2+}_{(aq)}$ are present in a waste solution from a commercial establishment. **(4 marks)**
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