Chemistry 12 Solubility Equilibrium I

Name: Date: Block:

- 1. Solutions Vocab & Calculations
- 2. Predicting Solubility
- 3. Writing Equations

Solutions Vocab & Calculations

What is a solution?

- A homogenous mixture of 2 or more pure substances.
- Pure substances can be made of any state gas & gas, solid & solid, solid & liquid, etc.

In this course, we will be focusing on solutions containing a solid (salt), mixed with a liquid (H₂O)

Definitions:

- Solute:
- Solvent:
- Soluble:
- Solution:
- Saturated Solutions:
- Solubility:
- Precipitate:

Calculations:

(1) Consider the addition of 2.3 g of CaCl₂ to water to produce 500. mL of solution.

- a) What is the concentration of the CaCl₂ solution?
- b) What is the dissociation equation?
- c) What is the concentration of each ion in the solution?

(2) Calculate the concentration of each ion in a solution formed with 25 mL of 0.50 M MgCl₂ is mixed with 10. mL of 0.60 M AlCl₃.

- What is the final volume?
- When one solution is added to another solution, both are diluted. What is the diluted concentration of each solution?

- What is the concentration of the ions in each solution? (You will need a dissociation equation).
- What is the final concentration of each of the ions?

(3) Calculate the molar solubility of lead (II) sulphate if 500. mL of saturated solution contains 0.0200 g of lead (II) sulphate.

(4) The molar solubility of lead (II) chloride is 0.014 M at 25°C. What is the solubility in g/mL?

(5) The solubility of lead (II) iodate is 4.5×10^{-5} M. What mass of lead (II) iodate is dissolved in 300. mL of saturated solution?

Solubility Calculations Worksheet

Predicting Solubility

SOLUBILITY OF COMMON COMPOUNDS IN WATER The term soluble here means > 0.1 mol/L at 25°C.				
	Negative Ions (Anions)	Positive Ions (Cations)	Solubilit Compou	y of nds
	All	Alkali ions: Li [*] , Na [*] , K [*] , Rb [*] , Cs [*] , Fr [*]	Soluble	
	All	Hydrogen ion: H*	Soluble	
	All	Ammonium ion: NH4 *	Soluble	
	Nitrate, NO ₃ -	All	Soluble	
	Chloride, Cl ⁻ Bromide, Br ⁻	All others	Soluble	
	Iodide, I	Ag ⁺ , Pb ²⁺ , Cu ⁺		Low Solubility
	Sulphate, SO ₄ ²⁻	All others	Soluble	
		$Ag^{+}, Ca^{2+}, Sr^{2+}, Ba^{2+}, Pb^{2+}$		Low Solubility
	Sulphide, S ²⁻	Alkali ions, H ⁺ , NH ₄ ⁺ , Be ²⁺ , Mg ²⁺ , Ca ²⁺ , Sr ²⁺ , Ba ²⁺	Soluble	
		All others		Low Solubility
	Hydroxide, OH ⁻	Alkali ions, H ⁺ , NH ₄ ⁺ , Sr ²⁺	Soluble	
		All others		Low Solubility
	Phosphate, PO_4^{3-}	Alkali ions, H ⁺ , NH ₄ ⁺	Soluble	
	Sulphite, SO ₃ ²⁻	All others		Low Solubility



Remember...

Soluble = dissolves

- Aqueous
- Cation and anion DO NOT form a precipitate

Low Solubility = does not dissolve

- Solid
- Cation and anion DO form a precipitate

How to read the table:

- \Rightarrow Identify ANION
- \Rightarrow Identify CATION
- \Rightarrow Soluble (aq) or Low Soluble (s)

Practice:

- 1. Classify the following salts as being soluble or having low solubility in water:
 - a. Copper (II) chloride
 - b. Aluminum hydroxide
 - c. Sodium phosphate
 - d. Calcium sulphate
 - e. Iron (II) sulphide
 - f. Strontium hydroxide
 - g. Zinc bromide
 - h. Cesium sulphite
 - i. Potassium chromate

- 2. Write the formula for the following:
 - a. A salt containing carbonate that is soluble
 - b. A salt containing sulphate with low solubility
 - c. A cation that forms a salt with low solubility with both chloride and sulphate ions
 - d. An anion that forms soluble salts with all cations.
- 3. A student is given a sample of either magnesium nitrate or strontium nitrate. When a few drops of a solution of sodium hydroxide is added to the sample, no precipitate forms. Does the sample contain magnesium nitrate or strontium nitrate? Explain your reasoning.

Types of chemical equations:

Formula Equation: shows the chemical formulas of the compounds and their states

 $2 \text{ KI}_{(aq)} + \text{Pb}(\text{NO}_3)_{2 (aq)} \rightleftharpoons 2 \text{ KNO}_{3 (aq)} + \text{PbI}_{2 (s)}$

<u>Complete Ionic Equation</u>: shows the soluble salts represented in their dissociated form.

<u>Net Ionic Equation</u>: shows only the ions that take part in the reaction. Ions that are the same on both sides of the equation are called **spectator ions**.

Practice:

- 1. Write the formula for the precipitate that forms when the following solutions are mixed:
 - a. BaS and MgSO₄
 - b. NH_4OH and $FeBr_2$
 - c. H_3PO_4 and $ZnCl_2$
 - d. K_2CO_3 and $CrSO_4$
 - e. MnI_2 and $Sr(OH)_2$
- 2. Write a formula equation, complete ionic equation and net ionic equation for the following reactions:a. Strontium hydroxide and silver nitrate

b. Magnesium sulphide and zinc chloride

c. Sodium carbonate and barium sulphide

d. $(NH_4)_2S_{(aq)} + FeSO_{4(aq)} \rightarrow$

e. $H_2SO_3_{(aq)} + CaCl_2_{(aq)} \rightarrow$

f. Copper (II) sulphate + calcium sulphide \rightarrow

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