Types of Mixtures Notes

*What is the Tyndall Effect?

	Homogeneous or Heterogeneous	# of visible phases	Settling?	Filterable?	Tyndall Effect? *	Particle Size	Examples
Suspension							
Colloid							
Solution							

COMPONENTS OF A SOLUTION

~ Solute:

~ Solvent:

* What substance is the most common solvent?
* What is it referred to as?

TYPES OF SOLUTIONS

~ Examples (solute/solvent)
solid/liquid
liquid/liquid
gas/liquid
solid/solid

FACTORS AFFECTING THE RATE OF SOLUTION

1.

2.

3.

SOLUBILITY:

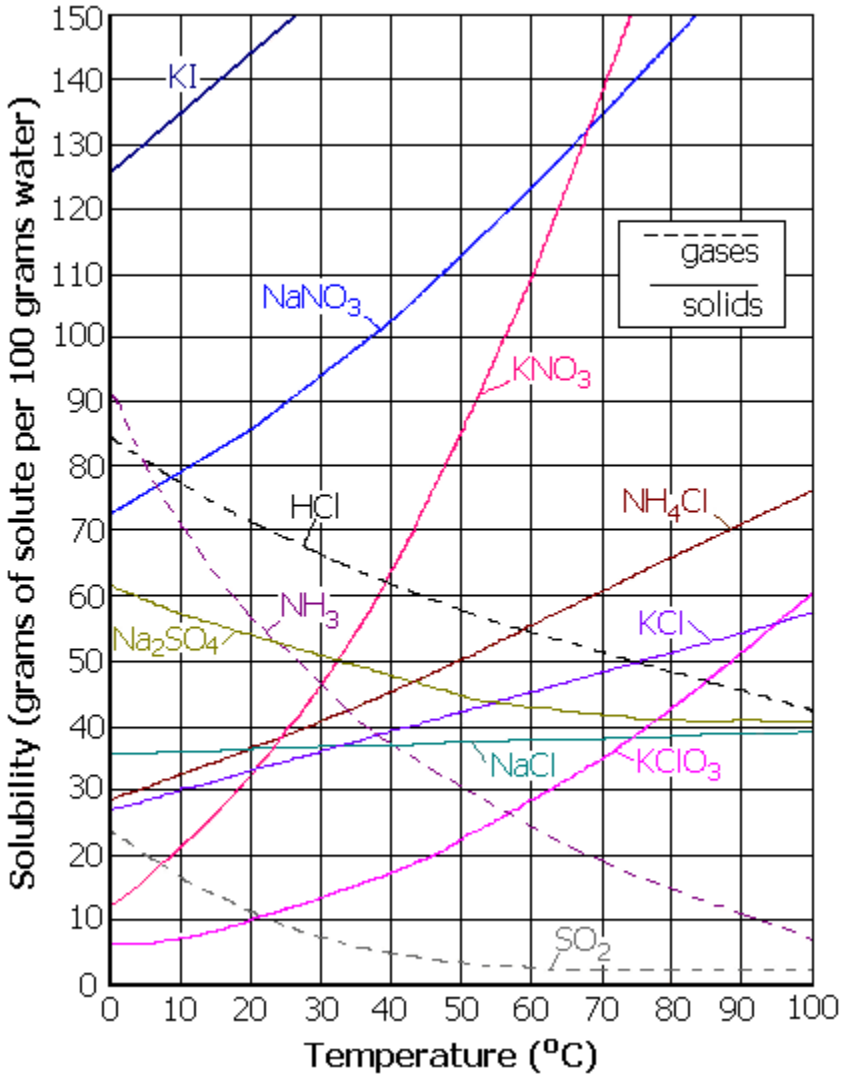
~ Saturated:

~ Unsaturated:

~ Supersaturated:

* How can you make a supersaturated solution?

SOLUBILITY CURVES WORKSHEET



1.) Which compound is *least* soluble at: (A) 20°C? (B) 80°C?

2.) Which substance is the *most* soluble at: (A) 10°C? (B) 50°C? (C) 90 °C?

3.) The solubility of which substance is *most* affected by changes in temperature?

4.) The solubility of which substance is *least* affected by changes in temperature?

5.) Are the following solutions saturated, unsaturated, or supersaturated?
(Assume all are dissolved in 100 grams of water.)
(A) 50 grams of NH_4Cl at 50°C
(B) 100 grams of $NaNO_3$ at 80°C
(C) 30 grams of KNO_3 at 25°C
(D) 51 grams of KCl at 80°C
(E) 65 grams of NH_4Cl at 70°C
(F) 30 grams of NH_3 at 50°C
(G) 10 grams of $KClO_3$ at 20°C

6.) NH_3 is a gas. Describe what happens to its solubility as the temperature goes from 20°C to 80°C.

7.) Which two substances have the same solubility at 68°C? What is the solubility?

8.) Which two substances have the same solubility at 94°C? What is the solubility?

9.) For each of the following, indicate the temperature at which the solution described would be saturated. (Assume all are dissolved in 100 grams of water.)
- (A) 30 grams of NH_4Cl
- (B) 130 grams of $NaNO_3$
- (C) 50 grams of Na_2SO_4
- (D) 20 grams of KNO_3
- (E) 40 grams of KCl
- (F) 60 grams of NH_3

10.) For each of these, indicate how many grams of solute (per 100 grams of water) will dissolve.
- (A) $NaNO_3$ at 70°C
- (B) NH_4Cl at 50°C
- (C) KI at 20°C
- (D) $KClO_3$ at 90°C

11.) At 40°C, how many grams of $NaNO_3$ will make a saturated solution if the $NaNO_3$ is added to 100 grams of water?

12.) At 80°C, how many grams of KCl can be dissolved in 200 grams of water?

13.) At what temperature will 10 grams of NH_3 dissolve completely in 100 grams of water to make a saturated solution?

14.) At 40°C, how many grams of KNO_3 can be dissolved in 300 grams of water?

15.) At 55°C, how many grams of $NaNO_3$ can be dissolved in 50 grams of water?

16.) At 80°C, you have a saturated solution of $KClO_3$. How many grams of solid precipitate will form if the solution is cooled to 50°C?

17.) How many grams of $NaNO_3$ precipitate will form if a saturated solution at 70°C is cooled to 10°C?

18.) A solution contains 20 g of NH_4Cl at 50°C. How many more grams of NH_4Cl need to be added to the 100 grams of water for the solution to be saturated?

FACTORS AFFECTING SOLUBILITY NOTES

~ TEMPERATURE:

In a solid/liquid solution, solubility _____ as the temp. of the solvent increases.

In a gas/liquid solution, solubility _____ as the temp. of the solvent increases.

~ PRESSURE:

In a gas/liquid solution, solubility _____ as the pressure of the gas over the liquid decreases.

GENERAL SOLUBILITY RULE: "LIKE DISSOLVES LIKE"

~ Polar solvents / polar solutes:
~ Polar solvents / nonpolar solutes:
~ Nonpolar solvents / polar solutes:
~ Nonpolar solvents / nonpolar solutes:

CONCENTRATION OF SOLUTIONS

~ MOLARITY (M) = $\frac{\text{moles of solute}}{\text{liters of solution}}$

EXAMPLE 1: What is the molarity of a solution made by dissolving 45.6 grams of $AgNO_3$ in enough water to make 550. mL of solution?

EXAMPLE 2: How many liters of a 0.25 M solution can be made from 50.0 grams of $CaCl_2$?

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~ DILUTIONS: $M_1 V_1 = M_2 V_2$

EXAMPLE 3: What is the molarity of a solution made by diluting 37.5 mL of 12.0 M HCl to 150.0 mL?

EXAMPLE 4: What volume of 18.0 M H_2SO_4 is necessary to be diluted to make 500. mL of 4.5 M solution?

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Molarity & Dilutions Worksheet

1.) What is the molarity of a solution in which 58.5 grams of NaCl are dissolved in 1.0 L of solution?

2.) What is the molarity of a solution in which 10.0 grams of $AgNO_3$ is dissolved in 500. mL of solution?

3.) How many grams of KNO_3 should be used to prepare 2.00 L or a 0.500 M solution?

4.) What volume of a 0.25 M solution could be made from 5.0 grams of KCl?

5.) How many grams of $CuSO_4$ are needed to prepare 100. mL of a 0.10 M solution?

6.) How much 18 M sulfuric acid (H_2SO_4) is needed to prepare 250 mL of a 6.0 M solution?

7.) 17 mL of 12 M hydrochloric acid (HCl) is diluted to 100. mL. What is the concentration of the new solution?

8.) To what volume should 25 mL of 15 M nitric acid (HNO_3) be diluted to prepare a 3.0 M solution?

9.) To what volume should 50. mL of 12 M hydrochloric acid be diluted to produce a 4.0 M solution?

10.) If 25.0 mL of 18 M sulfuric acid is diluted to 550. mL, what is the concentration of the diluted solution?

Answers: 1.) 1.0 M; 2.) 0.118 M; 3.) 101 g; 4.) 0.27 L or 270 mL; 5.) 1.6 g; 6.) 83 mL; 7.) 2.0 M; 8.) 130 mL; 9.) 150 mL; 10.) 0.82 M

ELECTROLYTES & NONELECTROLYTES NOTES

~ Electrolyte:

~ Nonelectrolyte:

~ A compound is an electrolyte if...

1.

2.

BOILING POINT ELEVATION & FREEZING POINT DEPRESSION

~ water freezes at 0°C and boils at 100°C
~ When a solute (any solute) is added to water, the freezing point gets LOWER and the boiling point gets HIGHER. (The same is true when solutes are added to other solvents.)
~ Electrolytes make a larger difference in freezing and boiling temperature than nonelectrolytes.

EXAMPLE QUESTIONS:
Which of the following solutions will have the lowest freezing point?
(A) 1 mole of solute dissolved in 1 liter of solution
(B) 2 mole of solute dissolved in 3 liters of solution
(C) 6 mole of solute dissolved in 4 liters of solution
(D) 4 mole of solute dissolved in 8 liters of solution

Which of the following solutions has the highest boiling point?
(A) 0.10 M $C_6H_{12}O_6$ (B) 0.10 M NaCl (C) 0.50 M $C_6H_{12}O_6$ (D) 0.50 M NaCl

SOLUBILITY RULES (NOTES) – listed on p. 6 of the Reference Tables
SOLUBLE:
1.) All nitrates, acetates, ammonium, group 1 salts
2.) All chlorides, bromides, and iodides, except silver, lead, and mercury (I)
3.) All fluorides except Group 2, Lead (II), and Iron (III)
4.) All sulfates except calcium, strontium, barium, mercury, lead (II), and silver
INSOLUBLE:
5.) All carbonates and phosphates except Group 1 and ammonium
6.) All hydroxides except Group 1, strontium, and barium
7.) All sulfides except Group 1, 2, and ammonium
8.) All oxides except Group 1
INSOLUBLE means a precipitate forms when equal volumes of 0.10 M solutions or greater are mixed.

SOLUBILITY RULES PRACTICE

Determine whether the following compounds are soluble (aq) or insoluble (s). Indicate the number of the rule used to determine the compound's solubility.

$CaSO_4$ $Sr(NO_3)_2$
Na_2CO_3 $Zn_3(PO_4)_2$

NET IONIC EQUATIONS

~ includes only the ions and compounds that undergo a chemical change in aqueous solution

EXAMPLE: $KCl\ (aq) + AgNO_3\ (aq) \rightarrow KNO_3\ (aq) + AgCl\ (s)$

* (aq) means dissolved in water; so, these compounds "break apart" into their + and - ions
* (s) means insoluble in water or solid; so, these compounds stay together (do not break apart)

$K^{+1}\ (aq) + Cl^{-1}\ (aq) + Ag^{+1}\ (aq) + NO_3^{-1}\ (aq) \rightarrow K^{+1}\ (aq) + NO_3^{-1}\ (aq) + AgCl\ (s)$

If an ion or compound is EXACTLY the same on both sides of the equation, it can be crossed out because it is not changed chemically.

~~$K^{+1}\ (aq)$~~ $+ Cl^{-1}\ (aq) + Ag^{+1}\ (aq) +$ ~~$NO_3^{-1}\ (aq)$~~ $\rightarrow$ ~~$K^{+1}\ (aq)$~~ $+$ ~~$NO_3^{-1}\ (aq)$~~ $+ AgCl\ (s)$

The NET IONIC EQUATION is what is left. In this case, the net ionic equation is:

$Cl^{-1}\ (aq) + Ag^{+1}\ (aq) \rightarrow AgCl\ (s)$

SPECTATOR IONS do not take part in a chemical reaction. They appear exactly the same on both sides of the equation. The spectator ions are the ones that get crossed out. They are simply "spectators" watching the chemical reaction take place – not taking part in it.

The spectator ions in the example are $K^{+1}\ (aq)$ and $NO_3^{-1}\ (aq)$.

The "shortcut" for writing net ionic equations:

Step 1 – Determine the solubility of the products of the reaction.

Step 2 – Write the product of the net ionic equation. (The product of a net ionic equation will always be the insoluble/solid product.)

Step 3 – Determine the reactants using the product as a guide. (The reactants will be the positive ion of the insoluble/solid product written with its oxidation number and "(aq)" after it, and then the negative ion of the insoluble/solid product written with its oxidation number and "(aq)" after it.)

Step 4 – Balance the equation using coefficients, if necessary.

The spectator ions in a reaction will be the positive and negative ions of the soluble/aqueous product.

Example: $KOH\ (aq) + Zn(NO_3)_2\ (aq) \rightarrow KNO_3\ (\ ) + Zn(OH)_2\ (\ )$

Net ionic equation:

Spectator ions:

NET IONIC EQUATIONS WORKSHEET

Determine the solubility of the products ((aq) or (s)). Then, write the net ionic equation. Also indicate the spectator ions for each equation.

1.) $Na_2S\ (aq) + AgC_2H_3O_2\ (aq) \rightarrow Ag_2S\ (\ \ ) + NaC_2H_3O_2\ (\ \ )$

net ionic eqn:

spectator ions:

2.) $Zn(NO_3)_2\ (aq) + (NH_4)_2S\ (aq) \rightarrow NH_4NO_3\ (\ \ ) + ZnS\ (\ \ )$

net ionic eqn:

spectator ions:

3.) K_2SO_4 (aq) + $Ba(NO_3)_2$ (aq) → $BaSO_4$ ( ) + KNO_3 ( )

net ionic eqn:

spectator ions:

4.) $AgNO_3$ (aq) + NaI (aq) → AgI ( ) + $NaNO_3$ ( )

net ionic eqn:

spectator ions:

5.) $HgCl_2$ (aq) + K_2S (aq) → KCl ( ) + HgS ( )

net ionic eqn:

spectator ions:

6.) $Al(NO_3)_3$ (aq) + $Ba(OH)_2$ (aq) → $Ba(NO_3)_2$ ( ) + $Al(OH)_3$ ( )

net ionic eqn:

spectator ions:

7.) $CuCl_2$ (aq) + $(NH_4)_3PO_4$ (aq) → NH_4Cl ( ) + $Cu_3(PO_4)_2$ ( )

net ionic eqn:

spectator ions:

8.) $ZnBr_2$ (aq) + $AgNO_3$ (aq) → $Zn(NO_3)_2$ ( ) + AgBr ( )

net ionic eqn:

spectator ions:

9.) ___ $BaCl_2$ (aq) + ___ Na_2SO_4 (aq) → ___ NaCl ( ) + ___ $BaSO_4$ ( )

net ionic eqn:

spectator ions:

10.) ___ $FeCl_3$ (aq) + ___ KOH (aq) → ___ $Fe(OH)_3$ ( ) + ___ KCl ( )

net ionic eqn:

spectator ions:

UNIT 12 REVIEW WORKSHEET

Part 1 – Solubility Curves - USE YOUR SOLUBILITY CURVE GRAPH TO ANSWER #1-4.

1. At what temp does 135 grams of KI dissolved in 100 grams of water form a saturated solution?
2. How many grams of KNO_3 will dissolve in 400 grams of water at 60°C?
3. If 10 grams of $KClO_3$ are dissolved in 100 grams of water at 30°C, is the solution saturated, unsaturated, or supersaturated?
4. How many grams of solid precipitate will form if a saturated $NaNO_3$ solution is cooled from 80°C to 20°C?

Part 2 – Concentration of Solutions/Boiling & Freezing Point Calculations

5. How many grams of $Fe(C_2H_3O_2)_3$ are needed to dissolve to make 350. mL of a 2.50 M solution?

6. What is the molarity of a solution made by diluting 17.3 mL of 12 M hydrochloric acid to 550. mL?

Part 3 – Solubility – Write (s) or (aq) next to each product. Then, write the net ionic equation.

7. $Ca(NO_3)_2$ (aq) + Na_2CO_3 (aq) --> $NaNO_3$ ( ) + $CaCO_3$ ( )

8. $Zn(NO_3)_2$ (aq) + K_3PO_4 (aq) --> KNO_3 ( ) + $Zn_3(PO_4)_2$ ( )