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Teacher: _____ Official Class: _____ Chemistry

Unit 7: Solutions

67	25	63	74	8	86	19
Ho	Mn	Eu	W	O	Rn	K
Holmium	Manganese	Europium	Tungsten	Oxygen	Radon	Potassium
164.93032	54.938045	151.964	183.84	15.9994	[222]	39.0983

The following pages are practice questions for this unit, and will be submitted for homework!

You must complete:

- Unit Vocabulary – **ALL QUESTIONS**
- Table F Practice – **ALL QUESTIONS**
- Factors Affecting Solubility – **ALL QUESTIONS**
- Table G Practice – **ALL QUESTIONS**
- Calculating Concentration – **ALL QUESTIONS**

DUE: Friday March 6, 2020

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Unit Vocabulary

- Solute:
- Solvent:
- Solution:
- Soluble:
- Insoluble:
- Solubility:
- Miscible:
- Immiscible:
- Vapor Pressure:
- Saturated:
- Supersaturated:
- Unsaturated:
- Concentrated:
- Dilute:
- Molarity:
- Parts Per Million:
- Freezing Point Depression:
- Boiling Point Elevation:
- Chromatography:
- Filtration:
- Distillation:
- Evaporation:
- Precipitate:

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Table F Practice

Directions: Use Table F to determine if the following compounds are soluble or insoluble.

Substance	Soluble or Insoluble	Substance	Soluble or Insoluble	Substance	Soluble or Insoluble
NaCl		K_3PO_4		Calcium hydroxide	
$PbBr_2$		$MgCO_3$		Copper (II) hydroxide	
$CaSO_4$		NH_4NO_3		Lead (II) sulfate	
Potassium chromate		Sodium hydrogen carbonate		Ammonium sulfide	

Directions: Use Table F to determine if the following compounds are soluble (S) or insoluble (I).

Key **I = Insoluble** **S = Soluble**	Acetate	Bromide	Carbonate	Chlorate	Chloride	Hydroxide	Hydrogen carbonate	Iodide	Nitrate	Phosphate	Sulfate	Sulfide
Aluminum												
Ammonium												
Barium												
Calcium												
Copper II												
Iron												

Directions: Double replacement reactions require the cations to switch with the anions. Using Table F, determine which product is the precipitate, then fill in the states of matter of the products formed (s) or (aq).

1. $(NH_4)3PO_4$ (aq) + $AlCl_3$ (aq) → $AlPO_4$ (____) + NH_4Cl (____)
2. NaCl (aq) + $AgNO_3$ (aq) → AgCl (____) + $NaNO_3$ (____)
3. K_2SO_4 (aq) + BaI_2 (aq) → $BaSO_4$ (____) + 2KI (____)
4. $CaCl_2$ (aq) + $LiCO_3$ (aq) → 2LiCl (____) + $CaCO_3$ (____)

Factors Affecting Solubility

Directions: Answer the questions below using full sentences.

1. Why doesn't oil and water mix?

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2. When you normally go to Dunkin Donuts you order a large coffee with 2 sugars which is really sweet and just how you like it. Today was really hot out so you decided to get a large iced coffee. Explain why the large iced coffee doesn't taste as sweet as you like it even though you added two sugar packets to it.

3. What type of substance would dissolve in CCl4?

4. The bends is a condition suffered by deep sea divers who surface quickly. Operating at high pressures deep below the surface and breathing compressed air causes more gas, especially nitrogen, to be dissolved in the blood than would otherwise be dissolved at surface pressure. As the diver surfaces the pressure decreases and makes the gases less soluble. If the diver surfaces quickly, bubbles of nitrogen gas form in the blood with excruciating pain and may result in death. What affect does pressure have on the solubility of a gas?

5. Why does pressure have this effect on gases?

6. Why does a soda fizz when you open it? Explain in terms of pressure and solubility.

7. What conditions would give soda the most amount of dissolved CO_2 (g)?

Directions: Check the conditions under which each of the following solutes will be <u>most soluble</u>.

Solute Name	**Solute Formula**	**Temperature**		**Pressure**			**Best Solvent**	
		Low	High	Low	High	No Effect	H_2O	CCl_4
Potassium nitrate	KNO_3(S)							
Hydrogen chloride	HCl (g)							
Carbon dioxide	CO_2 (g)							
Ammonium chloride	NH_4Cl (s)							
Potassium Iodide	KI (s)							
Potassium chlorate	$KClO_3$ (s)							

Table G Practice

Directions: State whether each of the following solutions is *saturated, unsaturated, or supersaturated.*

1. 80 g $NaNO_3$ in 100 g H_2O at 10 °C _____
2. 75 g $NaNO_3$ in 100 g H_2O at 10 °C _____

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3. 90 g $NaNO_3$ in 100 g H_2O at 10 °C _____
4. 90 g KNO_3 in 100 g H_2O at 50 °C _____
5. 40 g KCl in 50 g H_2O at 60 °C _____
6. 35 g $NaNO_3$ in 50 g H_2O at 10 °C _____
7. 5 g $KClO_3$ in 200 g H_2O at 5 °C _____
8. 30 g NH_4Cl in 200 g H_2O at 10 °C _____

Directions: Determine how many grams of each solute will crystallize/precipitate/settle. Assume all solutions are saturated and in 100 grams of H_2O.

Amount Cooled	Amount Precipitated
KNO_3 (aq) is cooled from 70 °C to 40 °C	
NH_4Cl (aq) is cooled from 90 °C to 20 °C	
KCl (aq) is cooled from 55 °C to 30 °C	
KI (aq) is cooled from 20 °C to 5 °C	

Directions: Determine how many MORE grams of each solute must be added to 100 g of water to form a saturated solution at that temperature.

Grams Solute per 100 g H_2O	Solute Added to make Saturated	Grams Solute per 100 g H_2O	Solute Added to make Saturated	**Grams Solute per 200 g H_2O	Solute Added to make Saturated
35 g KNO_3 at 40 °C		35 g NaCl at 90 °C		25 g NH_3 at 5 °C	
50 g NH_3 at 10 °C		5 g NH3 at 90 °C		30 g $NaNO_3$ at 50 °C	
15 g KCl at 75 °C		10 g $KClO_3$ at 40 °C		15 g $KClO_3$ at 75 °C	
95 g KI at 15 °C		15 g KCl at 60 °C		5 g KCl at 75 °C	

Calculating Concentration

Directions: Calculate the molarity of each of the following solutions.

1. 2.5 mol of NaOH in 0.500 L of solution.

2. 1.8 L of solution containing 3.3 mol of KNO_3.

3. 30 g or NaOH in 0.500 L of solution.

4. 12 g of HCl in 250 ml of solution.

Directions: Calculate the total moles of solute in each of the following solutions.

1. 1.7 L of 0.35M NaOH

2. 50 mL of 3.3 molar KNO_3

3. 5.0 L of 1.25M NaOH

4. 116 mL of 1.5M K_2SO_4

Directions: Calculate the percent by mass of the following solutions.

1. 50.0 grams of solute in 200.0 grams of solution

2. 25.0 grams of solute in 150.0 grams of solution

3. 15.0 grams of NaCl in 250.0 grams of solution

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Directions: Answer the followings using parts per million and your knowledge of chemistry.

1. Calculate the concentration of chlorine in ppm in a swimming pool if there is 0.02 g of chlorine in 10,000 g of pool water.

2. Exposure to lead has been linked to delays in physical and mental development and attention deficit disorders in children as well as kidney problems in adults. One source of this toxic heavy metal is drinking water in older homes whose plumbing contains lead. Water with a lead concentration of below 0.015ppm is considered safe to drink. A 100 g water sample taken from a home contains 1.2×10^{-6} grams of lead. Is this water considered safe to drink?

3. The health of fish depends on the amount of oxygen dissolved in the water. A dissolved oxygen (DO) concentration between 6 parts per million and 8 parts per million is best for fish health. A DO concentration greater than 1 part per million is necessary for fish survival. Fish health is also affected by water temperature and concentrations of dissolved ammonia, hydrogen sulfide, chloride compounds, and nitrate compounds. A student's fish tank contains fish, green plants, and 3800 grams of fish-tank water with 2.7×10^{-2} gram of dissolved oxygen.
   a. State how an increase in the temperature of the fish-tank water affects the solubility of oxygen in the water.

   b. Determine if the DO concentration in the fish tank is healthy for fish. Your response must include:
      - a correct numerical setup to calculate the DO concentration in the water in parts per million
      - the calculated result
      - a statement using your calculated result that tells why the DO concentration in the water is or is not healthy for fish

   c. Explain, in terms of molecular polarity, why oxygen gas has low solubility in water. Your response must include *both* oxygen and water.

   d. Under what kind of conditions of temperature and pressure would oxygen gas be most soluble in water?