Name_____ Period____

Assignment Checklists Unit – Solutions

Assign. ID	SCORE	Assignment	Due Date
A	5 4 3 2 1	Notes 12-1 *Types of Mixtures*	
B	5 4 3 2 1	Notes 12-2 *The Solution Process*	
C	5 4 3 2 1	Notes 12-3 *Concentrations of Solutions*	
D	5 4 3 2 1	Notes 13-1 *Compounds in Aqueous Solutions*	
E	5 4 3 2 1	Notes 13-2 *Colligative Properties of Solutions*	

Assign. ID	SCORE	Assignment	Due Date
1	5 4 3 2 1	Crucial Vocabulary	
2	5 4 3 2 1	Short Answer Prep	
3	5 4 3 2 1	World of Chemistry - Water	
4	5 4 3 2 1	Molality Calculations (pg 1)	
5	5 4 3 2 1	Molality Calculations (pg 2)	
6	5 4 3 2 1	Interpreting Solubility Curves (pg 1)	
7	5 4 3 2 1	Interpreting Solubility Curves (pg 2)	
8	5 4 3 2 1	Concentration Calculations (pg 1)	
9	5 4 3 2 1	Concentration Calculations (pg 2)	
10	5 4 3 2 1	Unit YouTube Videos (pg 1)	
11	5 4 3 2 1	Unit YouTube Videos (pg 2)	
12	5 4 3 2 1	Unit Learning Objectives (pg 1)	
13	5 4 3 2 1	Unit Learning Objectives (pg 2)	

Solutions – Crucial Vocabulary

Term	Definition
Homogeneous	
Heterogeneous	
Solution	
Suspension	
Colloid	
Dilute	
Concentrated	
Unsaturated	
Saturated	
Supersaturated	
Solute	
Solvent	
Molarity	
Molality	
Boiling point elevation	
Freezing point depression	
Soluble	
Insoluble	
Alloys	
Aqueous solutions	
Colligative property	
Vapor pressure	
Boiling point	
Freezing point	
Osmotic pressure	
Mole fraction	
Miscible	
Immiscible	
Solvation	
Hydration	

Short Answer Prep

1. After viewing the animations, describe how melting and dissolving are different. Be sure to discuss what is happening during each process at the molecular level. Draw pictures to support your answer!

2. After viewing the videos, describe how crystallization and distillation are used to separate the components of a solution.

3. Describe the action of detergents at the particle level. Explain how the axiom "like dissolves like" can be applied to explain the cleaning abilities of detergents. Draw pictures to support your answer!

4. What are the nine solute-solvent combinations? Give an example of each.

The World of Chemistry – Episode 12 – Water

1. What is the annual rate of consumption of water per person? What % of this is for agricultural purposes?

2. What are the main uses of water in industry?

3. How does the mass of a water molecule compare to common gases like nitrogen, oxygen, and CO_2?

4. What is meant by a polar molecule?

5. What is hydrogen bonding?

6. What are some properties of water that are due to hydrogen bonding?

7. What is unusual about the density of ice compared to the density of water?

8. Briefly describe the dissolving process.

9. What generalization may be made about whether or not one material will dissolve in another?

10. Why is there controversy about the amount of various chemicals that may be found in a sample of water?

Molality calculations

For water only

Freezing point depression constant (K_f) = - 1.86 C / m
Boiling point elevation constant (K_b) = 0.512 C / m

1. Determine the freezing point and boiling point of a 3.0 molal salt solution, NaCl.

2. Calculate the freezing point and boiling point of a 4.0 m solution of the non-electrolyte glucose, $C_6H_{12}O_6$.

3. The non-electrolyte methyl alcohol, CH_3OH, is frequently used a freezing point depression solvent in cars' windshield washer fluid. Find the freezing point of a 5.0 m solution.

4. What is the freezing point and boiling point of a 2.0 m solution of calcium chloride, $CaCl_2$?

5. Determine the freezing point and boiling point of a solution made by dissolving 171.0 grams of the non-electrolyte sucrose, $C_{12}H_{22}O_{11}$ in 500.0 grams of water.

6. Rank the following substances from greatest to least ability to change the colligative properties of water. Explain your answer.

   a) LiCl b) $C_6H_{12}O_6$ c) $AlBr_3$

7. Calculate the freezing point and boiling point of a solution made by dissolving 168.0 grams of sodium bicarbonate, $NaHCO_3$ in 1000.0 grams of water.

8. Two equally sized beakers are placed on a laboratory bench. One beaker is filled with distilled water. A second beaker is filled with a saturated solution of sugar. Which will completely evaporate first? Explain your answer.

Interpreting Solubility Curves

Answer the following questions using the solubility table provided in class.
Don't forget that: $100cm^3 = 100mL$ AND 1mL of water = 1 g of water

1. Which compound has a solubility of 50g / 100mL of water at 90ºC?

2. What is the solubility of potassium nitrate at 80º C?

3. At what temperature does potassium iodide have a solubility of 200g / 100 mL of water?

4. 40g of NaCl is dissolved in 100mL of water at 75ºC. Is this solution unsaturated, saturated or supersaturated?

5. 30 grams of potassium nitrate has been added to 100 cm^3 of water at a temperature of 50ºC. How many additional grams of solute must be added in order to make it saturated?

6. At which temperature would it be impossible to tell potassium chlorate and sodium chloride apart using solubility data?

7. A student is able to dissolve 33g of an unknown compound in 45ml of water at 45ºC. What is the unknown compound?

8. What is the molality of a saturated solution of potassium nitrate at 50ºC?

9. How many grams of potassium iodide should be mixed into 84mL of water at 30ºC to create a saturated solution?

10. Suppose you have a sodium nitrate solution at 100ºC containing 120g of dissolved sodium nitrate in 100mL of water. At what temperature will sodium nitrate crystals begin to form?

Concentration Calculations

INFORMATION – SHOW ALL WORK!!

K_f (of water) = -1.86 °C/m
Molality = moles solute / kg solvent
$M_1V_1 = M_2V_2$
ppb = μg solute/L solution

K_b(of water) = 0.512 °C/m
Molarity = moles solute / L solution
ppm = mg solute/L solution
% v/v = (vol.solute/vol.solvent)x 100

1. How would you make approximately 250mL of a 0.5m calcium chloride solution? Describe steps and amounts please.

2. Determine the boiling point of salt solution made by dissolving 15.0g NaCl in 125mL of water.

3. Calculate the freezing point of a sugar water solution made by dissolving 10.0g of table sugar ($C_{12}H_{22}O_{11}$) in 100.0mL of water.

4. What is the molarity of a solution made by dissolving 28.5g of KOH in a solution that has a total volume of 500.0mL?

5. How would you make 100.0mL of 0.25M KCl? Describe steps and amounts please!

6. 10.0mL of 1.0M HCl is diluted by adding 30.0mL of water. What is the molarity of the diluted HCl?

7. What volume of ethanol (C_2H_5OH) is found in a glass of wine if the total volume of wine is 115mL and the % v/v is 11.5%?

8. What mass (in kg) of ethanol would be present in a tank of gasoline which holds a total volume of 12 gallons if the ethanol content of gasoline sold in the US is 10% v/v?
$D_{ethanol}$ = 0.789g/mL 1gallon = 3.785L

9. What mass of nitrate (NO_3^-)is present in a 500.0mL water sample that tests determine contains 1,215ppm of nitrates?

10. How many moles of arsenic atoms are present in an apple juice drink box that tests determine has a total arsenic content of 16ppb? The volume of the juice box is 237mL.

YouTube Video Example Calculations

Calculating Molarity	Dilution Calculation
Molality Calculation	Calculating Parts per Million

Boiling and Freezing Point Calculations	Calculating Concentration (weight-weight)
Explain how the dissolution of salt can be an example of a process in which a dynamic equilibrium can be established. Use pictures in your answer!	Explain how the solubility of a gas in a liquid changes as a function of the temperature of the solvent. Compare this to the solubility of solids in liquid solvents when temperature changes.

UNIT XI: Solutions

Goal 1. The student will demonstrate the ability to describe characteristics of solutions.
a. -Distinguish between homogeneous and heterogeneous mixtures.

-Explain how dissolving is different from melting.

b. Identify and compare the nine different solute-solvent combinations.

c. Compare solutions, suspensions, and colloids.

d. Define: dilute, concentrated, unsaturated, saturated, and supersaturated.

Goal 2. The student will demonstrate the ability to describe factors affecting solubility.
a. Explain how stirring, surface area, temperature, and concentration influence the rate of solution formation.

b. Explain how distillation, crystallization, and chromatography are used to separate solutions into their components.

c. Apply "like dissolves like" to everyday events. (i.e. actions of detergents and soap)

d. Interpret a solubility curve.

e. Explain the relationship between equilibrium and solubility. [GT]

f. Explain why gases become less soluble at higher temperatures, whereas most solids become more soluble. [GT]

g. Explain why a precipitate forms when solutions of two ionic compounds are mixed. [GT]

Goal 3. The student will demonstrate the ability to determine molarity.
a. Calculate the molarity of a solution given the amount of solute and the volume of solvent.

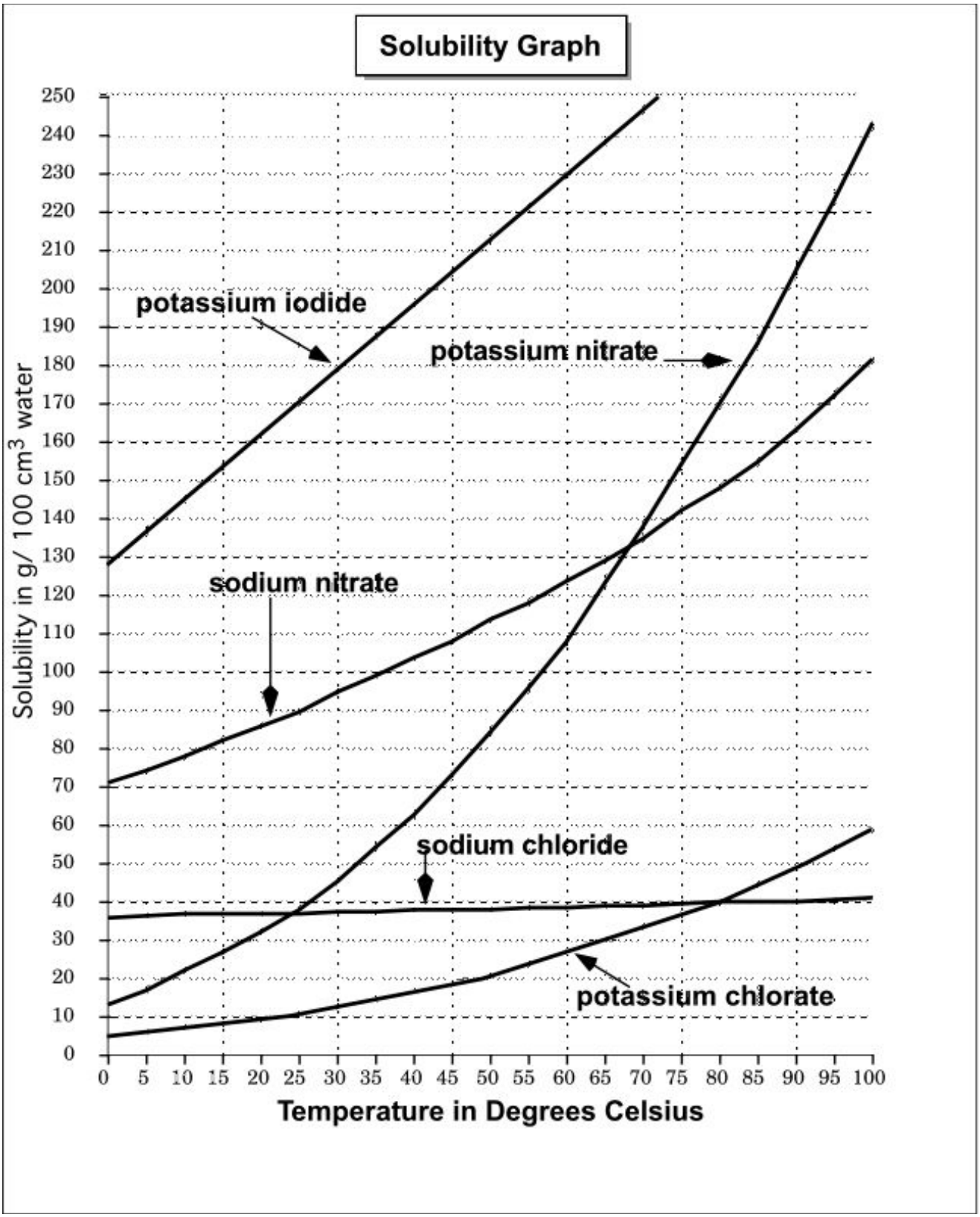
b. Calculate the amount of solute needed to prepare a specific volume of a given molarity.

c. Recognize the difference between concentration and amount, calculating the molarity and molality of a solution and calculations associated with dilutions. [GT]

d. Generate& use a standard curve of molarity versus absorbance using spectrophotometry. [GT]

Goal 4. The student will demonstrate the ability to describe colligative properties.
a. Explain why the boiling point increases and the freezing point decreases when solute particles are dissolved.

b. Give everyday examples of freezing point depression and boiling point elevations.


Solubility Graph
Solubility in g/ 100 cm3 water
Temperature in Degrees Celsius
potassium iodide
potassium nitrate
sodium nitrate
sodium chloride
potassium chlorate
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100