**CHAPTER 15/16 Test** **NAME:**
**VERSION A** **PERIOD:**

**PART 1: MULTIPLE CHOICE:** Choose the letter that best answers the statement or question. (2 points each)

_____ 1. A solution that contains as much solute as can be dissolved under the existing conditions is said to be:

a. saturated
b. supersaturated
c. soluble
d. concentrated

_____ 2. Supersaturated solutions are characterized by:

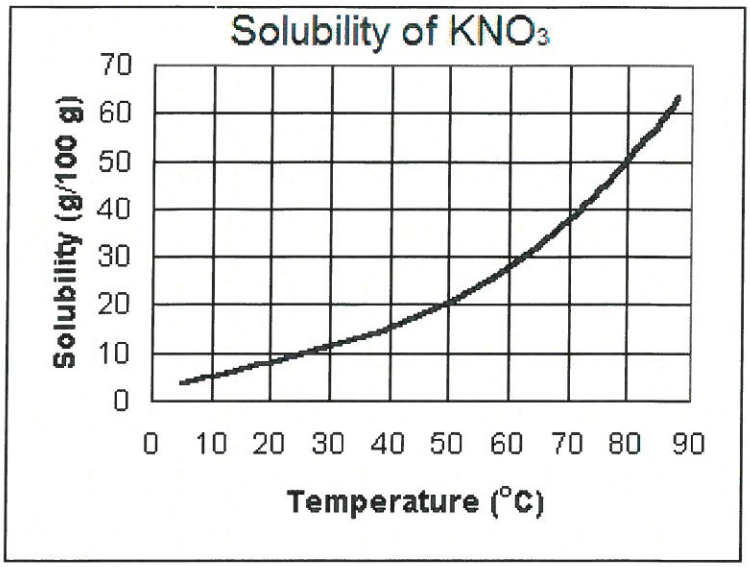
a. being super-hot
b. having great stability
c. having a larger amount of solute than can theoretically be dissolved
d. being able to exist at super low temperatures

_____ 3. Colligative properties of solutions depend on the:

a. chemical nature of the solute
b. number of solute particles dissolved
c. physical nature of the solute
d. number of moles of solvent

_____ 4. Gases are most soluble in liquids at:

a. high temperature and low pressure
b. low temperature and low pressure
c. high temperature and high pressure
d. low temperature and high pressure




Use the solubility curve above to answer questions 5-8:

_____ 5. What happens to a solution of $KNO_3$ that is saturated at 50°C when it is cooled ***quickly*** to 10°C?

a. the solution is not changed
b. the solution becomes unsaturated
c. the average kinetic energy rises
d. extra solute falls out of solution

_____ 6. How would you describe a solution of $KNO_3$ at 80°C if there are about 45 grams of $KNO_3$ dissolved in 100 grams of water?

a. it is supersaturated
b. it is dilute
c. it is unsaturated
d. it is saturated

_____ 7. Determine how many grams of $KNO_3$ would dissolve in 100 grams of water at 50°C to make a saturated solution:

a. 10 grams
b. 20 grams
c. 50 grams
d. 60 grams

_____ 8. How many grams of $KNO_3$ need to dissolve in ***300 grams*** of water in order to have a saturated solution at 50°C?

a. 20 grams
b. 150 grams
c. 60 grams
d. 120 grams

**PART 2: SHORT ANSWER**

1. Complete the table below. Write **YES** if the solute is soluble in each solvent. Write **NO** if the solute is not soluble in each solvent. In the last column, rank the **SOLUTES** in order of increasing boiling point (1 = lowest, 3 = highest). (1/2 point per box)

| | **Soluble in $H_2O$?** | **Soluble in $CCl_4$?** | **Soluble in Alcohol?** | **Rank solutes in order of increasing boiling point (1 = lowest, 3 = highest)** |
|---|---|---|---|---|
| $I_2$ | | | | |
| $C_6H_{12}O_6$ (sugar) | | | | |
| NaCl | | | | |

2. Write the dissociation equation for each compound below. Then determine the number of ions each salt will form. (1 point per box)

| **SALT** | **DISSOCIATION EQUATION** | **# OF IONS** |
|---|---|---|
| $CaBr_2$ | | |
| $K_3PO_4$ | | |

**PART 3: CALCULATIONS**

1. Determine the molality and mass percent of $Ca(NO_3)_2$ in a solution prepared by dissolving 60.0g of $Ca(NO_3)_2$ in 400g of water.

   a. Determine the molality of the solution. (3 points)

   b. Determine the mass % of $Ca(NO_3)_2$ in the solution. (3 points)

2. Determine the freezing point of a solution prepared by dissolving 50g of $C_6H_{12}O_6$ (molar mass = 180g/mol) in 250g of water.

| $K_f$ for water = 1.86°C/m | $K_b$ for water = 0.512°C/m |
|---|---|

   a. Find the molality of the solution. (2 points)

   b. Find the freezing point of the solution. (3 points)

Answer question #3 or #4. If you answer both questions, only #3 will be graded.

3. How many moles of $C_{12}H_{22}O_{11}$ must be added to 675g of water in order to prepare a 1.2m solution? (3 points)

4. Determine the mass of potassium sulfate that must be added to 350g of water in order to prepare a 0.50m solution. (5 points)

5. Find the molarity of a solution containing 60g of $BaCl_2$ in 320 mL of solution. (3 points)

6. How many milliliters of an 18 M solution of acetic acid ($HC_2H_3O_2$) would you need to make 575 mL of a 2.0 M solution of this acid? (3 points)

a. How many millileters of water would you need? (1 point)

7. Enough water is added to 120mL of 2.0M hydrochloric acid to bring the volume to 250mL. Find the new molarity of the solution. (3 points)

8. What volume of 2.0M NaCl solution can be made from 0.75moles of NaCl? (3 points)

9. You have 140g of $AgNO_3$ and need to make up a 0.35M solution. What will be the final volume of the solution? (4 points)

10. How many moles of NaOH are in 2.5L of a 0.65M sodium hydroxide solution? (3 points)

11. How many grams of $FeBr_3$ are needed to make 525 mL of a 0 .75 M solution? (4 points)

**CHAPTER 15/16 Test** **NAME:**

**VERSION A -** **PERIOD:**

**PART 1: MULTIPLE CHOICE:** Choose the letter that best answers the statement or question. (2 points each)

__A_____ 1. A solution that contains as much solute as can be dissolved under the existing conditions is said to be:

e. saturated
f. supersaturated
g. soluble
h. concentrated

___C_____ 2. Supersaturated solutions are characterized by:

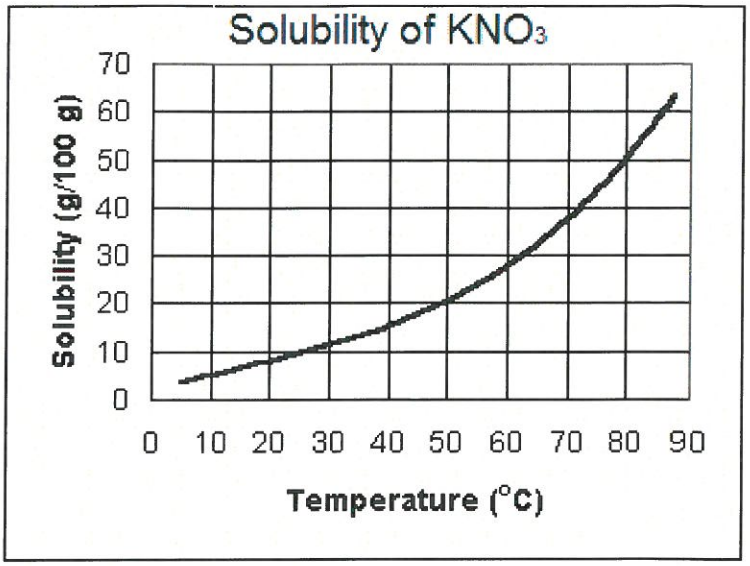
e. being super-hot
f. having great stability
g. having a larger amount of solute than can theoretically be dissolved
h. being able to exist at super low temperatures

__B_____ 3. Colligative properties of solutions depend on the:

e. chemical nature of the solute
f. number of solute particles dissolved
g. physical nature of the solute
h. number of moles of solvent

__D_____ 4. Gases are most soluble in liquids at:

e. high temperature and low pressure
f. low temperature and low pressure
g. high temperature and high pressure
h. low temperature and high pressure




Use the solubility curve above to answer questions 5-8:

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f. the solution becomes unsaturated

g. the average kinetic energy rises

h. extra solute falls out of solution

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e. it is supersaturated

f. it is dilute

g. it is unsaturated

h. it is saturated

___B_____ 7. Determine how many grams of $KNO_3$ would dissolve in 100 grams of water at 50°C to make a saturated solution:

e. 10 grams

f. 20 grams

g. 50 grams

h. 60 grams

___C_____ 8. How many grams of $KNO_3$ need to dissolve in ***300 grams*** of water in order to have a saturated solution at 50°C?

e. 20 grams

f. 150 grams

g. 60 grams

h. 120 grams

**PART 2: SHORT ANSWER**

3. Complete the table below. Write **YES** if the solute is soluble in each solvent. Write **NO** if the solute is not soluble in each solvent. In the last column, rank the **SOLUTES** in order of increasing boiling point (1 = lowest, 3 = highest). (1/2 point per box)

| | **Soluble in $H_2O$?** | **Soluble in $CCl_4$?** | **Soluble in Alcohol?** | **Rank solutes in order of increasing boiling point (1 = lowest, 3 = highest)** |
|---|---|---|---|---|
| $I_2$ | NO | YES | NO | 1 |
| $C_6H_{12}O_6$ (sugar) | YES | NO | YES | 2 |
| NaCl | YES | NO | NO | 3 |

4. Write the dissociation equation for each compound below. Then determine the number of ions each salt will form. (1 point per box)

| **SALT** | **DISSOCIATION EQUATION** | **# OF IONS** |
|---|---|---|
| $CaBr_2$ | $CaBr_2 \rightarrow Ca^{+2} + 2\ Br^{-1}$ | 3 |
| $K_3PO_4$ | $K_3PO_4 \rightarrow 3\ K^{+1} + PO_4^{-3}$ | 4 |

## PART 3: CALCULATIONS

1. Determine the molality and mass percent of $Ca(NO_3)_2$ in a solution prepared by dissolving 60.0g of $Ca(NO_3)_2$ in 400g of water.

   a. Determine the molality of the solution. (3 points)

$$60\ g\ Ca(NO_3)_2 \left| \frac{1\ mol}{164.1\ g} \right. = 0.3656\ mol$$

$$m = \frac{0.3656\ mol}{0.4\ Kg} = \boxed{0.91m}$$

   b. Determine the mass % of $Ca(NO_3)_2$ in the solution. (3 points)

$$\frac{60\ g\ Ca(NO3)2}{460\ g\ solution} \times 100 = 13.0\%$$

2. Determine the freezing point of a solution prepared by dissolving 50g of $C_6H_{12}O_6$ (molar mass = 180g/mol) in 250g of water.

| $K_f$ for water = 1.86°C/m | $K_b$ for water = 0.512°C/m |
|---|---|

   a. Find the molality of the solution. (2 points)

$$50g\ C_6H_{12}O_6 \left| \frac{1\ mol}{180\ g} \right. = 0.2778\ mol$$

$$m = \frac{0.2778\ mol}{0.25\ Kg} = \boxed{1.11m}$$

   b. Find the freezing point of the solution. (3 points)

$\Delta Tf = Kf \cdot m \cdot i$
$= 1.86\ (1.11)(1)$
$= 2.1°C$

$Tf = 0\text{-}2.1° = \boxed{\text{-}2.1°C}$

Answer question #3 or #4. If you answer both questions, only #3 will be graded.

c. How many moles of $C_{12}H_{22}O_{11}$ must be added to 675g of water in order to prepare a 1.2m solution? (3 points)

d. Determine the mass of potassium sulfate that must be added to 350g of water in order to prepare a 0.50m solution. (5 points)

5. Find the molarity of a solution containing 60g of $BaCl_2$ in 320 mL of solution. (3 points)

$\frac{60\text{g}}{208.3\text{ g}} \times \frac{1\text{ mol}}{} = 0.288\text{ mol}$

$\frac{0.288\text{ mol}}{0.320\text{ L}} = \boxed{0.9\text{M}}$

6. How many milliliters of an 18 M solution of acetic acid ($HC_2H_3O_2$) would you need to make 575 mL of a 2.0 M solution of this acid? (3 points)

$M_1V_1 = M_2V_2$

$18\text{M}\ (V_1) = 2\text{M}\ (575\text{mL})$

$V_1 = \boxed{63.9\text{mL}}$

a. How many millileters of water would you need? (1 point)

$575\text{mL} = 63.9\text{mL} + H_2O$

$\boxed{511.1\text{mL}} = H_2O$

7. Enough water is added to 120mL of 2.0M hydrochloric acid to bring the volume to 250mL. Find the new molarity of the solution. (3 points)

$M_1V_1 = M_2V_2$

$2M\ (120mL) = M_2\ (250mL)$

$M_2 = \boxed{0.96M}$

8. What volume of 2.0M NaCl solution can be made from 0.75moles of NaCl? (3 points)

$2.0M = \frac{0.75mol}{L}$

$= 0.375\ L$

9. You have 140g of $AgNO_3$ and need to make up a 0.35M solution. What will be the final volume of the solution? (4 points)

$\frac{140g}{258.6\ g} \left| \frac{1\ mol}{} \right. = 0.54\ mol$

$0.35\ M = \frac{0.54\ mol}{L}$

$= 1.5\ L$

10. How many moles of NaOH are in 2.5L of a 0.65M sodium hydroxide solution? (3 points)

0.65 M = mol

2.5 L

= 1.625 mol

11. How many grams of $FeBr_3$ are needed to make 525 mL of a 0 .75 M solution? (4 points)

0.75 M = mol

0.525 L

= 0.39 mol

$$\frac{0.39 \text{ mol} \mid 294.3 \text{ g}}{1 \text{ mol}} = 114.8 \text{ g}$$