Chemistry Name: _____

Section _____ CHAPTER 14 LEARNING GUIDE Date: _____

Complete the following table.

	Homogeneous or Heterogeneous	Particle Size	Settles or Not	Key Feature
Simple Suspension	heterogeneous	visible	settles	can be filtered
Colloid	heterogeneous	microscopic	does not settle	Tyndall effect
Solution	homogeneous	molecular	does not settle	clear

Solutions – solutes and solvents.

Solute the minor phase in a homogeneous mixture, the part that gets dissolved

Solvent the major phase in a homogeneous mixture, the part that does the dissolving

Consider the words: soluble, insoluble, miscible, and immiscible.

Pair the words that are most alike.

soluble is most like miscible

insoluble is most like immiscible

Soluble and insoluble are used for all phases (solid, liquid, or gas)

Miscible and immiscible are used only for liquid / liquid mixtures

Define the following words.

Unsaturated dissolving less than the maximum amount of solute under the given conditions

Saturated dissolving the maximum amount of solute under the given conditions

Supersaturated dissolving more than the maximum amount of solute under the given conditions

Solubility Curves: Table G

How much ammonia (NH_3) can be dissolved at 70° C? 18 g / 100 g

Describe a solution of 10. g of NaCl in 25 g H_2O at 90° C. saturated

Mass – mass concentration

Percent by Mass or Parts per Hundred

Using Table T, write the formula: percent concentration by mass = $\frac{\text{mass solute}}{\text{mass solution}} \times 100$

The symbol for percent by mass is $\%_{mass}$ and the units are There are no units (%)

Calculate the percent by mass concentration of a saturated $NaNO_3$ solution at 20° C.

$$\%_{\text{mass}} = \frac{\text{mass solute}}{\text{mass solution}} \times 100 = \frac{88\text{ g}}{88\text{ g} + 100.0\text{ g}} \times 100 = \underline{47\ \%}$$

Parts per Million

Using Table T, write the formula for parts per million: ppm = $\frac{\text{mass of solute}}{\text{mass of solution}} \times 1\ 000\ 000$

The symbol for parts per million is ppm and the units are there are no units (like %)

Calculate the mass of $Pb(NO_3)_{2\,(s)}$ required to make 500.0 g $Pb(NO_3)_{2\,(aq)}$ with a concentration of 155 ppm.

$$\text{ppm} = \frac{\text{mass solute}}{\text{mass solution}} \times 10^6 = 115\text{ ppm} = \frac{\text{mass solute}}{500.0\text{ g}} \times 10^6 \quad \therefore \text{mass solute} = \underline{0.0775\text{ g}}$$

Molality

Write the formula for molality: Molality = $\frac{\text{moles of solute}}{\text{kg of solvent}}$

The symbol for molality is m and the units are moles / kg

What is the van't Hoff factor (ionization constant), *i*, for NaOH? *i* = 2

Find the molality of a sodium hydroxide solution made by dissolving 0.575 moles of NaOH in 350. g of water.

$$m = \frac{\text{mol}}{\text{kg}} = \frac{0.575\text{ mol}}{0.350\text{ kg}} = \underline{1.64\ m}$$

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Mass – volume concentration

Molarity

Using Table T, write the formula for molarity: Molarity = $\frac{\text{moles of solute}}{\text{liter of solution}}$

The symbol for molarity is M and the units are mol / liter

Find the molarity of a solution made by dissolving 0.575 moles of NaOH in enough water to make 350 mL of solution.

$$\underline{\text{M}} = \frac{\text{mol}}{\text{L}} = \frac{0.575\ \text{mol}}{0.350\ \text{L}} = \underline{1.64\ \underline{\text{M}}}$$

Find the molarity of a solution made by dissolving 22.5 grams of NaOH in enough water to make 750 mL of solution.

$$22.5\ \text{g}_{\text{NaOH}} \times \frac{1\ \text{mol}}{40.0\ \text{g}_{\text{NaOH}}} = 0.5625\ \text{mol}_{\text{NaOH}}$$

$$\underline{\text{M}} = \frac{\text{mol}}{\text{L}} = \frac{0.5625\ \text{mol}}{0.750\ \text{L}} = \underline{0.750\ \underline{\text{M}}}$$

Molarity dilution problems

Dilution problems can be solved using the same formula as for titrations where A stands for after dilution and B stands for before dilution and for titrations A is for acid and B is for base.

Using Table T, write the titration (dilution) formula: $\underline{\text{M}}_{\text{A}}\text{V}_{\text{A}} = \underline{\text{M}}_{\text{B}}\text{V}_{\text{B}}$

In a titration, 50.0 milliliters of 0.026 M $HCl_{(aq)}$ is neutralized by 38.5 milliliters of $KOH_{(aq)}$. Find the concentration of the KOH solution.

$\underline{M}_A V_A = \underline{M}_B V_B$

(0.026 M)(50.0 mL) = ($\underline{M}_B$)(38.5 mL)

$\underline{M}_B$ = (0.026 M)(50.0 mL) / (38.5 mL) = 0.0338 M

Find the new concentration if 25.0 mL of a 1.75 M solution is diluted with water to 350. mL.

$\underline{M}_A V_A = \underline{M}_B V_B$

($\underline{M}_A$)(350.0 mL) = (1.75 M)(25.0 mL)

$\underline{M}_A$ = (1.75 M)(25.0 mL) / (350.0 mL) = 0.125 M

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Solvation

List the three factor affecting rate of solvation.

temperature , surface area and agitation

A fourth factor affecting only gases is pressure

Colligative Properties

The formula for boiling point elevation is $\Delta T = K_b\, m\, i$

where K_b for water = 0.512 °C / *m*

The formula for freezing point depression is $\Delta T = K_f\, m\, i$

where K_f for water = –1.86 °C / *m*

If 25.0 g of NaCl is dissolved in 200. g of water, what is the new freezing temperature of the water?

$$n = 25.0\ \text{g} \times \frac{1\ \text{mol}}{58.443\ \text{g}} = 0.4278\ \text{mol}$$

$$m = \frac{0.4278\ \text{mol}}{0.200\ \text{kg}} = 2.139\ m$$

K_f for water = –1.86 °C m^{-1}

i = 2 for NaCl [$Na^+_{(aq)}$ and $Cl^-_{(aq)}$]

$\Delta T_f = K_f\, m\, i$

$= (-1.86\ °C\ m^{-1})(2.139\ m)(2)$

$= -7.96°C$

New freezing point = normal freezing point + ΔT_f = 0°C – 7.96°C = –7.96°C

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