WLHS / Chem / Monson

Name_____
Date_____Per_____

STUDY GUIDE – Unit 9 – Water; Solutions; Acids & Bases (Sect. Ch 15. 16. 19)

CONCEPTS / VOCAB / EQUATIONS:

Chapter 15 – Liquid Water and Its Properties

hydrogen bonding	heat of vaporization	solvation	hydrated compounds
surface tension	evaporative cooling	electrolytes*	suspension vs. colloid
surfactant	aqueous solutions	nonelectrolytes*	Tyndall effect
specific heat capacity	solute vs. solvent	*strong vs. weak	emulsion

Chapter 16 – Properties of Solutions

miscible vs. immiscible	Henry's Law	dilutions	mole fraction
saturated	solubility	percent solutions	freezing point depression
unsaturated	molarity	colligative properties	boiling point elevation
supersaturated	concentrated vs. dilute	molality	

Chapter 19 – Acids & Bases

acid	monoprotic acids	conjugate acid	titration
base	diprotic acids	conjugate base	end point / equivalence pt
hydroxide ion	triprotic acids	conjugate acid-base pair	
hydronium ion	hydrogen-ion donor	neutralization reactions	
pH / pOH	hydrogen-ion acceptor		

EQUATIONS:

Molarity (M) = mol solute / L solution
Molarity by Dilution: $M_1V_1 = M_2V_2$
% solution (v/v): vol. solute / vol. solution
% solution (m/v): mass solute (g) / vol. solution (mL)
Henry's Law: $S_1 / P_1 = S_2 / P_2$

$pH = -\log[H^+]$
$pOH = -\log[OH^-]$
$[H^+][OH^-] = 1 \times 10^{-14}$
$pH + pOH = 14$

REVIEW QUESTIONS:

1) Distinguish between **MISCIBLE** and **IMMISCIBLE**.

2) Explain how **hydrogen bonding** causes (or contributes to) the following properties of water:

➔ surface tension:

➔ high heat of vaporization:

➔ ice floats on water:

3) List three factors that affect the **RATE** at which a solute dissolves into solution.

_____ _____ _____

4) List three factors that affect the **SOLUBILITY** of a solute (solid or gas).

_____ _____ _____

5) Complete the table below comparing SOLUTIONS, COLLOIDS, and SUSPENSIONS.

Property:	**Solution**	**Colloid**	**Suspension**
Particle Size			
Tyndall effect?			
Filtration			
Example			

PROBLEMS:

1) The solubility of methane, the major component of natural gas, in water at 20°C and 1.00 atm pressure is 0.025 g/L. If the temperature remains constant, what will be the solubility of this gas at the following pressures?

A) 0.65 atm **B) 3.15 atm**

2) Calculate the **molarity** of each solution below:

A) 445 g of $CuSO_4$ in 4.50 L of solution

B) 5.46 g $NaHCO_3$ in 1500 mL solution

3) You have the following stock solutions available:

2.00 M NaCl **0.50 M $MgSO_4$** **4.0 M KNO_3**

Calculate the volumes of stock solution you must begin with and dilute to make the following solutions:

A) 500.0 mL of 0.550 M NaCl B) 2.0 L of 0.220 M $MgSO_4$ C) 52.0 mL of 0.175 M KNO_3

7) Hydrogen peroxide (H_2O_2) is often sold commercially as a 3.0% (m/v) aqueous solution.

A) If you buy a 250-mL bottle of 3.0% H_2O_2 (m/v), how many grams of hydrogen peroxide have you purchased?

B) What is the **MOLARITY** of this solution?

8) What is the concentration, in % (m/v), of a solution with 75.0 g K_2SO_4 in 1500. mL of solution?

9) What is the concentration, in % (v/v), of a solution made by mixing 95 mL ethanol with 225 mL water?

CHAPTER 19: Acids & Bases

1) List at least three characteristic properties of acids and three of bases.

2) What is an Arrhenius acid? Provide an example equation.

3) What is an Arrhenius base? Provide an example equation.

4) Use >, <, = to fill out the following:

$[H_3O^+]$_____$[OH^-]$ Neutral

$[H_3O^+]$_____$[OH^-]$ Basic

$[H_3O^+]$_____$[OH^-]$ Acidic

5) What does each whole number on the pH scale represent?_____

CHAPTER 19 PROBLEMS:

1) Using Bronsted-Lowry theory, identify the acid, base, conjugate acid, and conjugate base in the following reactions:

a) $HNO_3 + H_2O \leftrightarrows H_3O^+ + NO_3^-$

b) $H_2C_2O_4 + CH_3NH_2 \leftrightarrows HC_2O_4^- + CH_3NH_3^+$

c) $NH_4^+ + H_2O \leftrightarrows NH_3 + H_3O^+$

d) $NO_2^- + H_2O \leftrightarrows HNO_2 + OH^-$

2) Calculate the **pH and pOH** of the following solutions:

a) $[H^+] = 1.72 \times 10^{-6}$ M

c) $[H^+] = 7.84 \times 10^{-8}$ M

e) $[H^+] = 3.22 \times 10^{-3}$ M

b) $[OH^-] = 5.75 \times 10^{-9}$ M

d) $[OH^-] = 9.90 \times 10^{-11}$ M

f) $[OH^-] = 5.76 \times 10^{-2}$ M

3) Calculate $[H^+]$ and $[OH^-]$ for the following solutions:

a) a solution with pH = 11.0

c) a solution with pH = 2.45

e) a solution with pOH = 1.35

b) a solution with pH = 8.5

d) a solution with pOH = 7.0

f) a solution with pOH = 12.6

4) Determine the **pH and pOH** of a 0.0020 M HCl solution.

5) What is the pOH of a solution with a pH of 6.98?

6) Determine the $[H_3O^+]$, $[OH^-]$, and pOH of a solution if the pH is 7.77. Is the solution acidic, basic, or neutral?

7) **Complete the following chart:**

[H+]	**[OH-]**	**pH**	**pOH**	**acid or base?**
			6.48	
	8.28×10^{-6} M			
		9.75		
			7.22×10^{-5} M	
		2.55		