Exam 4

Part I: Multiple Choice (2 points each)

Directions: Please circle the *best* answer for each of the following questions.

Question 1. It is OK to take off eye protection in chemistry lab

1. once you are done using chemicals, even if those around you are still using chemicals.
2. when you are writing notes in a lab notebook and not actively using chemicals.
3. when working at a chemical hood with the safety shield down.
4. if, at the end of the lab, you need to store your goggles in a drawer or locker in the lab and quickly exit the lab.
5. all of the above

Question 2. A substance that carries an electric current when dissolved in water is called a(n) \_\_\_\_\_\_\_.

1. solution
2. electrolyte
3. nonelectrolyte
4. solute
5. solvent

Question 3. An increase in the temperature of a solution usually

1. increases the solubility of a gas in the solution.
2. increases the boiling point.
3. decreases the solubility of a solid solute in the solution.
4. decreases the solubility of a liquid solute in the solution.
5. increases the solubility of a solid solute in the solution.

Question 4. Which of the following is correctly identified?

1. NH­3, strong acid
2. HCl, weak acid
3. Ca(OH)2, weak base
4. NaOH, strong base
5. H2CO3, strong acid

Question 5. When zinc metal reacts with hydrochloric acid, one product is

1. H2O2
2. H2O
3. H2
4. Zn(OH)2
5. ZnSO4

Question 6. Physiologically active nitrogen-containing compounds produced by plants are called \_\_\_\_\_.

1. ethers
2. polymers
3. aromatics
4. alkaloids
5. esters

Question 7. The compounds 1-butyne contains \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

1. a double bond
2. a triple bond
3. a ring structure
4. a bromine atom
5. all single bonds

Question 8. Which group of carbohydrates cannot be hydrolyzed to give smaller molecules?

1. Monosaccharides
2. Disaccharides
3. Trisaccharides
4. Oligosaccharides
5. Polysaccharides

Question 9. A monosaccharide that consists of 5 carbon atoms, one of which is in a ketone group, is classified as a(n) \_\_\_\_\_\_\_\_\_\_.

1. ketopentose
2. ketotetrose
3. aldohexose
4. aldopentose
5. aldotetrose

Question 10. An acid and base react to form a salt and water is a(n) \_\_\_\_\_ reaction.

1. oxidation-reduction
2. single replacement
3. neutralization
4. ionization
5. dissociation

Part II: Short Answer

Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work.

Question 1. Identify the following components of the net ionic equation below:

HC2H3O2 (aq) + H2O (l) $⇌$ H3O+ (aq) + C2H3O2- (aq) (4 points)

1. Acid \_\_\_\_\_ HC2H3O2\_\_\_\_\_\_\_\_\_\_
2. Conjugate acid \_\_\_\_\_H3O+\_\_\_\_\_\_\_\_\_\_
3. Base \_\_\_\_\_H2O\_\_\_\_\_\_\_\_\_\_
4. Conjugate base \_\_\_\_\_ C2H3O2-\_\_\_\_\_\_\_\_\_\_

Question 2. A 55.7 mL sample of phosphoric acid requires 95.0 mL of 2.25 M sodium hydroxide for complete neutralization. What is the molarity of the acid given the unbalanced equation (6 points):

H3PO4 (aq) + 3 NaOH (aq) 🡪 Na3PO4 (aq) + 3 H2O (l)

$$95.0 mL NaOH soln×\frac{2.25 mmol NaOH}{1 mL NaOH soln}×\frac{1 mmol H\_{3}PO\_{4}}{3 mmol NaOH}×\frac{1}{55.7 mL H\_{3}PO\_{4} soln }=1.2791741 M H\_{3}PO\_{4}≈1.28 M H\_{3}PO\_{4}$$

Question 3. A sample of acid rain has a pH of 2.37 (6 points).

1. Calculate the [H3O+].

$$\left[H\_{3}O^{+}\right]=10^{-pH}=10^{-2.37}=4.3×10^{-3} M$$

1. Calculate the pOH.

$$pH+pOH=14⇒pOH=14-pH=14-2.37=11.63$$

1. Calculate the [OH-].

$$K\_{w}=\left[H\_{3}O^{+}\right]\left[OH^{-}\right]⇒\left[OH^{-}\right]=\frac{K\_{w}}{\left[H\_{3}O^{+}\right]}=\frac{1×10^{-14}M^{2}}{4.3×10^{-3} M}=2.3×10^{-12}M$$

Question 4. Identify if the following statements are true or false (6 points):

1. Most plant lipids are saturated lipids. \_\_\_\_\_false\_\_\_\_\_\_\_\_\_
2. Sucrose is a disaccharide. \_\_\_\_\_true\_\_\_\_\_\_\_\_\_
3. Hydrogenation of a double bond in a triaclglyerol requires a catalyst. \_\_\_\_\_true\_\_\_\_\_
4. A nucleotide consists of only a base and a sugar. \_\_\_\_\_false\_\_\_\_\_\_\_\_\_
5. DNA is a protein. \_\_\_\_\_false\_\_\_\_\_\_\_\_\_
6. Uracil is found in both DNA and RNA. \_\_\_\_\_false\_\_\_\_\_\_\_\_\_

Question 5. Indicate whether each of the following compounds dissolves in water to give ions, molecules, or both (6 points):

1. HF, a weak electrolyte \_\_\_\_\_both\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Gluose, a nonelectrolyte \_\_\_\_\_molecules\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. CH3CH2OH, a nonelectrolyte \_\_\_\_\_molecules\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. NaCl, a strong electrolyte \_\_\_\_\_ions\_\_\_\_\_\_\_\_\_\_\_\_
5. H2CO3, a weak electrolyte \_\_\_\_\_both\_\_\_\_\_\_\_\_\_\_\_\_\_
6. KNO3, a soluble salt \_\_\_\_\_ions\_\_\_\_\_\_\_\_\_\_\_\_\_

Question 6. In the following solutions, is the [OH-] greater than, less than, or equal to the [H3O+] (4 points)?

1. Acid \_\_\_\_\_less than\_\_\_\_\_\_\_\_\_\_
2. [H3O+] = 1 x 10-7 M \_\_\_\_\_equal to\_\_\_\_\_\_\_\_\_
3. pH = 13 \_\_\_\_\_greater than\_\_\_\_\_\_\_\_\_\_
4. pH = 2 \_\_\_\_\_less than\_\_\_\_\_\_\_\_\_\_

Question 7. Identify the disaccharides (maltose, lactose, or sucrose) that fit each of the following descriptions (4 points):

1. Ordinary table sugar \_\_\_\_\_sucrose\_\_\_\_\_\_\_\_\_\_
2. Found in milk and milk products \_\_\_\_\_lactose\_\_\_\_\_\_\_\_\_\_
3. Also called malt sugar \_\_\_\_\_maltose\_\_\_\_\_\_\_\_\_\_
4. Hydrolysis gives galactose and glucose \_\_\_\_\_lactose\_\_\_\_\_\_\_\_\_\_

Question 8. Identify the structural level (primary, secondary, tertiary, or quaternary) in each protein (5 points).

1. The protein folds into a compact structure stabilized by interactions between R groups. Tertiary
2. the combination of two or more protein molecules to form an active protein quaternary
3. pleated sheet secondary
4. the peptide bonds between the amino acids primary
5. the structural level achieved when hydrogen bonds form between the carboxyl group of one amino acid and the amino group of a different amino acid secondary

Question 9. Explain what happens when potassium chloride, KCl, dissolves in water (4 points).

 The K+ ions are attracted to the partially negative oxygen atoms of the water molecules. The Cl- ions are attracted to the partially positive hydrogen atoms of the water molecules.

Question 10. Name the following compounds using the IUPAC method (8 points):

* 1. CH3-CH2-CH-CH=CH-CH2 –CH3 5-methyl-3-octene

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 CH2-CH2-CH3

* 1. CH3-CH2-CH2-OH 1-butanol
	2. Br-CH2-CH2-CH3 1-bromopropane
	3. H-C≡C-CH2-CH3 1-butyne

Question 11. State the major intermolecular force for the following organic functional groups (4 points):

1. Alcohol \_\_\_\_\_hydrogen bonding\_\_\_\_\_\_\_\_\_\_
2. Ester \_\_\_\_\_dipole force\_\_\_\_\_\_\_\_\_\_
3. Carboxylic acid \_\_\_\_\_hydrogen bonding\_\_\_\_\_\_\_\_\_\_
4. Alkene \_\_\_\_\_dispersion force\_\_\_\_\_\_\_\_\_\_

Question 12. Write the condensation reaction for the amidation of carbamic acid (NH2COOH) and ammonia (NH3) (5 points):



Question 13. A solution is prepared by dissolving 5.43 milligrams of aflatoxin in 2.53 kg of water. Calculate the concentration of aflatoxin in ppm (5 points).

$$ppm=\frac{mg solute}{kg solution}$$

$ppm=\frac{5.43 mg}{(5.43 mg×\frac{1 kg}{10^{6} mg}+2.53 kg)}=\frac{5.43 mg}{0.00000543 kg+2.53 kg}=\frac{5.43 mg}{2.53000543 kg}=\frac{2.146240453mg}{kg}≈2.15 ppm$

Question 14. Are the following substances soluble or insoluble (4 points)?

1. Carbon tetrachloride and water \_\_\_\_\_insoluble\_\_\_\_\_
2. Ethanol and water \_\_\_\_\_soluble\_\_\_\_\_
3. Sodium chloride and hexane \_\_\_\_\_insoluble\_\_\_\_\_
4. Silver chloride and water \_\_\_\_\_insoluble\_\_\_\_\_

Question 15. Hydrochloric acid (HCl) reacts with sodium carbonate (Na2CO3), forming sodium chloride (NaCl), water and carbon dioxide (CO2) according to the reaction (9 points): 2 HCl (aq) + Na2CO3 (aq) 🡪 2 NaCl (aq) + H2O (l) + CO2 (g)

1. A 507 mL sample of unknown HCl solution reacts completely with Na2CO3 to form 20.1 g CO2. What was the concentration of the HCl solution?

$$20.1 g CO\_{2}×\frac{1 mol CO\_{2}}{44.01 g CO\_{2}}×\frac{2 mol HCl}{1 mol CO\_{2}}×\frac{1}{507 mL}×\frac{1000 mL}{1 L}=1.80 M HCl$$

1. Given the net ionic equation. What are the spectator ion(s), if any? \_\_Na+ and Cl-\_

2 H+ (aq) + CO32- (aq) 🡪 H2O (l) + CO2 (g)