Exam 4

# Part 1: Multiple Choice (2 points each)

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

1. What is the pH of a solution when [OH-] = 6.5 x 10-9 mol/L?
   1. 5.81
   2. 8.19
   3. 6.81
   4. 7.00
   5. 7.19
2. Which one of the following is not characteristic of a base?
   1. tasting sour
   2. producing hydroxide ions in solution
   3. producing a solution with a pH greater than 7
   4. turning red litmus blue
   5. none of the above
3. Which one of the following pairs does not represent a conjugate acid-base pair?
   1. HClO3/ClO3-
   2. HBr/Br-
   3. NO3-/HNO3
   4. H3O+/H2O
   5. H2CO3/CO32-
4. Which molecule is least likely to show signs of hydrogen bonding?
   1. Methane, CH4
   2. Ammonia, NH3
   3. Hydrogen fluoride, HF
   4. Methanol, CH3OH
   5. Water, H2O
5. A metal is a type of
6. amorphous solid.
7. ionic solid.
8. molecular solid.
9. atomic solid.
10. covalent network solid.
11. How much energy is released when 16.0 g of liquid water is converted to solid at 0 °C? (The specific heat of water is 4.184 J/g °C and the heat of fusion for water at this temperature is 0.334 kJ/mol.)
    1. 7.22 x 104 J
    2. 5.35 kJ
    3. 96.3 kJ
    4. 72.2 kJ
    5. 1.74 x 103 J
12. What is the concentration of chloride ions in a 0.60 M barium chloride solution?
    1. 1.8 M
    2. 0.60 M
    3. 2.4 M
    4. 0.30 M
    5. 1.2 M
13. A solution that contains the maximum amount of solute possible at a particular temperature is said to be
    1. unsaturated.
    2. supersaturated.
    3. concentrated.
    4. saturated.
    5. dilute.
14. What type of vessel is used to prepare solutions of accurately known concentrations?
15. Beaker
16. Erlenmeyer flask
17. Volumetric flask
18. Molarity flask
19. Florence flask
20. When preparing a solution, a homogeneous mixture, the substance present in the larger amount is called the \_\_\_\_\_\_\_ and the substance in smaller amount is called the \_\_\_\_\_\_\_\_\_\_.
    1. solvent; solute
    2. dissolving agent; solute
    3. dissolving agent; solvent
    4. solute; solvent
    5. homogeneous; heterogeneous

# Part 2: 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.

1. Do the following statements describe the compound silver carbonate, Ag2CO3? Answer yes or no (4 points).

|  |  |  |
| --- | --- | --- |
|  | The compound would be expected to be a solid at room temperature and pressure. | yes |
|  | The compound is ionic. | yes |
|  | If the compound dissolved in water it would be a non-electrolyte. | no |
|  | The compound would be expected to have a relatively low melting point. | no |

1. A mixture of nitrogen and xenon gases is maintained in a 6.30 L flask at a temperature of 53 °C. If the partial pressure of nitrogen is 0.276 atm and the partial pressure of xenon is 0.352 atm, what is the total pressure in the flask (3 points)?
2. Oxalic acid dehydrate, H2C2O4 ∙ 2 H2O, is a solid, diprotic acid that can be used in the laboratory as a primary standard. A student dissolves 0.466 grams of oxalic acid dihydrate in water and titrated the resulting solution with a solution of barium hydroxide, Ba(OH)2, of unknown concentration (10 points).
   1. Write the balanced chemical reaction.

H2C2O4 (aq) + Ba(OH)2 (aq) 🡪 BaC2O4 (s) + 2 H2O (l)

* 1. If 28.9 mL of the barium hydroxide solution are required to neutralize the acid, what is the molarity of the barium hydroxide solution?

1. A 0.0250 L solution prepared by mixing 4.243 g of zinc nitrate, Zn(NO3)2, with water (10 points).
   1. What is the molarity of the solution?
   2. Inventory the ions in the solution.
2. Complete the following table (10 points).

|  |  |  |  |
| --- | --- | --- | --- |
| Acid name | Acid formula | Weak or Strong? | Major species in aqueous solution |
| Chloric acid | HClO3 (aq) | Strong | H+ and ClO3-ions |
| Hydrobromic acid | HBr (aq) | Strong | H+and Br- ions |
| Acetic acid | HC2H3O2 (aq) | Weak | HC2H3O2 molecules |

1. Write an equation to illustrate the acid-base reactions that will take place between HBr and NH3. Identify the acids, bases, and conjugate acid base pairs (6 points).
2. You love the smell of jasmine and have bought a solution of methyl jasmonate, one of the compounds responsible for the characteristic odor of jasmine. If the solution is composed of a 0.5298 molar solution of methyl jasmonate in acetone, how many molecules of methyl jasmonate will you spread around the room if you spritz 0.222 mL of the solution into the air (6 points)?

1. A cup of coffee has a volume of 250. mL, a mass of 250. g, and contains 175 mg of caffeine, C8H10N4O2 (8 points).
   1. What is the molarity of the caffeine in the coffee?
   2. What is the mass percent of the caffeine in the coffee?

1. Define the term viscosity. How does the viscosity of a liquid change as intermolecular forces become stronger? Explain using kinetic molecular theory (KMT) how differences in intermolecular forces affect viscosity (5 points).

Viscosity is a measure of resistance to flow.

As intermolecular forces become stronger, the viscosity of a liquid increases.

This is because stronger intermolecular forces cause the molecules to be more strongly attracted to each other resulting in a liquid that pours more slowly because the molecules do not want to roll past one another but rather stick.

1. What is the pH and pOH of a solution prepared by dissolving 2.5 g hydrochloric acid, HCl, in water to make 425 mL of solution (8 points)?

pH = - log[H+] = - log(0.16) = 0.79

pH + pOH = 14.000 🡪 pOH = 14.000 – pH = 14.000 – 0.79 = 13.21

1. Name the types of intermolecular forces for each molecule (6 points):
   1. ethanol, CH3CH2CH2OH London-dispersion forces, dipole forces, hydrogen bonding
   2. silicon dioxide, SiO2 London-dispersion forces
   3. carbon monoxide, CO London-dispersion forces, dipole forces
2. How does the solubility vary with pressure? Compare the effect of pressure change on gases, liquids, and solids (4 points).

The solubility of liquids and gases is generally not affected by pressure. Gases are always more soluble at high pressures.