Exam 1

Part I: Multiple Choice (2 points each)

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

Question 1. Which piece of glassware is not found in your lab locker?

1. Beaker
2. Erlenmeyer flask
3. Beaker cover
4. Buret
5. Thermometer

Question 2. Give the characteristic of a zero order reaction having only one reactant. The rate of the reaction

1. is not proportional to the concentration of the reactant.
2. is proportional to the square of the concentration of the reactant.
3. is proportional to the square root of the concentration of the reactant.
4. is proportional to the natural logarithm of the concentration of the reactant.
5. is directly proportional to the concentration of the reactant.

Question 3. What are the units of k in a second order reaction?

1. M/s
2. Ms
3. M-1s-1
4. M2/s
5. 1/s

Question 4. The rate of reaction will increase by a factor of \_\_\_\_, if the concentration of Y is doubled? rate = k[X]2[Y]3

1. 9
2. 8
3. 4
4. 2
5. none of the above

Question 5. Find the missing value, given:

H2 (g) + Br2 (g) 2 HBr (g) Kc = 3.8 x 104

2 HI (g) H2 (g) + I2 (s) Kc = ?

1. 1.9 x 104
2. 5.3 x 10-5
3. 2.6 x 10­-5
4. 6.4 x 10-4
5. not enough information

Question 6. In a reaction mixture containing only reactants, what is the value of Q?

1. -1
2. 1
3. ∞
4. 0
5. It cannot be determined without concentrations.

Question7. \_\_\_\_\_\_\_\_\_\_\_ forms an acidic solution in water.

1. Ammonium chloride
2. Sodium fluoride
3. Lithium iodide
4. Potassium nitrate
5. all of the above

Question 8. \_\_\_\_\_\_\_\_\_\_\_\_\_ is amphoteric.

1. CO32-
2. HF
3. NH4+
4. HPO42-
5. none of the above

Question 9. Identify the weak diprotic acid.

1. CH3COOH
2. HCOOH
3. H3PO4
4. H2SO4
5. H2CO3

Question 10. What is the correct procedure for preparing the dilution of a solution of an acid?

1. Add the acid to the water as quickly as possible.
2. Add the acid to the water slowly with stirring.
3. Add the water to the acid as quickly as possible.
4. Add the water to the acid slowly with stirring.
5. b or d

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. What are the four basic steps involved in heterogeneous catalysis (6 points)?

Question 2. The second-order decomposition of nitrogen dioxide has a rate constant of 0.255 M-1 s-1. How many grams of nitrogen dioxide decomposes in 4.00 s, if the initial concentration of nitrogen dioxide (1.00 L volume) is 1.33 M (12 points)?

Question 3. Define Le Chatelier's Principle (3 points).

Question 4. Do both protons ionize instantaneously from a diprotic acid such as carbonic acid, H2CO3? Explain your answer (4 points).

Question 5. Consider the reaction xenon and fluorine gases to produced xenon tetrafluoride gas. A reaction mixture initially contains 2.24 atm xenon and 4.27 atm fluorine gases (12 points).

* 1. If the equilibrium pressure of xenon is 0.34 atm, find the equilibrium constant, Kp, for the reaction.
  2. What is the value of the equilibrium constant, Kc, if the reaction takes place at 215 °C?

Question 6. Calculate the pH of a 1.60 M potassium hypobromite solution. Ka for hypobromous acid, HBrO, is 2.0 x 10-9 M (12 points).

Question 7. Describe the relationship between molecular structure and acid strength (4 points).

Question 8. Rank calcium oxide, cesium iodide, and aluminum chloride in order of increasing pH. Explain your answer (5 points).

Question 9. What is the percent ionization of a 0.490 M ammonia solution, Kb = 1.8 x 10-5 M (7 points)?

Question 10. The rate of the reaction

Cl2 (g) + CO (g) 🡪 COCl2 (g)

was determined in three experiments at 225 °C. The results are given in the following table (15 points):

|  |  |  |
| --- | --- | --- |
| [Cl2] (M) | [CO] (M) | Initial Rate (M-1 s-1) |
| 0.40 | 0.25 | 0.696 |
| 0.80 | 0.25 | 1.97 |
| 0.80 | 0.50 | 3.94 |

Determine the rate law for the reaction.