CHM 152/54 Quiz#12 25 Pts Fall 2019 Name:_____

The final exam is rapidly approaching!! It's already time to start reviewing. The following questions are meant to be a review of the early chapters. You can earn up to 25 Pts just by studying early! **Show all work in neat detailed form on a separate paper. DUE AT TIME OF FINAL** (Tues. Dec 10 9:00-10:50 a.m.)

1. Consider the following reaction between mercury(II) chloride and oxalate ion:

$$2HgCl_2(aq) + C_2O_4^{2-} \rightarrow 2Cl^-(aq) + 2CO_2(g) + Hg_2Cl_2(s)$$

The initial rate of this reaction was determined for several concentrations of $HgCl_2$ and $C_2O_4^{2-}$, and the following rate data were obtained:

Experiment	$[HgCl_2]$ (M)	$[C_2O_4^{2-}]$ (M)	Rate (M/s)
1	0.105	0.15	1.8×10^{-5}
2	0.105	0.30	7.1×10^{-5}
3	0.052	0.30	3.5×10^{-5}
4	0.052	0.15	8.9×10^{-6}

a) What is the rate law for this reaction?
b) What is the value of the rate constant?
c) What is the reaction rate when the concentration of $HgCl_2$ is 0.080 M and that of $C_2O_4^{2-}$ is 0.10 M if the temperature is the same as in the above experiments?

2. The first-order rate constant for the decomposition of a certain antibiotic in water at 20°C is 1.65 yr^{-1}. (a) If a 6.0×10^{-3} M solution of the antibiotic is stored at 20°C, what will its concentration be after 3 months? (b) After 1 year? (c) How long will it take for the concentration of the solution to drop to 1.0×10^{-3} M? (d) What is the half-life of the antibiotic solution?

3. What is the molecularity (uni, bi, or ter) of each of the following elementary steps (of various reactions). Write the rate law for each step.
(a) $N_2O(g) + Cl(g) \rightarrow N_2(g) + ClO(g)$
(b) $Cl_2(g) \rightarrow 2Cl(g)$
(c) $NO(g) + Cl_2(g) \rightarrow NOCl_2(g)$

4. For the reaction $I_2(g) + Br_2(g) \Leftrightarrow 2IBr(g)$, $K_c = 280$ at 150°C. Suppose that 0.500 mol IBr in a 1.00 L flask is allowed to reach equilibrium at equilibrium at 150°C. What are the equilibrium concentrations of IBr, I_2, and Br_2?

5. Methanol, CH_3OH, can be made by the reaction of CO with $H_2(g)$:

$$CO(g) + 2H_2(g) \Leftrightarrow CH_3OH(g)$$

(a) Use thermochemical data in your textbook's Appendices to calculate ΔH^o for this reaction.
(b) In order to maximized the equilibrium yield of methanol, would you use a high or low temperature?
(c) Assuming equal pressures of CO and H_2, how would the conversion of the gas mixture to methanol vary with total pressure?

6. Complete the following table by calculating the missing entries. In each case, indicate whether the solution is acidic or basic.

$[H^+]$	$[OH^-]$	pH	pOH	acidic or basic?
6.4×10^{-6} M				
	8.8×10^{-5}M			
		7.5		
			12.9	

7. Predict whether aqueous solutions of the following substances are acidic, basic, or neutral and write hydrolysis equations for the acidic and basic solutions.
(a) CsBr; (b) $Al(NO_3)_3$; (c) KCN; (d) CH_3NH_3Cl; (e) $KHSO_4$.

8. Determine the pH of each of the following solutions (K_a and K_b values can be found in the appendices of your textbook): (a) 0.045 M hypochlorous acid; (b) 0.0068 M phenol; (c) 0.080 M hydroxylamine.

9. Ephedrine, a central nervous stimulant, is used in nasal sprays as decongestant. This compound is a weak organic base:

$$C_{10}H_{15}ON(aq) + H_2O(l) \Leftrightarrow C_{10}H_{15}NOH^+(aq) + OH^-(aq)$$

K_b has the value of 1.4×10^{-4}. What pH would you expect for a 0.035 M solution of ephedrine, assuming that no other substances are present? What is the value of pK_a for the conjugate acid of ephedrine?

10. A buffer is prepared by adding 5.0 g of ammonia, NH_3, and 20.0 g of ammonium chloride, NH_4Cl, to enough water to form 2.50 L of solution. (a) What is the pH of the buffer? (b) Write the complete ionic equation for the reaction that occurs when a few drops of nitric acid are added to the buffer. (c) Write the complete ionic equation for the reaction that occurs when a few drops of potassium hydroxide solution are added to the buffer.

11. A 20.0 mL sample of 0.200 M HBr solution is titrated with 0.200 M NaOH solution. Calculate the pH of the solution after the following volumes of base have been added: (a) 15.0 mL; (b) 19.9 mL; (c) 20.0 mL; (d) 20.1 mL; (e) 35.0 mL.

12. A 50.0 mL sample of 0.150 M acetic acid, $HC_2H_3O_2$, is titrated with 0.150 M NaOH solution. Calculate the pH after the following volumes of base have been added: (a) 0 mL; (b) 25 mL; (c) 49 mL; (d) 50.0 mL; (e) 75.0 mL.

13. Calculate the solubility of CaF_2 in grams per liter in (a) pure water; (b) 0.15 M KF solution; (c) 0.080 M $Ca(NO_3)_2$ solution. (You will have to look up the K_{sp} value of CaF_2)

14. (a) Will $Mn(OH)_2$ precipitate from solution if the pH of a 0.050 M solution of $MnCl_2$ is adjusted to 8.0? (b) Will Ag_2SO_4 precipitate when 100 mL of 0.010 M $AgNO_3$ is mixed with 20 mL of 5.0×10^{-2} M Na_2SO_4 solution?

15. Be sure to study and review Thermodynamic (Chapter 18), Electrochemistry (Chapter 19), and Nuclear Chemistry (Chapter 20). …..AND….REMEMBER STUDY HARD FOR MY RETIREMENT!!!