

**CHEMISTRY 206**

Name: \_\_\_\_\_

**Final Exam**

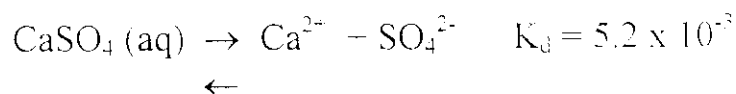
Thursday Feb. 3, 2000

Time: 2 hours

Dr. Ali Safa

- I. Calculate the **pH** of a solution obtained by mixing 200 mL of 0.6 M  $\text{NH}_3$  with 300 mL of 0.3 M  $\text{NH}_4\text{Cl}$ . Calculate the **new pH** after adding 0.02 moles of  $\text{H}_3\text{O}^+$  to the above mixture.  $\text{PK}_a$  for  $\text{NH}_4^+ / \text{NH}_3 = 9.24$
- II. A student started titrating a solution of weak acid, HA, with NaOH. When he has added 10 mL of the base, he noticed that the concentration of the acid is  $10^{-5}$  M. He continues the titration until he reaches the **equivalent point**. At this time his buret reads 22.22 mL. Calculate  **$K_a$**  of the acid.
- III. A piece of copper is placed in 0.05 M  $\text{AgNO}_3$ . Calculate the **equilibrium composition** of this solution. (The Cu metal is not totally dissolved, i.e. Cu metal is in excess). Calculate the **potential** of this solution **before** and **after** the piece of cu is added.  
Given:  $E^0$  for  $\text{Cu}^{2+} / \text{Cu} = 0.34$  V  
 $E^0$  for  $\text{Ag}^+ / \text{Ag} = 0.80$  V
- IV. Why does a **buffer capacity increase** as a solution becomes very acidic (**pH = 1**) or very basic (**pH = 13**)?
- V. Calculate the **minimum difference** in standard potentials needed for a **quantitative reaction** in which both reactants undergo a **1 electron change**.
- VI. A) What are the **desirable properties** of a **standard solution**?  
B) Explain the **difference** between: **accuracy and precision, mean and median, absolute and relative error**.
- VII. A 0.2356 g sample containing only NaCl ( $58.44 \text{ g.mol}^{-1}$ ) and  $\text{BaCl}_2$  ( $208.25 \text{ g.mol}^{-1}$ ) yielded 0.4637 g of dried AgCl ( $143.32 \text{ g.mol}^{-1}$ ). Calculate the percent of each halogen compound in the sample.

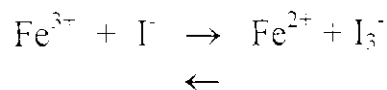
VIII. In contrast to many salts, calcium sulfate is only partially dissociated in aqueous solution:



The solubility-product constant for  $\text{CaSO}_4$  is  $2.4 \times 10^{-5}$ . Calculate the solubility of  $\text{CaSO}_4$  in a) water and b) 0.0100 M  $\text{Na}_2\text{SO}_4$ .

IX. Calculate the equilibrium concentration of methylamine in a solution that has a molar analytical  $\text{CH}_3\text{NH}_2$  concentration of 0.120 and a pH of 11.471. Given:  $K_a = 2.3 \times 10^{-11}$ .

X. Calculate the equilibrium constant for the reaction:



Given:  $E^0$  for  $\text{Fe}^{3+} / \text{Fe}^{2+} = 0.771 \text{ V}$   
 $E^0$  for  $\text{I}_3^- / \text{I}^- = 0.536 \text{ V}$

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**GOOD LUCK**