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 NH_3 with 300 mL of 0.3 M NH_4Cl.
Calculate the new pH after adding 0.02 moles of H_3O^+ to the above mixture. PK_a for $NH_4^+ / NH_3 = 9.24$

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 $AgNO_3$. 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 $Cu^{2+} / Cu = 0.34$ V
E^0 for $Ag^+ / Ag = 0.80$ 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 $g.mol^{-1}$) and $BaCl_2$ (208.25 $g.mol^{-1}$) yielded 0.4637 g of dried AgCl (143.32 $g.mol^{-1}$). 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:

$$CaSO_4\,(aq) \rightleftarrows Ca^{2+} - SO_4^{2-} \qquad K_d = 5.2 \times 10^{-3}$$

The solubility-product constant for $CasO_4$ is 2.4×10^{-5}. Calculate the solubility of $CaSO_4$ in a) water and b) 0.0100 M Na_2SO_4.

IX. Calculate the equilibrium concentration of methylamine in a solution that has a molar analytical CH_3NH_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:

$$Fe^{3+} + I^- \rightleftarrows Fe^{2+} + I_3^-$$

Given: E^0 for $Fe^{3+} / Fe^{2+} = 0.771$ V
E^0 for $I_3^- / I^- = 0.536$ V

GOOD LUCK