Instrumental Analysis
Practice Exam and Study Guide
Electrochemistry

This is a practice exam and study guide only. Do not rely on these being the questions asked on the exam nor is this study guide comprehensive.

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1. Consider the cell

   $$Ag|Ag^{+}\ (0.01\ M)||Fe^{3+}\ (0.010\ M),\ Fe^{2+}\ (0.0010M),\ 1M\ HCl|Pt$$

   Calculate the theoretical cell potential using molar concentrations. As written, is the cell galvanic or electrolytic? (Note: Cell shorthand notation is written from anode to cathode.)

2. The cell in question 4 uses an electrode of the first kind and an inert electrode. Identify the electrodes by their type and give a short description of why each is identified as it is.

3. Calculate the theoretical cell potential for the cell

   $$Pt|HCl\ (0.0100\ M)||HCl\ (0.200\ M)|Pt$$

4. Calculate the thermodynamic half-cell potential for the reaction

   $$CuSCN_{(s)} + e^{-} \rightleftarrows Cu_{(s)} + SCN^{-}$$

   K_{sp} (CuSCN) = 4.8×10^{-15}

5. A 4.00 mmol quantity of MCl_2 (where M is a metal) was dissolved 100.0 mL of 1.00 M ammonia. The potential measured (vs. the saturated calomel electrode, SCE = 0.244 V) at a wire composed of metal M for the ammoniacal solution of M^{2+} was -0.328 V. The thermodynamic reduction potential, $E°$, for M^{2+} to the metal is 0.392 V. Calculate the formation constant, Kf, of $M(NH_3)_4^{2+}$.

6. Describe, with pictures and words, how the glass pH indicating electrode works.

7. At very high pH (>11), the glass electrode often no longer responds to the concentration (activity) of hydrogen ion but, rather, becomes sensitive to sodium ion. Explain this observation.