

CH302H – Principles of Chemistry II: Honors
Fall 2016, Unique 49420

Homework, Week 10

1. A 10 mL solution containing 3.0×10^{-5} M Cu^{2+} is used in an electrolytic cell for the reduction of Cu^{2+} to Cu(s) at an electrode. The cell is run at a constant current of 3.0 mA.

- a) Is the copper deposited on the anode or cathode of this cell?
- b) How long must the electrolysis run to reduce all of the Cu^{2+} ?
- c) If your solution was contaminated with a metal that was easier to reduce than copper, would your calculation for the amount of copper in the solution based on this electrolysis give you a value that was too low or too high? Justify your answer.

2. Given the following electrochemical cell:



(i.e. the electrode on the left hand side of the cell is a Ag wire on which AgI is deposited).

- a) Write the half cell reactions (expressed as reductions) and their values of E^0 .
- b) Write the overall chemical reaction taking place in this cell.
- c) What is E^0_{cell} ? If you cannot find a reduction potential for one of your half reactions in your textbook, it is -0.152 V, but make sure you know which reaction is described by this potential.
- d) What is the anode in the cell?
- e) What is ΔG^0 for this reaction?
- f) Which chemical species is serving as the reducing agent in this reaction?

3. A piece of Cu metal is put into a solution containing 1.0 M HCl and maintained under a constant pressure of 1.0 atm $\text{H}_2(\text{g})$. Will the Cu dissolve?

4. The same experiment as problem 3 is now run with a solution of 1.0 M HNO_3 . Will the Cu dissolve?

5. Is potassium permanganate (KMnO_4) a good oxidizing agent, reducing agent, or neither? Justify your answer.

6. Methane (CH_4) gas is a convenient and relatively clean-burning fuel, but it is difficult to store in gas form. There is therefore great interest in converting CH_4 to methanol (CH_3OH), which is

a liquid at room temperature and much easier to store and transport. This is done by dissolving methane in an acidic aqueous solution.

a) Is this a redox reaction? (This question implies that you should write out the balanced reaction.)

b) If the products include $\text{H}_2(\text{g})$ as well as methanol, is this a redox reaction?

7. Use information from the table of standard reduction potentials in your textbook to determine the K_{sp} for $\text{Hg}_2\text{Cl}_2(\text{s})$.