AP Chemistry Lab
Redox Titration

Pre-Lab Questions

1) What is the major difference between acid/base titration and redox titration?
2) Why isn't it necessary to add an indicator to this titration?
3) How many grams of $KMnO_4$ are needed to prepare 500 mL of a 0.1M solution?
4) Write the half reaction for the reduction of permanganate ion to manganese (II) ion in acidic solution.
5) Write the half reaction for the oxidation of oxalate ion to carbon dioxide in acidic solution.
6) Write the half reaction for the oxidation of hydrogen peroxide to oxygen gas in acidic solution.
7) Write the overall equation for the reaction of potassium permanganate with sodium oxalate in acidic solution.
8) What is the stoichiometric ratio of permanganate ion to oxalate ion in the above reaction?
9) Write the overall equation for the reaction of potassium permanganate with hydrogen peroxide in acidic solution.
10) What is the stoichiometric ratio of permanganate ion to hydrogen peroxide in the above reaction?

Procedure

Prepare your lab book for this experiment. All the glassware used in this lab needs to be washed with soap and water and then rinsed with distilled water before use. Follow the detailed procedures shown in the lecture.

Prepare the Titrant

1) Clean a 1-L bottle and label it approximately 0.1M $KMnO_4$.
2) Accurately weigh out the $KMnO_4$. Dissolve this in distilled water in the bottle you just prepared to a volume of 500 mL. Mix this thoroughly and shake every time you pour from it. This bottle needs to be kept in a dark place.

Standardize the Titrant

1) Weigh out approximately 0.5-0.8 g of $Na_2C_2O_4$. Place this in an Erlenmeyer flask, along with 35 mL of 3M H_2SO_4 and 40 mL of distilled water, and heat to between 80-90°C.
2) Prepare a buret with the $KMnO_4$ as outlined in lecture.
3) Titrate to equivalence with the $KMnO_4$ being careful to not let the temperature drop below 60°C.
4) Repeat two more times or until three satisfactory trials are performed.

Determine the Concentration of an Unknown Hydrogen Peroxide Solution

1) Accurately measure out 10.0 mL of H_2O_2 into an Erlenmeyer flask, along with 15 mL of 3M H_2SO_4 and 25 mL of distilled water.
2) Prepare a buret with the $KMnO_4$ as outlined in lecture.
3) Place the flask on a stir plate and titrate to equivalence.
4) Repeat two more times or until three satisfactory trials are performed.
5) Perform all calculations immediately to see if it is okay to discard the titrant or to use it to perform more trials.

Post Lab Questions
These questions can be answered in the data tables.

1) Calculate the concentration of the standardized $KMnO_4$ solution. Report this as an average.
2) Calculate the percentage of the H_2O_2 solution used in this lab. Report this as an average.

These questions should be answered as essays at the end of the lab.

3) Why are these titrations carried out in acidic solution?

Imagine the following procedural errors were made. Explain if they would have any effect on the outcome of the lab and what it would be.

4) After rinsing the buret with distilled water, the buret is filled with the standard $KMnO_4$ solution; the sodium oxalate is titrated to its equivalence point.
5) Extra water is added to the 0.5-gram sample of sodium oxalate.
6) Extra water is in the graduated cylinder used to measure the hydrogen peroxide.
7) The standardized $KMnO_4$ was allowed to sit for several hours in the bottle between uses. The bottle was then used without shaking.