232 Homework: Introductory Chapters

Hand in the answers to the following questions by, Wed. Jan. 28, 2004. These questions are based on calculation procedures that you learned in General Chemistry. The introductory part of Chapter 7 (7.1, 7.2) of Harris covers this material.

1. Oxalic acid, H$_2$C$_2$O$_4$ is a reducing agent that reacts with KmnO$_4$ as follows:

\[5H_2C_2O_4 + 2MnO_4^- + 6H^+ \rightarrow 10CO_2 + 2Mn^{2+} + 8H_2O\]

It's two protons are also titratable with a base. How many milliliters of 0.100M NaOH and 0.100 M KMnO$_4$ will react with 500 mg H$_2$C$_2$O$_4$?

2. How many a) moles and b) grams of NaCl does a volume of 150 ml of 0.1200 M NaCl contain?

A 2.6 g sample of plant tissue was analyzed and found to contain 3.6 µg zinc. What is the concentration of zinc in parts per million? In parts per billion?

4. Standard Solutions:

Direct method of preparation of standard solutions:
Make a solution by weighing a known amount of a primary standard, dissolving in solution, and making up to a known volume.
How would you prepare 250 ml of 0.05 M K$_2$Cr$_2$O$_7$, MW=294.19?

Indirect methods of preparation of standard solutions:

Method A. React solution of approximate concentration (e.g. your approximate NaOH solution in the lab.) with known weight of Primary Standard.
A 0.7952g sample of Primary Standard KHP, purity factor 100.03%, is dissolved in water and titrated with 34.65 ml of NaOH. Calculate the molarity of NaOH.

Method B. React solution of approximate concentration with known volume of standard solution.
A 35.00 ml solution of HCl reacts with 33.26 ml of 0.0527M Na$_2$CO$_3$. What is the molarity of HCl?

Method C. Dilution of a Standard Solution.
A 25.00 ml solution of 0.1000 M KOH is to be diluted to result in a solution which is 0.02500 M. To what volume must the solution be diluted?

5. Use of standard solutions in volumetric analysis:
A 0.5068 g sample of impure Na$_2$CO$_3$ was dissolved and titrated with 35.27 ml of 0.1027 M standardized HCl. What is the percent of Na$_2$CO$_3$ in the sample? i.e. What is its purity? Express the answer as percent by weight.

A 0.4671 g sample containing sodium bicarbonate was dissolved and titrated with standard 0.1067 M hydrochloric acid solution, requiring 40.72 mL. Calculate the percent sodium bicarbonate in the sample.