Experiment 6

MAKING A BUFFER

REFERENCE: Text, Section 9-5, pages 167-176

For this lab you will be assigned to make a buffer with a particular pH and buffer capacity. It will be up to you to determine just how to do this and to carry out the procedure you devise.

Your laboratory write-up should include experimental evidence that you have achieved your goals as well as the buffer composition which you settled upon.

Consider how to approach this before coming to lab – make an effort to understand Section 9-5 of the Harris text. Here is an **example** assignment to help you think:

Prepare a pH 7 ±0.1 buffer such that 100 mL of this buffer solution can absorb between 35 ± 15 mmol of strong acid or strong base to effect a pH change of one unit.

In other words, the starting pH of your buffer would have to be between 6.9 and 7.1. At that point you would test the buffer capacity by addition of 1 M HCl or 1 M NaOH. If the buffer pH is 7.0 to begin with, and you add 1 M HCl, then the pH would have to change to 6.0 somewhere after adding 20 mL of HCl and before adding 50 mL of HCl. If you test your buffer capacity by adding NaOH the same thing applies except the pH of the buffer would have to change to 8.0 from 7.0. So there are two things which need to be considered: 1) how to attain the desired starting pH; and 2) how to attain the desired buffer capacity. When you are ready to use a pH meter, consult your instructor.

Once you have the buffer solution prepared to achieve the desired goals, inform your instructor and he or she will watch you test your buffer for initial pH and buffer capacity. Use a graduated cylinder to add either 1 M NaOH or 1 M HCl for testing of buffer capacity.

You will use pH electrodes to monitor the pH. Please treat the pH electrodes as the breakable and sensitive instruments they are. Always be aware that the tip of the electrode is very fragile and act accordingly. Be sure to thoroughly rinse the pH electrode with a stream of deionized water whenever you move the electrode from one solution to another, and please be careful to always leave the electrode soaking in the buffer solution you found it in. This keeps the electrode hydrated and prolongs the life of the electrode.

Before taking any measurements perform a 2-point calibration of the electrode.

Write and hand in a brief report following the guidelines below. Understanding section 9-5 should really help you with this.

Buffer Lab Report Guidelines

1. To the report staple the original buffer solution specifications provided to you.

2. Discuss the preparation of your buffer solution. Include the following:

   a) Choice of buffer composition and reasoning.
   b) Choice of buffer concentration and reasoning.
   c) Method of buffer preparation and reasoning.
      Include sample calculations where appropriate for a→c above.

3. Experimental results of buffer concentration, original pH, and buffer capacity.

4. Deviation of experimental results (particularly in buffer capacity) from the ones that you had predicted may occur. Propose possible reasons for this deviation.

For the next experiment: dry about 0.5 g of $CaCO_3$ for at least 2 h at 110 °C or leave it in the oven until you need it. You'll use it to make primary standard Ca^{2+} solution. Cool in a desiccator.