

Lab - Buffers

Purpose: To investigate the effects of buffers when adding acids and bases.

Procedure:

- 1) Read the entire procedure and construct a data table or list suitable for collecting all relevant data.
- 2) Place a piece of paper under a well plate.
- 3) In two of the wells, place 20 drops of distilled water. To each well, place 2 drops of universal indicator. Note and record the colors of the resulting solutions. Label the wells on the paper below the well plate.
- 4) Add 20 drops of buffer 1 to two of the wells, preferably just below the wells with the water. Add 2 drops of universal indicator to each well. Label the wells.
- 5) Add 20 drops of buffer 2 to two of the wells. Add 2 drops of universal indicator to each well. Label the wells.
- 6) Add 20 drops of buffer 3 to two of the wells. Add 2 drops of universal indicator to each well. Label the wells.
- 7) Add 5 drops of 0.01 M NaOH to one of the wells containing distilled water and universal indicator. Note and record the color of the solution.
- 8) Carefully counting each drop, slowly add 0.01 M NaOH to one of the wells with buffer 1 in it until the color matches the color in the well of the base and water mixture from step 7. Record the number of drops required.
- 9) Repeat step 8 for the buffer 2 solution and buffer 3 solution.
- 10) Add 5 drops of 0.01 M HCl to the other well containing distilled water and universal indicator. Note and record the color of the solution.
- 11) Carefully counting each drop, slowly add 0.01 M HCl to the other well with buffer 1 in it until the color matches the color in the well of the acid and water mixture from step 10. Record the number of drops required.
- 12) Repeat step 11 for the buffer 2 solution and buffer 3 solution.
- 13) Save the solutions until you have gathered all the information required in the data table.
- 14) Dispose of the solutions in the waste container provided by the teacher.

Data Table/List:

Questions:

- 1) What observations from the lab suggest that the solutions you used were buffers?
 - 2a) How many drops of NaOH were needed to bring the buffer solution to the same color (or pH) created by adding 5 drops of NaOH to the distilled water? Explain any difference.
 - 2b) Make the same comparison for HCl.
 - 3) One of the buffers used in this activity included hydrogen phosphate ions (HPO_4^{-2}). Write an equation showing how these ions would prevent the pH of water in a lake from decreasing if limited quantities of acid rain (H^+) ions were added to it.
 - 4a) Assuming that each drop from the dropper is equal to $1/20$ mL or 5×10^{-5} L, how many moles of 0.01 M HCl was added to the distilled water? How many moles of NaOH?
 - b) Each well already had 20 drops of water in them prior to you adding the HCl. Using the moles that you calculated in 4a, what is the new concentration of the HCl? What is the new concentration of NaOH?
 - c) What is the pH of the solutions of distilled water after the addition of acid or base.

Conclusion:

