

Simple Buffer Demonstration

Recommended for Chapter(s): 8

Demo #026

Materials NOT in box

1. Safety goggles.

Procedure

1. (Prep) Pour 100 mL of water into 2 of the 250 mL Erlenmeyer flasks.
2. (Prep) Pour 100 mL of the 0.1 M $\text{HC}_2\text{H}_3\text{O}_2$ / 0.1 M $\text{NaC}_2\text{H}_3\text{O}_2$ solution into the other 2 Erlenmeyer flasks.
3. Put 5 drops of universal indicator in each of the 4 Erlenmeyer flasks. The flasks containing water will be green and the flasks containing $\text{HC}_2\text{H}_3\text{O}_2$ / $\text{NaC}_2\text{H}_3\text{O}_2$ will be red.
4. Add 2 drops of the 3 M HCl to one of the flasks containing water and to one of the flasks containing $\text{HC}_2\text{H}_3\text{O}_2$ / $\text{NaC}_2\text{H}_3\text{O}_2$. The water flask will turn red and the $\text{HC}_2\text{H}_3\text{O}_2$ / $\text{NaC}_2\text{H}_3\text{O}_2$ flask will remain the same color.
5. Add 2 drops of the 3 M NaOH to one of the flasks containing water and to one of the flasks containing $\text{HC}_2\text{H}_3\text{O}_2$ / $\text{NaC}_2\text{H}_3\text{O}_2$. The water flask will turn blue and the $\text{HC}_2\text{H}_3\text{O}_2$ / $\text{NaC}_2\text{H}_3\text{O}_2$ flask will remain the same color.
6. Show the students that if you add excessive amounts of acid or base (5 droppers full) the buffer will no longer be able to compensate for the acid or the base and the solution will change pH.

Safety

1. Wear safety goggles.

Clean Up

1. Put all the solution in the waste bottle.
2. Return the materials to the cart in the demonstration library room.

Stockroom Notes

1. Put waste down the drain with plenty of water.
2. Refill any solutions that need refilling
3. Replace the glassware with clean glassware.
4. Return items to demonstration tub.
5. Return tub to the demonstration library.
 - a. The goggles go in the goggle box.

Discussion

Buffers are made from a weak acid and its conjugate base or a weak base and its conjugate acid. When small amounts of acid or base are added to buffer systems the pH of the system is essentially constant. This is due to the fact that the strong acid/base can react with the weak base/acid which allows the H^+ ion in solution to stay essentially constant. This is what happens in the $NaC_2H_3O_2/HC_2H_3O_2$ system. The buffer system will break down if too much strong acid/base is added because there will be no more weak base/acid to react with the strong acid/base. Once this happens the pH will begin to change. Water is not a buffer system so even when a drop of strong acid or base is added to water the pH changes dramatically which can be seen by the change in color of the system.

Materials for demo 026

1. DI water
2. 0.12 M $\text{HC}_2\text{H}_3\text{O}_2$ / 0.12 M $\text{NaC}_2\text{H}_3\text{O}_2$
3. Dropper bottle with 3 M NaOH
4. Dropper bottle with 3 M HCl
5. Four 250 mL Erlenmeyer flask