Acid Base Properties of CO_2

Recommended for Chapter(s): 7

Demo #022

Materials NOT in box

1. Dry ice (dry ice holder, hammer, and bag are in the general cabinet; get dry ice from the cage near shipping a receiving).
2. Stir plate (general cabinet).
3. Safety goggles.

Procedure

1. (Prep) Gets Styrofoam container and take it to get dry ice. The dry ice is located outside chemistry shipping and receiving. If you do not have a project code, contact Darby (feldwinn@chem.ucsb.edu) for a code to use. You will need less than 1 lb of dry ice for this demonstration.
2. (Prep) Put 200 mL of water in both of the 400 mL beakers. Make sure to use the water provided in the kit which is ½ tap water and ½ DI water.
3. (Prep) Put 75 mL of water in the 125 mL Erlenmeyer flask. Make sure to use the water provided in the kit which is ½ tap water and ½ DI water.
4. (Prep) Place a stir bar in each beaker.
5. (Prep) Place the beakers side by side on the stir plate and start them stirring.
6. (Prep) Place ~ 5 mL of bromothymol blue in each of the beakers and the Erlenmeyer flask.
7. Ask the students to predict what will happen when you add dry ice to one of the beakers.
8. Add dry ice to a beaker. The solution will turn yellow.
9. Ask the students what will happen if you add 7 Up/Sprite or Seltzer Water to one of the beakers.
10. Add the beverage to one of the beakers the solution will turn yellow.
11. Ask the student to predict what would happen if you blew into the Erlynemer flask.
12. Using a straw blow into the Erlenmeyer flask. After a minute the solution will turn yellow.

Safety

1. Wear safety goggles.

Clean Up

1. Return the materials to the cart in the demonstration library room.

Stockroom Notes

2. Put waste down the drain.
3. Replace glassware with clean glassware.
4. If needed make bromothymol blue solution. Make the solution using the following procedure:

    a. Mixing 0.1 g of bromothymol blue powder in 10 mL of a 1.0 M NaOH
    b. Add 20 mL of ethyl alcohol
    c. Dilute to 1 L with DI water.
    d. The solution should be deep blue. If it is green, add sodium hydroxide solution drop by drop until the solution turns blue.
5. Return items to demonstration tub.
6. Return tub to the demonstration library.
    a. Return dry ice container to general cabinet
    b. Return goggles to goggle box.

Discussion

Bromothymol blue is blue in the presence of a base and yellow in the presents of acid. When the dry ice is added to the solution it turns yellow indicating that the solution is acidic. This is a result of the following reaction.

$CO_2(g) + H_2O(l) \rightarrow H_2CO_3(aq)$

All carbonated beverages will contain carbonic acid due to the dissolved CO_2. Therefore, when 7-Up/Sprite or seltzer water is poured into the water/bromothymol blue the solution turns yellow. Note: 7-Up/Sprite also contains citric acid which adds to its acidic properties.

When we take in air, our bodies absorb the O_2 out of the air and replace it with CO_2 during our respiration process. Therefore, if we blow into a solution of water and bromothymol blue the solution will turn yellow indicating the presents of CO_2.

Materials for demo 022

1. 7 up or sprite
2. Seltzer water
3. Bromothymol blue
4. Straws
5. 2 400 mL Beakers
6. 1 125 mL Erlenmeyer flaks
7. 2 Stir bars
8. Tongs
9. Bottle for ½ DI water and ½ tap water