

## Conductivity of Ionic/Molecular Solutions

*Recommended for Chapter(s): 4*

### Demo #013

#### Materials NOT in box

1. Safety goggles.

#### Procedure

1. (Prep) Fill the wash bottle with DI water.
2. (Prep) Put the following into the appropriate beakers
  - a. DI                    200 ml of DI water put in 250 ml beaker. This beaker will be also used for rinsing the apparatus between runs.
  - b. Tap                    100 ml of tap water
  - c.  $C_{12}H_{22}O_{11}$         100 ml of DI water
  - d. NaCl                  100 ml of DI water or NaCl solution
  - e.  $HC_2H_3O_2$         100 ml of vinegar
  - f. HCl                    100 ml of 1.0 M HCl
  - g. NaOH                100 ml of 1.0 M NaOH
3. Plug the light bulb apparatus into the wall.
4. Place the light bulb apparatus into the beaker of DI water.
5. Show students that DI water has no ions in it, therefore, will not light the light bulb. (From here on out the DI water will be used as a rinse between beakers.)
6. Place the light bulb apparatus into the beaker of tap water. This should make the light bulb glow weakly. Ask students what this means. Tap water has dissolved ions in it.
7. Rinse the light bulb apparatus by sticking it back in the DI water.
8. Put a spoonful of sugar in the beaker for  $C_{12}H_{22}O_{11}$  and stir with the spoon.
9. Place the light bulb apparatus in the  $C_{12}H_{22}O_{11}$  beaker. The light bulb should not light.
10. Rinse the light bulb apparatus by sticking it back in the DI water.
11. Use the wash bottle to rinse the spoon off into the waste beaker.
12. Place the light bulb apparatus into the beaker of NaCl. The light bulb should glow brightly.
  - a. If you filled the NaCl beaker with DI water. Put  $\sim 1/8$  of a teaspoon of salt into the beaker and stir with the spoon. The light bulb should glow brighter than the tap water.
  - b. More salt can be added to the beaker causing the light bulb to glow brighter.
13. Rinse the light bulb apparatus by sticking it back in the DI water.
14. Rinse the spoon off into the waste beaker using the wash bottle.
15. Place the light bulb apparatus into the beaker of  $HC_2H_3O_2$ . The light bulb will be very dim. You will need to turn off the lights to see glow.

16. Place the light bulb apparatus into the beaker of HCl. The light should glow brightly.
17. Rinse the light bulb apparatus by sticking it back in the DI water.
18. Place the light bulb apparatus into the beaker of NaOH. The light should glow brightly.
19. Rinse the light bulb apparatus by sticking it back in the DI water.

### **Safety**

1. Wear safety goggles.
2. Be careful not to touch the electrical leads.

### **Clean Up**

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

### **Stockroom Notes**

1. Pour the acid and base together to neutralize each other and then pour down the drain.
2. Pour all other solutions down the drain.
3. Replace glassware with clean glassware.
4. If needed, refill any materials that have been used up.
  - a. The NaCl solution is a saturated NaCl solution. To make add salt to water until you see some salt on the bottom of the container.
5. If there are extra materials (solution and lighting apparatus not glassware) they are returned to the box labeled “demo 013 extra materials” which is located in the same cabinet as demo 013.
6. Return items to demonstration tub.
7. Return tub to the demonstration library.
  - a. Return the goggles to the goggle box.

### **Discussion**

Compounds that form ions in solution such as ionic compound and acids conduct electricity while molecular compounds do not. The strength of the acid / electrolyte is proportional to how bright the light bulb glows. NaCl is a strong electrolyte (completely dissociates), therefore, in solution it contains many ions and the bulb will glow brightly. HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub> is a weak acid therefore, although there are some ions in solution the majority of the species are still in molecular form (HC<sub>2</sub>H<sub>3</sub>O<sub>2</sub>) causing the bulb to barely light.

*Materials for demo 013*

1. 7 150 ml Beakers
2. 1 250 ml Beaker
3. 2 Testing apparatus one with pencils
4. Extension cord
5. 1 Extra light bulb
6. 2 Extra pencils
7. 2 Spoon
8. Wire with 2 end stripped
9. Wash bottle
10. Salt
11. Salt solution
12. Sugar
13. Vinegar
14. DI water
15. Tap water
16. 1.0 M HCl
17. 1.0 M NaOH