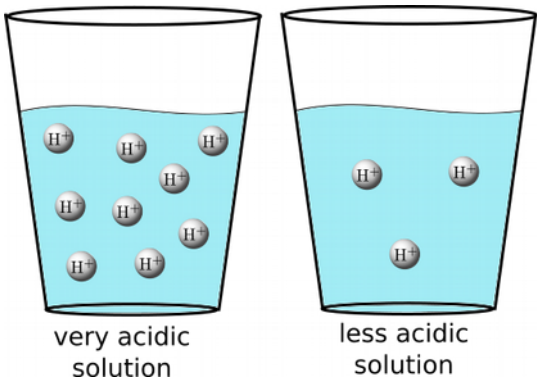
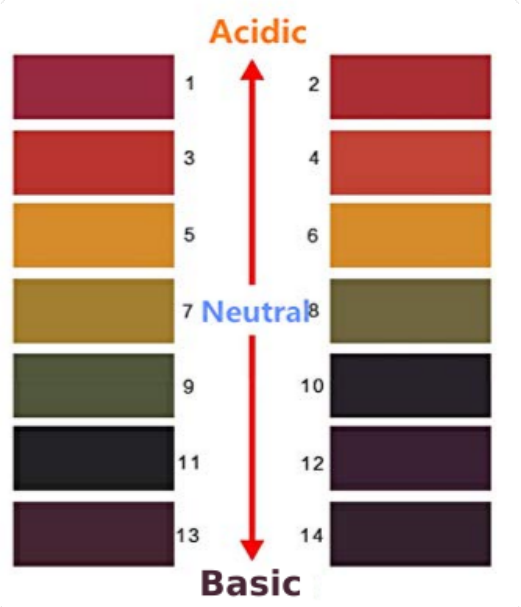
Acids and Bases

Blowing up balloons with chemical reactions

- **Acids** are chemicals that like to drop hydrogen ions (H+) when dissolved in water. They tend to taste sour.
- **Bases** are chemicals that like to grab extra hydrogen ions (H+) out of solution. Baking soda is basic.
- When acids and bases are mixed together, chemical reactions happen that produce neutral water and other compounds. Baking soda makes **carbon dioxide gas** (CO_2) when reacting with acid.
- The **pH** of a **solution** measures how many H+ ions are present
  - Low pH (below 7) means the solution is acidic (lots of H+ ions).
  - High pH (above 7) means the solution is basic (few H+ ions)
  - Neutral pH (=7) means the solution is neither acidic nor basic.
  - Going up one unit of pH means the solution has 10 times fewer H+ ions.





Measuring pH and Making Dilutions

(use water from the unopened bottles or from the pitchers)

1. Put 3 dixie cups of water into the bowl labeled **Solution 1**. Dip in a pH strip for a couple seconds, then lay it out on a white surface. Compare with the chart.

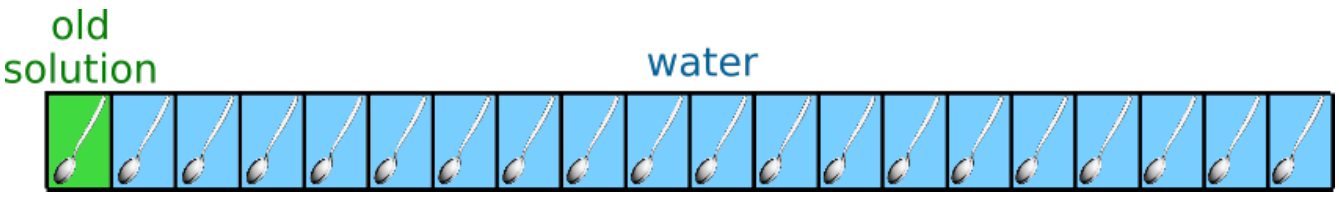
Pure water: measured pH _____

2. Label one bowl **Solution 1**. Make Solution 1 by adding 3 spoonfuls of citric acid powder to your cup with water. Mix until fully dissolved. Measure the pH.

Solution 1: measured pH _____

3. You can make a "twenty-fold" dilution by mixing 1 part of your solution with 19 parts water. Make a prediction – what do you predict the pH will be if you make a 20-fold dilution of Solution 1?

   20-fold dilution of Solution 1: Predicted pH: _____



4. Make **Solution 2** in a second cup by mixing 4 spoonfuls of Solution 1 + 4 dixie cups of water. (1 dixie cup = 19 spoonfuls). Label your bowl. Measure the pH.

   Solution 2: measured pH _____

5. Make a prediction:
   Which of the 2 solutions will taste more sour? _____

   Test your prediction by dipping your finger into each and tasting 1 drop.

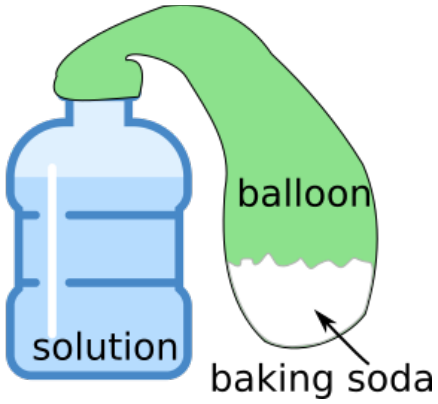
   Which is more sour? _____

Acid-Base Reactions

1. Pour 2 dixie cups of Solution 1 into one of your bottles. Pour 2 dixie cups of Solution 2 into the other bottle. Label the bottles!

2. Use the funnel to fill your two balloons with 2 spoonfuls of baking soda **each**.

3. Place the balloons over the opening of each bottle. The balloon should be draped so the baking soda does not fall out yet.



4. Lift up the balloon to empty out the baking soda into **Solution 2** first. Hold the neck of the balloon so nothing spills out!

   What do you see?

5. Swirl the bottle a bit to make sure the reaction runs to completion. Use a ruler to measure the width of the inflated balloon.

   Width of balloon (Solution 2): _____

6. Now dump the balloon full of baking soda into Solution 1. Measure the width of the balloon.

   Width of balloon (Solution 1): _____

   Which solution made more gas? _____

   Do you see more baking soda left in the bottle afterwards? Where did it all go?

7. Make a prediction for what will be the pH of each after the reactions. Circle one.

   Predicted pH of Solution 1 after reaction: acidic neutral basic

   Predicted pH of Solution 2 after reaction: acidic neutral basic

8. Take off the balloons. Use pH strips to test the liquids left in the bottles.

   pH of Solution 1 after reaction: _____

   pH of Solution 2 after reaction: _____

   Which solution is more basic after the reaction? Why do you think that is?