Sour Power! Identifying acids and bases

Take home points:

- We can categorize foods (chemicals, everything!) as acidic or basic.
- Acidic things are sour.
- Acids and bases are opposites and create chemical reactions (like mixing vinegar and baking soda). Sometimes, we use these chemical reactions in making food.

Extra/bonus points:

- Acids and bases are opposites and create chemical reactions (like mixing vinegar and baking soda). We can use these chemical reactions in making food.
- There are different levels of acidity and basicity. Strong acids and strong bases are both very dangerous. But mild acids and mild bases are common in our everyday lives!

Group discussion (Part I -- Acids):

Who has heard of an “acid” before? What do you think of when hear the word “acid?”
Have you ever tasted an acid before? (What does it taste like? OR if no one thinks they have tasted an acid, how many people like sour candies or soda?) Today we are going to use a chemical reaction to test for acids.

Small groups (Acid test):

Materials:

• 6 small paper or plastic cups (per group) [note: 3 for first part + 3 for later part]
• Cotton swabs (~1 per cup, i.e. 6 per group) [note: 3 for first part + 3 for later part]
• Red cabbage (~ 1 leaf per student)
• Plastic spoon (~1 per group)
• Lemon-lime soda
• Lemon juice/lemonade
• Water
• 1 paper towel per student + couple extra to clean messes
• Newspaper to line table
• Masking tape
• Ballpoint pen
• Scissors and glue stick (to cut and paste results into notebook)

What is your favorite food and least favorite food? How do they taste? Can you think of other “taste” words? (What kinds of words do we use to describe the taste of food? -- If using words like “good” or “yummy,” ask them to explain the taste to someone who has never tried it before OR explain why “yummy” may not distinguish the taste of a yummy candy bar versus a yummy hamburger.)

Procedures:

1. Line table with newspaper.
2. Try to determine the taste of the different drinks (water, lemon-lime soda, lemonade) on worksheet.
3. First fold the paper towel in half (just to make it thicker). Then fold/cut into thirds or fourths (sections for each test). Label each section as “water,” “soda,” “lemon,” and “control.” (May omit control for younger kids.) Rub/crush the red cabbage leaf into each section until it becomes purple color (you only need a small blotch of color). This is your indicator.
4. Label your cups "lemon," "water," and "soda." Place a small amount of the corresponding liquid in each cup.
5. Place a separate cotton swab in each cup. Wipe a streak of lemon juice on your red cabbage indicator in its area on the paper towel. What color did your indicator become?

6. Now wipe separate streaks of water and soda on your indicator. Do not wipe anything on the control. Did the water seem to change the indicator color? How about the soda? From this test, do you think the soda has acid in it? Check the soda ingredients and find out! (Also discuss why we need a control. What would happen if the water is slightly acidic?)
7. Cut and paste the different results into notebook. If time permits, discuss/write in notebook what is the difference between mixing colors last week (red + yellow = orange) and this week's experiment. What colors did we mix and what color was produced? Would this happen normal paint? (This week a chemical reaction produced a new color. May need to explain that a chemical reaction is when two things mix to create a new thing.)

Where's the Chemistry?
Most sodas have an acid in them called citric acid. This is the acid that gives lemons, oranges, and other citrus fruits a sour taste.
Red cabbage contains natural chemicals that can be used as an indicator. When certain chemicals (such as the lemon juice or lemon-lime soda) are added to an indicator, a chemical reaction occurs causing a color change. An indicator can give you an idea about how acidic a solution is. Where did your soda's power rate on a scale between water and lemon juice?

At ~4:30pm:
Group Discussion (Part II -- Acids and Bases)
What happened when you added lemon juice to the red cabbage? (turned color to a lighter pink/red)
Demonstration with lemon juice and egg white

- lemon juice should turn red
- egg white should turn blue/green

Did you know that there is the opposite of an acid is a base? In fact, all chemicals (and basically, all of our foods) are either acidic or basic.
A lot of chemical reactions happen between acids and bases. One example of an acid-base reaction is vinegar and baking soda. Which is the acid and which is the base?

Small groups (Base test):
Materials:
• Vinegar
• Baking soda + water
• Dish detergent + water (if time permits)
• Additional red cabbage and paper towels, if needed

1. Fill one cup with vinegar and a second cup with baking soda and a little water. Do you know what vinegar tastes like? What about baking soda? (Note: Probably best to avoid actually tasting…) Guess which is acidic and which is basic? (This is called a "prediction" or "hypothesis")
2. Use red cabbage to test acidity/basicity. Cut and paste results into notebook.
3. Application to food: Did you know that we often use acid-base reactions in baking? Have you ever noticed little holes in cake? Those holes are often produced by baking soda or baking powder. (Feel free to mix a little bit of the vinegar and baking soda to show that this produces bubbles.) The bubbles produced by mixing a baking soda (a base) with an acid (like vinegar, milk, lemon juice, etc.) gets trapped in the batter and makes our cake light and fluffy!

If you have extra time at this point, test dish detergent + water. Explain that it is more difficult to taste basic substances, but we often feel the difference. Try to feel the basic solutions and compare them to the feeling of water. (Should be slippery or slimey)