Lesson Plan: Chromatography and Chlorophyll

(Module-Based Project)

Washington Berkeley Elementary

Mentors:

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Teaching Plan:

The teaching plan includes:

1. Background on **adhesion/cohesion**
    a. Plants have vascular tissue, like straws. Photosynthesis is like sucking up water and nutrients (including sunlight) from the roots through these veins.
    b. Adhesion is when water is attracted to other water molecules. This is due to the polarity of water. Do you remember what polarity is?
    c. Cohesion is when water is attracted to other materials, such as the glass of a cup or the walls of a plant's xylem.
        i. Example: water moving up the celery stalk
        ii. Example: meniscus in a tube of water
2. Demonstration of adhesion/cohesion: droplets of water on a penny. Use a dropper to drop water onto a penny until it flows off. Notice how the water "sticks" to the penny.
3. Demonstration of adhesion: water inside a graduated cylinder. Notice how the water "sticks" to the side of the cylinder.
4. Example of adhesion/cohesion in a plant: celery stalk in a cup of dyed water. When left overnight, the celery absorbs the water, including the dye. Notice how the top end of the celery has colored spots, indicating where the xylem are located.
5. Moving onto **chromatography**… Explain the basic principles of chromatography:
    a. Chromatography is the separation of chemical components due to their affinity to the solvent (liquid).
    b. Some things that affect the affinity of a component are **polarity** and **size** of molecules.
    c. Chromatography is used to analyze dyes and other substances.
    d. Due to their different properties, different pigments (colors) will separate into different lines.
6. Demonstration of chromatography with a **black marker**.
    a. The color black is a combination of many other colors that you see around you.
    b. Procedure:

i. On a piece of chromatography paper, draw a thin line with pencil about ½ inch from the bottom.
ii. Then draw a thicker line with black marker above your first line.
iii. Dip the chromatography paper into a cup of water, making sure that the water does not go above the pencil line.
iv. Let the paper sit for about 20 minutes or until the colors separate. Notice which colors come out on top and how clearly or not clearly the colors separated.
v. Repeat with two other types of black markers.

7. Brief description of plant biology and **chloroplasts**:
    a. Chloroplasts absorb the sun's energy using their pigments and turn it into food, which provides us with our energy as well.
8. Demonstration of chromatography with chloroplasts:
    a. Procedure:
        i. Repeat the first step above, making the pencil line ½ inch from the bottom.
        ii. Make a line by placing a leaf over the paper and grinding the leaf into a line above your first line.
        iii. Dip the chromatography paper into a cup of water, making sure that the water does not go above the pencil line.
        iv. Let the paper sit for about 20 minutes or until the pigments in the chloroplasts separate. Notice which colors the chloroplasts are made up of.
        v. Repeat with two other types of leaves.

Materials:

- Pennies (approximately 10)
- Droppers (approximately 5)
- Water (lots!)
- Graduated cylinders (1 at minimum, 5 at maximum)
- Celery stalks—4 inches
    - 1 *prepared* for demonstration
    - More raw stalks for trial (approximately 10)
- Food dye (4 colors)
- Chromatography paper *or* coffee filters (approximately 20-30)
- Plastic cups (approximately 20)
- Scotch tape
- Black markers (3 types)
- Leaves (3 types)
- Pencils

Name: _____

Chromatography Worksheet

1. How many droplets of water could you fit onto your penny before it spilled?

2. What concept is responsible for the water staying on the penny?

3. Why did the food dye move up the celery stalk?

4. What different colors made up the different black markers? Were you surprised to see the separation of colors?

5. Why would the chloroplasts have more than one pigment?

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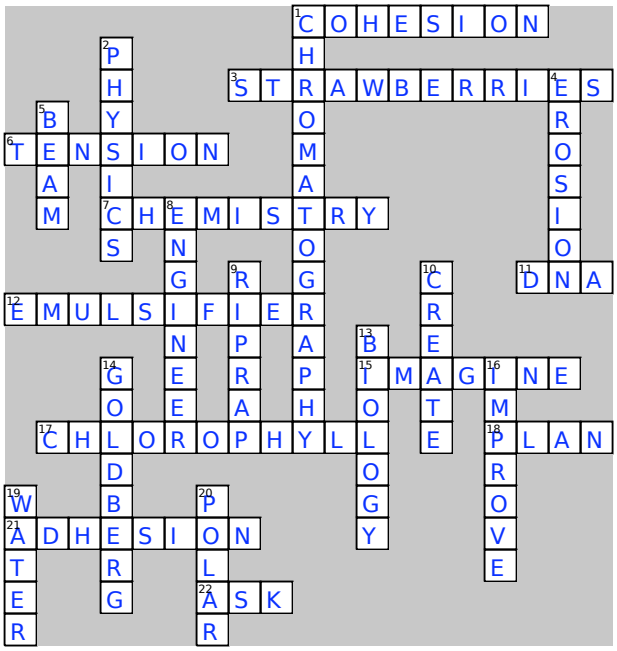
End-of-Year Crossword



Across

1 When water molecules stick together
3 The fruit we extracted DNA from
6 The pulling force on buildings and bridges
7 The study of chemicals
11 The molecules that contain our genetic information
12 Soap is an example of this type of substance that sticks to oil AND water
15 Second step of the design process: Brainstorm ideas
17 The green pigment found in plants
18 Third step of the design process: Make a list of materials and draw a diagram
21 When water molecules stick to other things
22 First step of the design process: What is the problem?

Down

1 How we can separate parts of a mixture
2 The study of motion and forces
4 The washing away of dirt and soil by water
5 Your favorite after-school program!
8 A person who designs and makes useful things
9 Various materials used to prevent erosion
10 Fourth step of the design process: Test your plan out!
13 The study of plants and animals
14 Rube _____ machine: used to perform a simple task in a complex way
16 Last step of the design process: Modify your design and test it out!
19 _____ pressure: the force that made our rockets fly
20 A property of water molecules that creates a negative end and a positive end