Chemical and Physical Changes
4th Grade

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Benchmarks & Objective:

- PS-1: Identify characteristics of a simple physical change (e.g. heating or cooling can change water from one state to another and is reversible)
- PS-2: Identify characteristics of a simple chemical change. When a new material is made by combining two or more materials, it has chemical properties that are different from the original materials (e.g. burning paper, mixing vinegar and baking soda)
- PS-4: Explain that matter has different states (e.g. solid, liquid, gas) and that each state has distinct physical properties
- SI-1: Select the appropriate tools and use relevant safety procedures to measure and record length, weight, volume, temperature and area in metric and English units
- SI-3: Develop, design and conduct safe, simple investigations or experiments to answer questions

Materials:

- Science journals
- Hot plate
- Thermometers
- Balances
- Beakers
- Metal stirring rod
- Tweezers
- Group 1
    - Water
    - Food coloring (green, red or blue)
    - Filter paper
- Group 2
    - Water
    - Cornstarch
- Group 3
    - Vinegar
    - Baking soda
- Group 4
    - Antacid tablets
    - Water
- Group 5
    - Heat shrink

Target Concept:

This lesson will be used to teach students about designing an experiment, running an experiment, collecting data, and drawing conclusions all within a lesson on chemical and physical changes.

Initial Introduction:

The previous lessons should be enough of an introduction on the topic of chemical and physical changes.

Procedure:

Day One

1. Have each group write their system of interest in their journals
2. Tell the students that they are to make a guess about what type of change their system undergoes
3. Have the students discuss and think-up an experiment to test what type of change their system undergoes (remind them that their test must show that their system is one type and is not the other type)
    a. The students are not likely to completely design an experiment so general procedures for each group are listed below
4. Have the students discuss their experiments with the class and allow them the opportunity to make suggestions to other groups

Day Two

5. Let the students perform their experiments and record their observations (*refer to Appendix A for general experimental procedures*)

Day Three

6. Have the students discuss their results with the class (this will allow all the students to see various types of changes)

Target Observations:

- Physical changes involve physical properties and don't irreversibly alter the material
- Chemical changes involve chemical properties and do alter the materials

Final Target Concept:

The students should have learned the difference between physical and chemical changes. They should also have gained some experience with designing experiments and collecting data.

Summary & Discussion:

The teacher should review the difference between physical and chemical changes and the methods of achieving both changes.

Appendix A (*Cut and paste each group's instructions onto its own page and give to each group*)

1. Group 1
    a. Measure the mass of a clean, empty beaker and record the value
    b. Pour 25mL of room temperature distilled water into the beaker and then record the volume, mass and temperature
        i. Describe how the water looks.
    c. Drop-in 3 drops of room temperature food coloring (with the beaker still on the balance) and measure and record the new mass and volume
    d. Stir the water to completely mix the food coloring
        i. Describe how the water/food coloring mixture looks.
    e. Measure and record the temperature
        i. Did the temperature change after adding the food coloring?
    f. Place two pieces of filter paper on top of another, empty beaker and carefully pour the water/food coloring mix into the empty beaker
        i. What do you notice about the filter paper?
        ii. What do you notice about the water/food coloring mix?
    g. Once all the water has been transferred place the filter paper on top of the empty beaker and pour the water into it
        i. What do you notice about the filter paper?
        ii. What do you notice about the water/food coloring mix?
    h. Repeat steps f. and g. two more times using new filter paper each time
        i. Describe how the filter paper changed
        ii. Describe how the water/food coloring mix looks now compared to when you first mixed the two materials (i.e. is the mixture still a very dark color or has the color faded?)
    i. With the help of a teacher, boil the water/food coloring mix until all the water has evaporated
        i. Describe the beaker

Q1. What type of change did mixing water and food coloring represent? Explain your answer using your experimental observations.

2. Group 2
    a. Measure and record the mass of the clean, empty beaker
    b. Add 10mL of room temperature distilled water and then measure and record the mass of the beaker and water together
    c. Measure and record the temperature of the water
    d. Measure and record the mass of a second, empty beaker
    e. Add cornstarch up to the 10mL mark on the empty beaker and measure and record the mass
    f. Add the corn starch to the water and mix using a metal stirring rod
    g. Measure and record the mass of the beaker/water/corn starch and measure and record the temperature
        i. Describe the mixture
    h. Place a piece of filter on top of a clean, empty beaker and pour the water onto the filter paper CAREFULLY!
        i. Describe what you see on the filter paper
    i. Repeat step h. two more times, each time using new filter paper
        i. Describe what you see on the filter paper and describe the water
    j. Allow the filter paper pieces to dry and then scrape the solid material into the cup on the balance
    k. Measure and record the mass of the solid material
        i. How does this measure mass compare to the original mass of the cornstarch?
    l. Place the beaker with the water near the window and allow the remaining water to evaporate
        i. What do you notice about the beaker?
    m. Measure the mass of the beaker and the solid material
        i. How does the mass of the solid material in the beaker and the mass of the solid material you scraped off the filter paper compare to the original mass of cornstarch?

Q1. What type of change did mixing water and cornstarch represent? Explain your answer using your experimental observations.

3. Group 3
    a. Measure and record the mass of a clean, empty beaker
    b. Pour 25mL of liquid A into the beaker and measure the mass and temperature. Record the volume, mass and temperature
    c. Measure of the mass of solid B and record the value
    d. Mix liquid A and solid B in the beaker CAREFULLY! DO NOT stick your face directly over the beaker
        i. Describe what happens when you mix the two materials
    e. Measure the temperature, the mass and the volume and then record all the values
        i. How did the mass, temperature and volume change?

Q1. What type of change was represented? Use what you know about physical and chemical changes as well as your observations to justify your answer.

4. Group 4
    a. Measure and record the mass of a clean, empty beaker
    b. Add 25mL of distilled water and then measure and record the volume, mass and temperature
    c. Measure and record the mass of 4 solid tablets
    d. Add the 4 tablets to the water and mix until you no longer see the tablets. Measure and record the temperature while you're mixing
        i. What do you observe?
    e. Measure and record the volume, mass and temperature after the tablets have completely disappeared
        i. What do you notice?

Q1. What type of change was represented? Use your observations and what you know about physical and chemical changes to justify your answer.

5. Group 5
    a. Measure and record the mass, length and width of the solid material
        i. Describe how the solid materials looks
    b. Place the solid material on the hot plate and record the temperature
    c. Turn the hot plate on WITH THE HELP OF A TEACHER and set the temperature to 35 degrees Celsius
    d. Wait 1 minute and then using the tweezers pull the solid off the hot plate and measure and record the mass, length and width
        i. What happened to the solid material?
    e. Using the tweezers place the solid on the hot plate and adjust the temperature to 45 degrees Celsius
    f. Wait 1 minute and then using the tweezers pull the solid off the hot plate and measure and record the mass, length and width
        i. What happened to the solid material?
    g. Using the tweezers place the solid on the hot plate and adjust the temperature to 55 degrees Celsius
    h. Wait 1 minute and then using the tweezers pull the solid off the hot plate and measure and record the mass, length and width
        i. What happened to the solid material?
    i. Using the tweezers place the solid on the hot plate and adjust the temperature to 65 degrees Celsius
    j. Wait 1 minute and then using the tweezers pull the solid off the hot plate and measure and record the mass, length and width
        i. What happened to the solid material?

Q1. How does the mass, length and width at the end of the experiment compare to the values taken at the beginning of the experiment?

Q2. What type of change was represented? Justify your answer.

    k. WITH THE HELP OF A TEACHER set the temperature and observe the solid material
    l. Record the temperature and your observations of what's happening

Q3. What happened to the solid material after you set the temperature higher?

Q4. What type of change was represented in steps k. and l.? Justify your answer.