

Physical and Chemical Changes

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Eighth Grade Integrated Science

Standard I: Students will understand the nature of changes in matter.

Objective 2: Observe and evaluate evidence of chemical and physical change.

- a. Identify observable evidence of a physical change (e.g., change in shape, size, phase).
- b. Identify observable evidence of a chemical change (e.g., color change, heat or light given off, change in odor, gas given off).

Intended Learning Outcomes (ILOs)

1. Use Science Process and Thinking Skills
 - a. Observe objects and events for patterns and record both qualitative and quantitative information.
 - e. When given a problem, plan and conduct experiments in which they:
 - Select appropriate format (e.g., graph, chart, diagram) to summarize data obtained.
3. b. Distinguish between examples and non-examples of concepts that have been taught.

Time Needed to Complete Inquiry: 45 minutes

Inquiry: Students will be using a structured inquiry method to determine the following: What observations help to determine if a chemical or physical has occurred? What are some evidences that a chemical reaction has occurred?

Prior Knowledge Needed: Students should have a working knowledge of how to operate in a laboratory situation, including proper behaviors and safety precautions. Students should also have a basic knowledge of what a chemical change is versus a physical change. Students need to know that when a chemical change occurs a new substance has been created. A physical change means that the substance has only changed its appearance and is still the same material.

Introduction: Most changes that occur can be classified as physical or chemical changes. **Physical changes** occur without any changes in composition. In other words, no new substances appear as a result of the change. This could be demonstrated by the crushing of rock salt or ripping paper into pieces. On the other hand, when **chemical changes** take place, a change in composition also occurs. Basically, one or more new substances appear as a result of the change. This could be demonstrated with adding food coloring to water and then adding bleach drop-wise to the mixture until the dye is de-colored.

Materials for the changes the students will perform are located at different stations in the room. Simple instructions for the students to follow at each station are included. The students should go to each station, not necessarily in order, record the name of the change, follow the instructions and record their observations and their conclusions about the type of change involved.

Safety Precautions:

- **Do NOT** mix any items unless instructed.
- **DO NOT** taste any of the materials; some of them are poisonous.
- Wear goggles and aprons at all times.
- Wash your hands after completing the experiments.

Materials / Resources Needed for the Investigation:

Vinegar (Plain), baking soda, potato, iodine solution (can be obtained at the local drugstore –Tincture of Iodine), effervescent tablets (like Alka-Seltzer), salt, water, small pieces of ice, matches, household ammonia, vinegar solution (iron acetate) that had very fine steel wool soaking in it for a week (cover to prevent evaporation, and stir periodically to release bubbles), calcium chloride (ice melt, but check labels), universal indicator or phenol red solution, cabbage juice, test tubes, small beakers, popsicle sticks or small craft sticks (the handle of a plastic spoon works too), sandwich size zip top baggies, salt water ice baths (make with ice and water with salt stirred in within a thermos/insulated container).

Procedures of the Investigation: Put students in small groups and have them perform the following experiments. The last one is optional, since it is a little time consuming and sometimes strange things happen for no particular reason. This might be something to do for a demonstration. Depending on time and resources, you may decide to have the students do all of these investigations, or only a part of them.

Station #1 Vinegar and Baking Soda – chemical change – gas production

Put about 1 cm of vinegar into a test tube. Then use a stick to put a **SMALL** (about ½ cm long on the stick) amount of baking soda into the tube. After your observations are complete, pour the test tube contents into the sink, and rinse the test tube with water before putting it back into the rack.

Station #2 Iodine on a Potato – chemical change – color change

Cut a **SMALL** fresh slice from the potato. Use a dropper to put 3-4 drops of iodine solution on the potato slice. After your observations are complete, **throw away** the used slice of potato into the **trash can!**

NOTE: iodine solution can be obtained at a drugstore in the first aid section as Tincture of Iodine

Station #3 Salt – physical change – dissolving of a solid

Fill a test tube about ¼ full with tap water. Use a spoon handle to add ½ cm (long on the stick) of salt to the water. Shake the test tube gently until the salt dissolves. When you have completed your observations, pour the test tube contents into the sink, and rinse the test tube with water before putting it back into the rack.

NOTE: You may want to evaporate the water in a demonstration to show the salt remains, or have them taste the water to prove the salt is still present.

Station #4 Seltzer Tablet – chemical change – gas production

Fill a test tube about ¼ full with tap water. Put a small piece of crushed seltzer tablet into the water in the test tube. When you have completed your observations, pour the test tube contents into the sink, and rinse the test tube with water before putting it back into the rack.

Station #5 Ice – physical change – phase change

Put 2 or 3 small pieces of ice into a test tube and observe what happens as the solid ice turns to a liquid. When you have completed your observations, pour the test tube contents into the sink and rinse it before returning it back to the rack.

Station #6 Matches – chemical change – gas production, light, heat

Strike a match and watch it as it burns. Blow the match out before it burns your fingers. When your observations are completed, rinse the used match in tap water and dispose of it in the waste basket.

Station #7 PH Indicators – chemical change – color change

Fill a test tube about $\frac{1}{4}$ full of cabbage juice. Add 3-4 drops of the vinegar provided, and gently shake the test tube. When your observations are completed, discard the contents and rinse the test tube in the sink before returning it to the rack.

NOTE: Prepare cabbage juice by boiling red cabbage (until the cabbage is cooked). Remove the cabbage and refrigerate the juice, because it can grow some great mold and other forms of science experiments!

Station #8 Baggie Experiment – chemical change – color change; gas production; heat production

- Place one small spoonful of calcium chloride into a plastic sealable bag and the same amount of BAKING SODA. Seal the bag, shake it. Observe (physical change – mixture of solids).
- Measure 2 small teaspoons (about 10 mL) of phenol red indicator solution into the small cup (or beaker). Carefully put the beaker into the bag. Seal it.
- GENTLY tilt the bag to tip the small cup (beaker) over. Observe. Hold the bag in your palm while making observations
- Clean the beaker with water and throw the baggie away.

NOTE: to prepare the phenol red solution, add 1 g of phenol red to 1 gallon of water

Station #9 Two Clear Liquids – chemical change – precipitate formed

Take full dropper of the vinegar solution and squirt its contents into a 50 ml beaker. Take a full dropper of the ammonia and add it drop wise into the 50 ml beaker. Make sure you don't mix up the droppers!! When your observations are completed, pour the contents down the drain and clean the beaker with water.

NOTE: To prepare the iron acetate (vinegar) solution, use the following: Cover very fine steel wool (size #0000) with vinegar in a beaker/jar (if the wool isn't covered, it will rust). You only need to use a small portion of the pad, not the whole piece of steel wool. Cover with a lid or plastic wrap to prevent evaporation. Let it sit for about a week, stirring periodically to release bubbles.

Station #10 Water Baths - physical change – phase change

Fill a test tube $\frac{1}{4}$ or less with tap water. Place it in the salt-water ice bath and stir it around gently and constantly for 2-3 minutes (possibly more) without removing it. Take the test tube out. Record your observations.

Rinse the inside AND outside of the test tube well with water and return to the test tube rack.

Data Collection: Students will create a single data table that shows the station number, station name, their observations, and whether each station is an example of a chemical change or a physical change.

Data Analysis: Students will analyze their observations to first differentiate whether a physical or chemical change has occurred (is the original substance still present after the change has occurred). **STOP** the students at this time to see if they correctly identified the chemical and physical changes that occurred. Then, looking at their data for chemical reactions that occurred students will determine evidences that a chemical reaction has occurred. Students will also analyze their observations to look for evidences that a physical change has occurred.

Assessment: After performing the experiments, students will create individual data tables and answer the questions in the data analysis as well as writing a well-developed conclusion.

Station Changes

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Materials for the changes you will perform are located at different stations in the room. Simple instructions for you to follow at each station are included. You should go to each station, not necessarily in order, record the name of the change, follow the instructions and record your observations and your conclusions about the type of change involved.

Safety Precautions:

- **Do NOT** mix any items unless instructed.
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- Wear goggles and aprons at all times.
- Wash your hands after completing the experiments.

Procedures:

Station #1 Vinegar and Baking Soda

Put about 1 cm of vinegar into a test tube. Then use a stick to put a **SMALL** (about $\frac{1}{2}$ cm long on the stick) amount of baking soda into the tube. After your observations are complete, pour the test tube contents into the sink, and rinse the test tube with water before putting it back into the rack.

Station #2 Iodine on a Potato

Cut a **SMALL** fresh slice from the potato. Use a dropper to put 3-4 drops of iodine solution on the potato slice. After your observations are complete, **throw away** the used slice of potato into the **trash can!**

Station #3 Salt

Fill a test tube about $\frac{1}{4}$ full with tap water. Use a stick to add $\frac{1}{2}$ cm (long on the stick) of salt to the water. Cover the mouth of the test tube with your thumb and vigorously shake the tube. Observe what happens to the salt. When you have completed your observations, pour the test tube contents into the sink, and rinse the test tube with water before putting it back into the rack.

Station #4 Seltzer Tablet

Fill a test tube about $\frac{1}{4}$ full with tap water. Put a small piece of crushed seltzer tablet into the water in the test tube. When you have completed your observations, pour the test tube contents into the sink, and rinse the test tube with water before putting it back into the rack.

Station #5 Ice

Put 2 or 3 **small** pieces of ice into a test tube and observe what happens to the solid ice for one minute while holding the test tube cupped in the palm of your hand. When you have completed your observations, pour the test tube contents into the sink and rinse it before returning it back to the rack.

Station #6 Matches

Strike a match and watch it as it burns. Blow the match out before it burns your fingers. When your observations are completed, rinse the used match in tap water and dispose of it in the waste basket.

Station #7 PH Indicators

Fill a test tube about $\frac{1}{4}$ full of cabbage juice. Add 3-4 drops of the vinegar provided, and gently shake the test tube. When your observations are completed, discard the contents and rinse the test tube in the sink before returning it to the rack.

Station #8 Baggie Experiment

- Place one small spoonful of calcium chloride into a plastic sealable bag and the same amount of BAKING SODA. Seal the bag, shake it. Observe.
- Measure 2 small teaspoons (about 10 mL) of indicator solution into the small cup (or beaker). Carefully put the small cup into the bag. Seal it.
- GENTLY tilt the bag to tip the small cup over. Observe. Hold the baggie in the palm of your hand while making your observations.
- Clean the small cup with water and throw the baggie away.

Station #9 Two Clear (or mostly) Liquids

Take full dropper of the vinegar solution and squirt its contents into a 50 ml beaker. Take a full dropper of the ammonia and add it drop wise into the 50 ml beaker. Make sure you don't mix up the droppers!! When your observations are completed, pour the contents down the drain and clean the beaker with water.

Station #10 Water Baths

Fill a test tube $\frac{1}{4}$ or less with tap water. Place it in the salt water ice bath and stir it around gently and constantly for 2-3 minutes (possibly more) without removing it. Take the test tube out. Record your observations. Rinse the inside AND outside of the test tube well with water and return to the test tube rack.

Data Collection: On your own paper, create a single data table that shows the station number, station name, your observations, and whether each station is an example of a chemical change or a physical change. Make sure your observations are SUPER-complete – write down EVERYTHING that you observe!

Data Analysis: answer the following questions on your own paper

1. List all of the chemical changes you observed.
2. List all of the physical changes you observed.
3. What were some of the observations that indicated a physical change had occurred?

4. What were some of the observations that indicated a chemical reaction had occurred?

Conclusion: On your own paper, write a well developed conclusion (at least 4 sentences) about what was learned and what types of observations (evidences) can be used to tell whether a physical or chemical change has occurred.