

Investigating Changes

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| Standard 3240-01 | Students will observe and describe chemical and physical change. | <i>Topic:</i> Chemical and Physical Change <i>Course:</i> #3240 |
| Objective 3240-0101 | Differentiate between common chemical and physical changes. | |
| ILO'S: | 1a Make observations and measurements 2b Formulate research questions 2c Plan field studies, controlled experiments 2d Collect and record data 6c Report results honestly. | |

Description of Activity

Title: Investigating Changes

Overview: Students will use "skill building" activities to gain knowledge about physical and chemical changes. Using this background information they will construct and perform their own experiment on an edible liquid of their choice.

Duration: 2-5 days depending on how long skill building activities take.

Materials, Facilities and Resources: A lab room with sinks, safety equipment and standard lab materials will be necessary. Reasonable ventilation is needed for or bunsen burners. See materials listed for each "skill building" lab individually. The students will need to bring a liquid food item from home for the lab they design.

Background information

Physical changes are described as changes during which **no new substance** is formed. Examples are boiling, melting, freezing, and shape changes. Chemical changes are described as changes that result in a **new substance** being formed. Examples are burning, rusting, reacting with acid or other chemicals. Students should understand these two basic concepts before they design their own lab. The "skill building" activities are designed to help them recognize these changes.

Teaching and Learning Strategies

The "skill building" activities include labs that demonstrate physical and chemical changes. By performing these labs, students should gain experience in recognizing and measuring chemical and physical changes. The inquiry portion of this experiment can be ensured by having students bring in a substance of their choice and choosing what tests they want to perform on it. Do not tell students what equipment to use, but have appropriate items available. In large classes, groups of 4 or less will be the most practical. One student can bring the liquid for the group, preferably a day in advance to make sure it arrives. Student experiments should be checked for safety problems as well as scientific validity before the experiment begins.

Development of Laboratory Skills and Tools

Two "skill building" activities are included. Each includes specific safety procedures and write-up forms. It is assumed that basic lab safety guidelines have been outlined previously and students know where emergency equipment is. If students are using a piece of equipment for the first time, its' use and safety issues should be discussed.

Invitation to Learn

As the students finish the labs "Changing Water" and "Lemon Juice", their results should be summarized and discussed. Assign the students to bring in an edible liquid from home. (Being edible ensures a reasonably safe substance). One person in each group needs to bring in about 50 ml of the liquid. If this is assigned several days in advance, odds increase that each group will have one.

Pose the question to the students: Can you demonstrate a physical and a chemical change on the liquid you brought?

To prepare for the experiment, students will need to write their groups' experimental plan. See following pages for a sample outline. It can be checked by the teacher to make sure safe operating procedures are being followed and that it is clear. Do not guide students any more than necessary. Share the scoring rubric with the students to ensure they understand how they will be graded.

Summary of Learning

Multiple Choice:

1. Which of the following is a way to recognize a chemical change?

- a. the substance has changed shape
- b. the substance has changed from liquid to gas
- c. a new substance has formed
- d. the change is reversible

answer: c

2. Which of the following indicates a chemical change has occurred?

- a. a gas forms when two liquids are mixed
- b. a powder dissolves in a liquid
- c. a solid has melted into a liquid
- d. a piece of clay has a new shape

answer: a

Strategies to share learning: Several strategies might be used to share students results. Students may give an oral report, trade substances and see if they could verify others' results or design an advertisement for their substance which includes information that they discovered. (Milk, does a body good, boils at 120 degrees C.)

Student Designed Experiment Format

TITLE:

PURPOSE: (What is the question or problem?)

PREDICTION: (What is a possible answer?)

MATERIALS: (What will I use to find out?)

PROCEDURES: (What steps will I take to find out?)

DATA: (What happened?)

ANALYZE RESULTS: (What does data mean? Will a graph help? Is there more than one way to view the data? Could I have done something differently?)

CONCLUSIONS: (What did I learn?)

Scoring rubric for student designed experiment:

| RESPONSE | CRITERIA | RATING |
|-----------------------------|---|---------------|
| Exemplary | Develop experiment with controls, tests one variable at a time. Clearly tests physical and chemical changes. Records data, makes a graph, forms conclusions. Shows understanding of proper procedures. | 6 |
| Competent | Experiment is fairly clear. Acceptable tests of physical and chemical changes. Procedures are completed acceptably. Data is recorded, graph not clear, conclusions sketchy. | 5 |
| Satisfactory | Completes the experiment, some of the tests for physical and chemical changes are improper. Procedures are done with some difficulty. Data is recorded, graph is not complete. Conclusions do not relate to data. | 4 |
| Nearly Satisfactory | Begins the experiment satisfactorily, omits significant procedures to show physical and chemical changes. Difficulty in using controls and variables. Data is not recorded properly, no graph or conclusions. | 3 |
| Fails to complete | Experiment is not clear, incomplete development of physical and chemical changes. Major flaws in design of experiment. Incorrect results. Experiment not complete. | 2 |
| Unable to begin effectively | Experiment does not follow procedures. Does not show a control or uses too many variables. Experiment doesn't show either chemical or physical changes. Doesn't show understanding of how to develop the experiment. Not completed. | 1 |
| No attempt made | Does not begin or try to develop an experiment to show physical or chemical changes. | 0 |

Teacher Page

SKILL BUILDING LAB FOR "INVESTIGATING CHANGES" EXPERIMENT

Title: Changing Water

Description: This lab should provide students with adequate knowledge and lab skills to prepare them for the "Investigating Changes" experiment. During this lab they will melt and freeze water and observe the temperatures at which these changes occur.

Materials: water, thermometers, test tubes, ring stands, clamps, wire stands (or ring with screen), beakers, styrofoam cup, dry ice (or ice and salt slush), heat source, boiling chip.

Facilities: a properly ventilated science lab room, fire safety equipment.

Background Information: At sea level, water boils at 100 degrees C and melts at 0 degrees C. As elevation increases the boiling point becomes lower as air pressure decreases. Phase changes are physical changes because they are reversible and no new substances are formed.

Safety suggestions: Students should know where fire extinguishing materials are and how and when bunsen burners are to be lit and extinguished. Warnings about not touching or eating dry ice should be given. Dry ice can cause serious harm, if you are uncomfortable with using it, a slurry of ice, water and salt will give you a temperature well below zero and can be used in its place. It will work more slowly. Goggles should be worn at all times.

Title: Changing Water

Purpose: To observe and measure two physical changes in water, freezing and boiling.

Prediction: (what temperature will water freeze and boil at?)

Materials:

Part 1: styrofoam cup, dry ice, small plastic container, graduated cylinder, thermometer

Part 2: water, thermometers, ring stands, clamps, wire stands (or ring with screen), beaker, heat source, 1-hole rubber stopper, boiling chip

Procedure:

Part A

1. Add 5 ml of water to the plastic container.
2. Have your teacher place a small amount of dry ice in the styrofoam cup.
3. Place the plastic container in the styrofoam cup on top of the dry ice. Do not touch the dry ice!
4. Place the thermometer in the water and take readings every minute until the water has been frozen for 4 minutes.

Part B

1. Place 50 ml of water in a beaker. Place it on a wire stand next to the ring stand.
2. Place the tip of the thermometer through a rubber stopper. Place the clamp around the stopper so that the thermometer is suspended in the water.

Teacher page:
Skill building activity for "Investigating Changes" experiment

Title: "Lemon Juice"

Description: This lab should provide students with adequate knowledge and lab skills to prepare them for the "Investigating Changes" experiment. During this lab they will combine substances to see what a chemical change looks like.

Materials: acid-base indicators (Bromothymol Blue, Phenylthalein-turned pink with base, litmus paper), metals (iron filings, zinc, magnesium), baking soda, alcohol or bunsen burners or hot plates, evaporating dishes, goggles, lemon juice (may be diluted) test tubes, test tube rack.

Facilities: a properly ventilated science lab room, fire safety equipment, eye wash.

Background Information: Chemical changes are not easily reversed and a new product is formed. The students will have a limited knowledge of what substances cause chemical change. Acid-base indicators provide an easy to see color change. The metals and baking soda will provide color changes as well as gas formation. Heating most foods will produce a color change (black carbon) as the water evaporates. This lab will give them some ideas of what chemicals frequently cause chemical changes. There are lots of other ways to cause chemical change, if your resources are limited, use what you have.

Safety suggestions: Students should know where fire extinguishing materials are and how and when bunsen burners are to be lit and extinguished. Eyewash information should be posted and emphasized. Goggles should be worn at all times.

Student Page

Name _____

Title: Lemon Juice

Purpose: To observe chemical changes and see what kinds of substances cause them.

Materials: acid-base indicator (Bromothymol Blue, Phenylthalein, litmus paper), metals (iron filings, zinc, magnesium) baking soda, alcohol or bunsen burners or hot plates, evaporating dishes, graduated cylinder, goggles, beaker, lemon juice, 3 test tubes, markers, test tube rack, tweezers

Prediction: (What will lemon juice do when you heat it?)

Procedure:

1. Get a beaker with 50 ml of lemon juice. Add 5 ml to each of the three test tubes. Label the tubes A, B, and C.
2. Add a few drops of one "indicator" to tube A. Describe the results in your data.
3. Add a few drops of another "indicator" to tube B. Describe the results.
4. Add a piece of litmus paper to tube C. Describe the results.
5. Clean the tubes and add 5 ml of lemon juice to each. Add a tweezerful of the metals your teacher has provided, one metal in each tube. Describe results.
6. Clean the tubes and add 5 ml of lemon juice and a scoop of baking soda to tube A. Describe your results.

| | tube A | tube B | tube C |
|--------------|--------|--------|--------|
| indicators: | | | |
| metals: | | | |
| baking soda: | | | |

7. Pour a small amount of lemon juice into the evaporating dish. Heat it until you notice a chemical change. Describe the change.

Description of evaporating dish after heating:

Analysis:

1. How do you know when a chemical change has occurred?
2. Which of the experiments you did in this lab did not have a chemical change?
3. How did the indicators show a chemical change?
4. What evidence did you have that baking soda and acid combined to form a chemical change?
5. Describe 5 chemical changes you see every day.

Conclusion: