Georgia Performance Standards Framework for Physical Science – GRADE 8

Unit: Food and Cooking
General Task
Don't Go Changing

Subject Area: Physical Science
Grade: 8

Standards (Content and Characteristics):

S8P1. Students will examine the scientific view of the nature of matter.
   e. Distinguish between changes in matter as physical (i.e. physical change) or chemical
      (development of a gas, formation of precipitate, and change in color).
   g. Identify and demonstrate the Law of Conservation of Matter.

S8CS2. Students will use standard safety practices for all classroom laboratory and field investigations.
   a. Follow correct procedures for use of scientific apparatus.
   b. Demonstrate appropriate techniques in all laboratory situations.
   c. Follow correct protocol for identifying and reporting safety problems and violations.

S8CS4. Students will use tools and instruments for observing, measuring, and manipulating equipment and materials in scientific activities utilizing safe laboratory procedures.
   a. Use appropriate technology to store and retrieve scientific information in topical, alphabetical, numerical, and keyword files, and create simple files.
   b. Use appropriate tools and units for measuring objects and/or substances.
   c. Learn and use standard safety practices when conducting scientific investigations.

S8CS6. Students will communicate scientific ideas and activities clearly.
   c. Organize scientific information in appropriate tables, charts, and graphs, and identify relationships they reveal.

S8CS9. Students will understand the features of the process of scientific inquiry.
   Students will apply the following to inquiry learning practices:
   a. Investigations are conducted for different reasons, which include exploring new phenomena, confirming previous results, testing how well a theory predicts, and comparing different theories.
   b. Scientific investigations usually involve collecting evidence, reasoning, devising hypotheses, and formulating explanations to make sense of collected evidence.
   e. Accurate record keeping, data sharing, and replication of results are essential for maintaining an investigator’s credibility with other scientists and society.
f. Scientists use technology and mathematics to enhance the process of scientific inquiry.

Enduring Understandings:

- Energy is neither created nor destroyed but can be transformed.
- Energy is involved in chemical and physical changes.
- As particles are exposed to increasing levels of energy, their speed of movement increases and they will experience a change of phase.

Essential Question:

Why do onions make you cry, why do lemons taste sour, and why do sliced apples turn brown after they set in a bowl for awhile?

ADMINISTRATION PROCEDURES

Pre-Assessment:

Present the following examples and ask students to identify the physical and chemical changes in each event. Each event contains examples of both.

- Boiling an egg (Water boiling is a physical change and the change in the egg protein is a chemical change.)
- Burning a candle (Melting wax is a physical change and the burning of the wax is a chemical change.)
- Making vinegar from apples (Cutting up or mashing the apples to get the juice is physical; the change from apple juice to vinegar is chemical.)
- Making cheese, yogurt, or buttermilk (The change in thickness or texture is physical; the change in flavor is the result of various chemical changes.)
- Baking bread (The liquid batter or semi-liquid dough becomes solid, which is a physical change. The bread rises as a result of carbon dioxide being produced by a chemical change in the dough.)

Resources: Quia Physical or Chemical Changes quiz at http://www.quia.com/quiz/303980.html or http://www.fordhamprep.org/gcurran/sho/sho/worksheets/worksht15c.htm (can be printed out as a hard copy)

Outcome / Performance Expectations:

Students will distinguish between chemical and physical changes by carrying out changes of matter in a laboratory setting and identifying the type of change.
General Teacher Instructions:

Introduction:
Discuss the difference in physical and chemical changes as they are demonstrated to the class.

Use a teacher demonstration to introduce the concept of physical and chemical changes. Use the QX5 Digital Microscope to observe changes when you:
- Add water to baking soda
- Add vinegar to baking soda
(Alternative: These changes can be demonstrated using a large beaker at the demonstration counter. A document camera can be used to enhance the display.)

Another instructive demonstration can be done with marshmallows. Heated slowly, the marshmallow will melt (physical change). When heated quickly to a high enough temperature, the sugar will react with oxygen in the air and burst into flame. The products of this chemical change (a decomposition reaction) are carbon dioxide and water. A third possibility is that the marshmallow might be nicely browned. In this case, some carbon atoms from the sugar do not get hot enough to completely react with the oxygen and are left as a brown deposit of carbon on the surface of the marshmallow. This is a good time to point out the involvement of energy in physical and chemical changes. Melting requires an input of energy, and the combustion of the marshmallow releases energy.

Safety:

The Task:
A good way to do this lab is to set up stations with the supplies needed for each activity at a station. Students rotate from one station to another. You can limit how many groups are at a given station, depending on your room layout.

Review standard safety procedures before this lab. In particular, review the handling and disposal instructions for each station. Students should wear goggles and aprons. Instruct students to clean all glassware before leaving a station. The station should be left clean and you should be notified if a student arrives at a dirty station.

Teacher note: In the following instructions there are some terms that are not required for the student’s attainment of the standard. These terms are here for the identification of the materials that are used, and for teacher information. These terms may go beyond the language of the standard. They may be simplified as needed for students.
The stations are as follows:

**Station 1.** Students add liver or potato (your choice) to 3% peroxide to observe the action of the enzyme catalase. This enzyme converts hydrogen peroxide to water and oxygen gas. The bubbling indicates the release of oxygen gas. This is a chemical change that produces a gas. Note that it is the production of the gas, and not just the presence of a gas that indicates the chemical change.

**Station 2.** Students compare apple slices treated with a fruit antioxidant powder (available at grocery stores) with ones not treated. When an apple is cut, the torn cells release the enzyme, polyphenol oxidase, which catalyzes the reaction between oxygen and certain compounds in the apple, forming a brown product. The antioxidant powder prevents the enzyme from catalyzing this reaction. This is why the untreated apple slices turn brown and the treated slices do not. This browning is a chemical change. (See [http://chemistry.about.com/od/chemistryfaqs/f/brownapplefaq.htm](http://chemistry.about.com/od/chemistryfaqs/f/brownapplefaq.htm) for more information about the browning of fruit.) This change indicates one important indicator of a chemical change, a change in color.

**Station 3.** Students observe the melting of margarine, a physical change. Make sure the hotplate is set on a very low setting; otherwise, the margarine will burn.

**Station 4.** Students dilute green food coloring, a physical change.

**Station 5.** Students add bleach to the food coloring, causing it to change color. The bleach is an oxidizing agent and changes the structure of the dye molecule to a colorless form. This reaction is an example of a change in color indicating that a chemical change has occurred.

**Station 6.** Students chop nuts. This is a physical change.

**Station 7.** Students observe boiling water, a phase change. This is a physical change. Emphasize in discussion with students that this is a physical change because the steam is still chemically the same as liquid water. (You could begin this activity using ice.)

**Station 8.** Students observe the denaturing of egg white protein. Do this by heating the egg. The heat causes chemical change in the structure of the egg protein molecules which can be considered to be...
partially decomposed. The change will be evident as a color change, but also the resulting product has very different properties from the original egg white.

Station 9. Students observe sublimation of solid carbon dioxide (dry ice). This is a physical change. **SAFETY PRECAUTION:** Students must be instructed not to touch the dry ice. It must be handled with tongs or a protective glove.

Station 10. Students observe the curdling of milk by acid. This is actually similar to Station 8. In this case the curdling of the milk occurs when the protein, casein, reacts with vinegar, which is an acid. The protein has a certain 3D structure, which is disrupted by the reaction with the acid. This is a chemical change.

Station 11. Students dissolve sugar in water. This is a physical change.

Station 12. Students react vinegar (acetic acid) with baking soda (sodium bicarbonate) to form sodium acetate, carbon dioxide, and water. The release of a gas is indicative of a chemical change.

Station 13. Students will place small chips of egg shell in a small beaker of vinegar and observe the resulting events. (Carbon dioxide will be produced, and upon careful observation the presence of calcium carbonate as a precipitate can be observed.

Teacher background information: It is enough for students to recognize the chemical nature of this event. The chemistry involves three reactions and the details go beyond the level of this course. The events can be summarized as follows: the calcium carbonate was a main component of the egg shell. It reacted with the vinegar, to form calcium acetate and carbonic acid. The carbonic acid is the source of the carbon dioxide in the solution and the carbon dioxide reacts with the calcium from the calcium acetate to reform calcium carbonate which shows up as an insoluble product in the mixture.

**Assessment:**

 Assessment of the activity can occur using one or both of these techniques:

1. Students can use a digital camera to take a picture of each change and can then arrange the pictures into two categories: physical changes and chemical changes. Beside each picture they should explain how they determined whether the change
was physical or chemical.

2. Students complete the data chart provided with this task and answer the analysis questions at the end of this task.

Materials Needed: Stations:

1. Test tube in a test tube rack, a 10 mL graduated cylinder, eyedropper, tweezers, thermometer (non-mercury), 3% hydrogen peroxide (available from the grocery or drug store), and pieces of either liver or potato
2. Slices of apple left exposed to the air and labeled “untreated” and slices of apple treated with “Fruit Fresh” (or lemon juice) and labeled “treated”
3. Hot plate set on low heat, evaporating dish and a stick of margarine, cut into small pieces
4. 10 mL graduated cylinder, a test tube, test tube rack, green food coloring, water
5. 10 mL graduated cylinder, a test tube, test tube rack, green food coloring, water, dropper bottle of bleach
6. Walnuts or some other type of nut (not peanuts), scissors
   Celery or carrots could be substituted.
7. Hotplate, beaker, water
8. Hotplate, beaker of boiling water, egg white, and eye dropper
9. Piece of dry ice in a container where the sublimation can be observed without the students touching the dry ice
10. Beaker, two 25 mL graduated cylinders (one labeled milk, one labeled vinegar), 25 mL milk per group and 25 mL vinegar per group
11. Per group- 5 g of sugar, 50 mL graduated cylinder, beaker, water (You can have students mass the sugar if you provide a balance.)
12. Per group- 5 g baking soda (sodium bicarbonate) and 15 mL vinegar (acetic acid). You can provide a balance, a 250 mL beaker, and a 25 mL graduated cylinder, along with the chemical supplies
13. Chips of egg shell, vinegar, small beakers

Safety Precautions: Review standard safety procedures before this lab. In particular, review the handling and disposal instructions for each station. Students should wear goggles and aprons. Bleach and hydrogen peroxide should be washed off skin with copious amounts of water.
Task with Student
Directions: (You can copy this to make a handout for students if desired.)

Don't Go Changing

Cooking involves physical and chemical changes in matter. Today you will investigate some changes that commonly occur in food preparation, or that are related to the chemistry of food. As you observe the changes, determine whether the changes are physical or chemical. You must follow standard laboratory procedure, showing respect for the safety of yourself and others in the lab. Wear goggles and aprons the entire time in laboratory, clean up each station before you leave it, and handle and dispose of chemicals properly. Each group will be assigned a certain station to begin. Then you will proceed in numerical order through all stations. Make your observations, and based on those observations, determine whether each change is a chemical change or a physical change. Record this information on your data sheet.

1. Measure 5 mL of hydrogen peroxide into a test tube and measure its temperature. Use the tweezers to transfer the potato or liver piece into the test tube. Measure temperature again.
2. Compare the treated to the untreated piece of apple.
3. CAUTION: HOT SURFACE! Place a piece of butter in the evaporating dish and place it on the hot plate. Use tongs or other safe means of moving the evaporating dish.
4. Measure 5 mL of water into the test tube. Add 10 drops of green food color.
5. Add 10 drops of bleach to the food coloring/water mixture created in station 4. Observe.
6. Use scissors to cut the nuts into smaller pieces.
7. CAUTION: HOT SURFACE AND HOT LIQUID! Observe the boiling water.
8. CAUTION: HOT SURFACE AND HOT LIQUID! Add a dropper of beaten egg white to the beaker of hot water on the hotplate. Observe.
9. Observe the dry ice.
10. Measure 25 mL of milk and put it in the beaker. Add 25 mL of vinegar. Observe.
11. Measure 5 g of sugar and dissolve the sugar in 50 mL water.
12. Add 5 g of baking soda to 15 mL of vinegar in a 250 mL beaker. Observe.
13. Place small chips of egg shell in a small beaker of vinegar. Observe for several changes.
Resources:  

Unitedstreaming video segment: Physical Changes vs. Chemical Changes in the video Solids, Liquids, and Gases


MSDS for Hydrogen Peroxide:  
http://www.jtbaker.com/msds/englishhtml/h4070.htm (Note: in this task use a 3% solution, available at a drug store or grocery store- NOT the 30% solution that is used in some chemical applications)

MSDS for bleach:  
http://ptcl.chem.ox.ac.uk/~hmc/hsci/chemicals/sodium_hypochlorite.html

Homework / Extension:  

Required: After completing all stations reorganize your data. Look at your grid. Record what observations were associated with chemical changes.

Teacher Note: Students should associate chemical changes with formation of a precipitate (the calcium carbonate precipitated from egg shell), evolution of a gas (baking soda and vinegar, hydrogen peroxide and liver or potato), color change (apple, food coloring), and energy change (sugar).

1. Physical and chemical changes involve energy. For each activity, describe the involvement of energy. Was it absorbed? Was it released? In which case did combustion occur?

2. In which cases did a phase change occur? What was happening at the molecular level? How was energy involved?

Optional: Watch a meal being prepared or prepare a meal and make a list of the chemical and physical changes that occurred during its preparation. MAKE SURE AN ADULT IS PRESENT FOR SAFETY REASONS.
Instructional Task Accommodations for ELL Students:

Students can be provided a handout to be attached into their science journals with basic notes on how to organize observations and required statements. Include all required vocabulary words in a word bank with basic definitions as needed. Students can check off the vocabulary as it is used with the requirement that all the words be included in written responses. Assign the ELL student a specific task at each stage of the lab. Be sure to monitor progress frequently to assess comprehension and progress.

Instructional Task Accommodations for Students with Specific Disabilities:

Students with impaired social skills may find the cooperative element of this lab difficult. Discuss the lab with the student ahead of time along with discussion about specific roles the student would have in data collection, assembly of lab report, etc. The teacher should assess focus and progress at timed intervals throughout the lab. Students with organizational deficits may need handouts to attach in their journals for each activity that gives them a skeleton organization arranged by activity to record observations, explanations and conclusions. Be sure that students record needed data for each activity before moving on to a new activity.

Instructional Task Accommodations for Gifted Students:

Make a video of *A Day in the Life of Ralph*, in which the leading character (You choose Ralph’s species.) encounters physical and chemical changes. Show it to your classmates and let them identify physical and chemical changes in the video. **NOTE:** [Georgia Public Broadcastings](http://www.tienetwork.org/) free, teacher-friendly educational multimedia support group, the TIE Network (at the website http://www.tienetwork.org/) is an invaluable means of integrating technology and multimedia into this and other projects.
# Don’t Go Changing - Data Table

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<th>Station</th>
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Analysis Question:

Pick three examples from this task and explain how the Law of Conservation of Matter is illustrated.