Georgia Performance Standards Framework for Physical Science – GRADE 8

Unit: Energy in our Life
Inquiry Task
What’s Cooking?

Subject Area: Physical Science
Grade: 8

Standards (Content and Characteristics):

S8P2. Students will be familiar with the forms and transformations of energy.
   b. Explain the relationship between potential and kinetic energy.
   c. Compare and contrast the different forms of energy (heat, light, electricity, mechanical motion, sound) and their characteristics
   d. Describe how heat can be transferred through matter by the collisions of atoms (conduction) or through space (radiation). In a liquid or gas, currents will facilitate the transfer of heat (convection).

S8CS1. Students will explore the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works.
   a. Understand the importance of—and keep—honest, clear, and accurate records in science.
   b. Understand that hypotheses can be valuable even if they turn out not to be completely accurate.

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.

S8CS3. Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations.
   a. Analyze scientific data by using, interpreting, and comparing numbers in several equivalent forms, such as integers, fractions, decimals, and percents.
   b. Apply the metric system to scientific investigations that include metric to metric conversions (i.e., centimeters to meters).

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 tools and units for measuring objects and/or substances.
   b. Learn and use standard safety practices when conducting scientific investigations.

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S8CS6. Students will communicate scientific ideas and activities clearly.
   a. Write clear, step-by-step instructions for conducting scientific investigations, operating a piece of equipment, or following a procedure.
   b. Write for scientific purposes incorporating information from a circle, bar, or line graph, data tables, diagrams, and symbols.
   c. Organize scientific information in appropriate tables, charts, and graphs, and identify relationships they reveal.

S8CS7. Students will question scientific claims and arguments effectively.
   a. Question claims based on vague attributions (such as “Leading doctors say...”) or on statements made by people outside the area of their particular expertise.
   d. Recognize that there may be more than one way to interpret a given set of findings.

S8CS8. Students will be familiar with the characteristics of scientific knowledge and how it is achieved.
   Students will apply the following to scientific concepts:
   a. When similar investigations give different results, the scientific challenge is to judge whether the differences are trivial or significant, which often requires further study. Even with similar results, scientists may wait until an investigation has been repeated many times before accepting the results as meaningful.
   b. When new experimental results are inconsistent with an existing, well-established theory, scientists may pursue further experimentation to determine whether the results are flawed or the theory requires modification.
   c. As prevailing theories are challenged by new information, scientific knowledge may change.

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. Scientific investigations usually involve collecting evidence, reasoning, devising hypotheses, and formulating explanations to make sense of collected evidence.
   b. Scientific investigations usually involve collecting evidence, reasoning, devising hypotheses, and formulating explanations to make sense of collected evidence.
   c. Scientific experiments investigate the effect of one variable on another. All other variables are kept constant.
   d. Scientists often collaborate to design research. To prevent this bias, scientists conduct independent studies of the same questions.
   e. Accurate record keeping, data sharing, and replication of results are essential for maintaining an investigator’s credibility with other scientists and society.

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Enduring Understandings:
- Energy is neither created nor destroyed but can be transformed
- Energy can be transferred by radiation, conduction, and convection

Essential Question:
- How can we use radiation, conduction, and convection to transfer heat efficiently during cooking?

Pre-Assessment:
Ask students to research how and why things are cooked differently. Draw diagrams of how heat is provided, transferred, and controlled in a cooking process. Make a table to share their knowledge and findings.

<table>
<thead>
<tr>
<th>Outcome/ Performance Expectations</th>
<th>The student will experimentally determine what method of cooking food will provide the best cooked product and relate the cooking method to the types of heat transfer.</th>
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</thead>
</table>
| Write a concept statement...How would you formulate an expert idea? | Concept: Heat may be transferred through matter (conduction), through space (radiation), or through currents in fluids (convection). Examples to support the concept:  
- Get students to describe examples of how food is cooked  
- Get students to think about what methods of heat transfer are involved in each type of cooking |
| Write a concept statement / question...What kind of situation would cause this concept to become apparent in students’ understanding? | What different types / methods are used to cook food?  
What method of cooking do you think cooks food best? Why?  
What type of heat transfer is involved in that cooking?  
How could you test your idea?  
What would your independent variable be?  
What variables would you have to control?  
What would be your dependent variable?  
What would be the limitations of your study? |
| Identify necessary data and observations...What data would demonstrate the mastery of the concept by ALL students in the classroom? | What will you cook? What method will you use to cook it in order to use all three types of heat transfer?  
Students will need to pick a substance that can be cooked via microwave or solar heating, convection oven or boiling, and regular oven.  
NOTE: You will need to have methods of cooking food available to students. Before students use any heat-generating device, GO OVER SAFETY PROCEDURES INVOLVING THE USE OF HOT OBJECTS, ESPECIALLY BOILING WATER. PROVIDE OVEN |

MITTS OR POT HOLDERS, BUT REALIZE THAT IF THE MITTS GET WET, THEY ARE NO LONGER EFFECTIVE.

**Note:** This activity could be done in conjunction with the solar cooking of a hot dog, and that could be the primary use of radiation.

How could you set up your study so that your cooking methods are comparable?

Students should use comparable cooking times or comparable temperatures. They should just be aware of controlling variables.

How do you ensure that your results are due to different starting materials?

An initial substance should be subdivided so that identical quantities are cooked in each trial.

How will you evaluate your results?

A rubric for determining food quality should be developed before the experiment begins. This could be a class activity or left to each experimenter. Students will need to decide what the word “best” incorporates as it relates to food preparation- should it include taste and texture only or are there other factors such as ease of preparation that should be included in the rubric? See “Organizer for Cooking Comparison” at the end, for a sample rubric.

How do you know your results could be repeated if another class did your experiment?

Students should be encouraged to use multiple evaluators (i.e., they will evaluate each other’s products of cooking).

The use of a numerical rubric will facilitate data handling and in making conclusions.

How will you eliminate preconceptions on the part of evaluators regarding which method of cooking is best?

To eliminate bias you should discuss the use of a single blind or double blind experiment. (Single blind is where the food product is identified by number and only the experimenter knows what the number means. The evaluator does not know how the food was cooked. Double blind is where someone who does not know how the food was cooked poses the questions to the evaluators so that neither the evaluators nor the questioner knows how the food was cooked.)

| Write questions or activities to use or apply the concept (represent, model, visualize, or design new experiments). | Students are encouraged to create an organizer (graphic or otherwise) beforehand, similar to the one attached. |

**Homework/Extension**

- What method was best, according to your criteria?
- Did each of your cooking methods utilize only one method of heat transfer?
- Was all the energy transferred in each method? If not, did it disappear? How can you account for it?
- How could you increase the efficiency of heat transfer with each method of cooking?
- What energy conversions were involved in your cooking of food?
- What forms of energy were involved?
- Was potential or kinetic energy involved? Was one converted to the other?

<table>
<thead>
<tr>
<th>Instructional Tasks Accommodations for ELL Students</th>
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<tbody>
<tr>
<td>Assign the ELL student a specific task at each stage of the lab. Be sure to visit the team at timed intervals to assess comprehension and progress. Provide a handout that includes all required vocabulary words in a word bank with basic definitions as needed.</td>
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<tr>
<th>Instructional Tasks Accommodations for Students with Disabilities</th>
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<tr>
<td>Students with developmental disorders such as Asperger's Syndrome, or students having Autistic tendencies display impaired social interactions and repetitive patterns of behavior. Since these activates involve close interactions such as eating, be sure the student has a say in which group he/she will be involved in. If possible, discuss the lab, data collection, assembly of lab report, and specific roles of each student, ahead of time. The teacher may want to assess focus and progress at timed intervals throughout the lab. Students with organizational deficits may need reminders to record needed data for each activity before moving on to a new activity.</td>
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<tr>
<th>Instructional Tasks Accommodations for Gifted Students</th>
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| Have students visit the following web-based resource:  
*The Science of Food*  
http://www.exploratorium.edu/cooking/ |
| Ask them to identify evidence of the importance of heat transfer in food preparation. Gifted students could be required to provide the same amount of energy to each sample. This would necessitate research into:  
- heat capacity of water,  
- electrical power calculations,  
- or radiant heat calculations. |

### Sample Organizer for Cooking Comparison

<table>
<thead>
<tr>
<th>Primary method of heat transfer</th>
<th>Conduction</th>
<th>Convection</th>
<th>Radiation</th>
</tr>
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<tbody>
<tr>
<td>Type of food used: ____</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method of cooking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brief explanation of the cooking method</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantity of food used</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time of cooking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature of cooking</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sample Rubric for Evaluating Food

<table>
<thead>
<tr>
<th>Rank</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>1 was the worst I have tasted</td>
</tr>
<tr>
<td>2</td>
<td>2 was awful</td>
</tr>
<tr>
<td>3</td>
<td>3 was tolerable but not notable</td>
</tr>
<tr>
<td>4</td>
<td>4 was good but not the best I have tasted</td>
</tr>
<tr>
<td>5</td>
<td>5 was the best I have tasted</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Taste</th>
<th></th>
<th></th>
<th></th>
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<tbody>
<tr>
<td>Texture</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tenderness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aftertaste</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Letter of food sample = ____________________