

Processes that Serve as Sources of Heat Energy: Grade 3

Lesson Overview

In this lesson, students will increase their knowledge of things that create heat energy by reading about the processes, relating them to their daily surroundings, and collecting data on where they observe the processes around them. This lesson also addresses the math standard related to collecting and graphing data.

Alignment

Science Standards

3.P.2A.4 Obtain and communicate information to **compare** how different processes (including burning, friction, and electricity) serve as sources of heat energy.

Science and Engineering Practices

3.S.1A.8 Obtain and evaluate informational texts, observations, data collected, or discussions to (1) generate and answer questions, (2) understand phenomena, (3) develop models, or (4) support explanations, claims, or designs. Communicate observations and explanations using the conventions and expectations of oral and written language.

Math Standards

3.MDA.3 Collect, organize, classify, and interpret data with multiple categories and draw a scaled picture graph and a scaled bar graph to represent the data.

Math Process Standards

- 6.** Communicate mathematically and approach mathematical situations with precision.
- Express numerical answers with the degree of precision appropriate for the context of a situation.
 - Represent numbers in an appropriate form according to the context of the situation.
 - Use appropriate and precise mathematical language.
 - Use appropriate units, scales, and labels.

ELA Standards

3.RI.6 (Reading Informational Text)

Summarize key details and ideas to support analysis of central ideas.

3.W.2(Writing: Meaning, Context, and Craft)

Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content

Computer Science and Digital Literacy Standards

3.DA.2 Collect, arrange, and represent data.

3.DA.2.1 Discuss appropriate tools for collecting data

3.DA.2.2 Represent data with bar graphs

3.DA.3 Interpret and analyze data and information.

3.DA.3.1 Interpret and analyze given data (i.e. tables)

Connections

Content Area Connections

- Science
- Math
- Computer Science and Digital Literacy

Content Connections

This lesson connects the science learning about processes that serve as heat energy to a math learning opportunity for students to collect, organize, and analyze data related to those processes.

Computational Thinking

This lesson promotes computational thinking by providing an opportunity for students to logically organize and analyze data.

Lesson Plan Part A

This part of the lesson is focused on the science standard.

Time Required: one 45-minute class

Disciplinary Vocabulary: heat energy

Materials Needed:

- Chart paper or board space to record list.
- Copies of Informational Text Page (provided with this lesson)

Misconceptions: *Be prepared for careful discussion of heat sources and be sure to keep focused on identifying the process that creates the heat energy. Some examples are clear and easy to identify, while others may have some additional features that must be set aside in order to focus on only the process that creates heat energy. For example, gas logs may have a fan attached which is powered by electricity, but the actual heat comes from the burning of the natural gas or propane gas fuel while the fan just moves that heat around to make it more efficient.*

Engage

- *Have students brainstorm a list of items around their homes or school that produce or generate heat (candles, fireplaces, lightbulbs, computers, tv, bike wheel against driveway, car, ...) Make no corrections at this time.*

Explore

- *Students read informational text (included in this lesson) on the 3 processes (burning, friction, electricity) to obtain information and take notes in the graphic organizer (see sample attached) as they read.*
- *Students return to the brainstormed list on the board and sort the list into the 3 processes, justifying their thinking. They write the items from the brainstormed list under the correct process on their graphic organizer.*
- *Teacher may want to have a few video clips or photos on hand of some common items that produce heat. All students may not be familiar with some items and how those items work such as gas logs, heat pump units, kerosene heaters, portable space heaters, hair styling devices, hot water heater, etc. These could be used to give students a clear picture of what is being discussed when sorting the list into the three processes.*

Explain

- *Students communicate their thinking by writing a summary paragraph comparing how these processes serve as sources of heat energy.*

Lesson Plan Part B

This part of the lesson is focused on the math standard, but requires prior knowledge of the science standard in Part A.

Time Required: homework – data collection and one 90-minute class block

Disciplinary Vocabulary: heat energy, scaled

Materials Needed:

- Student copies of task sheet “Heating the Buildings and Homes in Our Community”
- Computer with spreadsheet application

Engage

Introduce students to their home task of collecting data by giving them one or two examples from the classroom or school setting. This should be brief and may be at the end of Lesson Part A or at end of the school day.

Explore

- *Once students return to school with their data, the teacher should review the expectations of the project and prompt students to begin organizing their individual data collection and drawing their graphs*
- *As students complete their individual graphs they can begin to enter their data into a class spreadsheet at a computer station. This spreadsheet template will need to be setup in advance of the lesson by the teacher or by a student leader.*
- *Once all data is combined, the teacher will lead a “data talk” about the combined data and how it represented heat energy processes in the community. Topics and questions may include how the combined data is or is not similar to student individual data and how the*

combined data might compare to communities different from yours (urban, rural, geographic location, etc.).

Explain

Students will work with partners or in small groups to create an infographic as described on the task sheet.

Graphic Organizer

<i>Topic: Processes that Serve as Sources of Heat Energy</i>		
Burning	Electricity	Friction
<p>Write a summary paragraph comparing how these processes serve as sources of heat energy.</p>		

Informational Text: Processes that Serve as Sources of Heat Energy

Different processes (including burning, friction, and electricity) serve as sources of heat energy.

Burning



Heat can be produced when materials are burned. For example, burning candles and fuel in cars produces heat. Many people also warm their homes by burning either gas, oil, coal, kerosene, or wood.

We may also burn wood, paper, or coals on a camping trip for a campfire or for cooking. Our bodies also produce heat from burning. What do our bodies burn to produce heat?



Friction

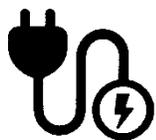
Friction is the rubbing of two things together. Have you ever rubbed your hands together on a chilly day to warm them? When objects are rubbed together they produce heat.



If no matches are available, friction can be used to light fires by rubbing two sticks or other objects together.

Friction is rarely used to warm homes or buildings. Why might that be?

Electricity



When electricity is used heat can be produced. Some people heat their homes or buildings with electricity. When electricity is used in heaters, lamps, clothes dryers, hair dryers, or toasters they produce heat becoming warm or hot to touch. Can you think of other things that produce heat from electricity?

As we learn about the processes of burning, friction, and electricity, remember some objects keep things warm, but do not produce heat. For example, coats, quilts, and blankets. These objects trap heat to keep things warm, but they do not produce heat. What other objects keep things warm, but don't produce heat?



Heating the Buildings and Homes in our Community



Bethany was curious after her science class about which source of heat was most popular in her neighborhood for heating homes and other buildings such as churches, stores, and restaurants. She knew that some her friends and family used gas, oil, wood, coal, and kerosene to heat their homes and that these were examples of burning. She also knew that electricity heated her home and her church, but could think of none using friction.

She decided to conduct a survey to find out. She asked 25 people if they heated their homes or work locations with either gas, oil, wood, coal, or electricity? Find out the sources of heat energy in your community and think about how the information you learn connects to other communities. Follow these steps:

AT HOME:

- Complete a survey of 25 people and **collect data** on heating the buildings and homes in your community using these categories: oil, gas, coal, kerosene, electricity, and other.

INDIVIDUALLY (in class):

- **Organize** the data in the categories/**classifications**.
- **Draw a scaled picture graph** and a **scaled bar graph** to represent your survey results.
- **Interpret: Explain which of the categories on your survey are burning? Friction? Electricity?** Why might one process (burning, friction, electricity) be more heavily represented than another?

TOGETHER (as a class group or small group):

- Using a computer combine your data with that of your classmates. What does your class' data say about energy usage in your community? How might your class' data compare to that of another city? State? Country?
- Create an infographic to help others understand heat energy usage in your community. Include what you have learned about the processes that serve as sources of heat energy and the data and graphics that support your claims.