Transformers

Energy is transformed and transferred in many ways. Students will begin thinking of how these transformations and transfers occur as they explain what happens as thermal, light, sound, electrical, chemical, mechanical, electromagnetic, and nuclear energy work in a system. Since this segment combines and uses information from the other segments, it can review, introduce, or elaborate on each portion of the year.

Student Science Performance	
Grade or course High School Physical Science	**Title** Transformers
Topic: Energy	

Performance Expectation for GSE:

SPS7. Obtain, evaluate, and communicate information to explain transformations and flow of energy within a system.

a. Construct explanations for energy transformations within a system. (Clarification statement: Types of energy to be addressed include chemical, mechanical, electromagnetic, light, sound, thermal, electrical, and nuclear.)
b. Plan and carry out investigations to describe how molecular motion relates to thermal energy changes in terms of conduction, convection, and radiation.
c. Analyze and interpret specific heat data to justify the selection of a material for a practical application (e.g., insulators and cooking vessels).
d. Analyze and interpret data to explain the flow of energy during phase changes using heating/cooling curves.

Additional notes on student supports

Performance Expectations for Instruction:

- Construct arguments for energy transformations.
- Explain how conduction (heating particles that are touching), convection (heating in fluids) and radiation (heating through electromagnetic waves) allows heat to transfer from one object to another and relate this to what they learned in previous instructional segments on particle movement.
- Analyze specific heat data for material selection.
- Model (diagram) the transformations of energy along a simple pathway (ex. coal to classroom lights).

Materials:

Exploring Types of Energy:

- Access to the internet
- Items for stations- toy car, fan, hot plate, flashlight, golf ball and meter stick (two of each for classes over 20 students)
- Data collection sheets
- Station cards

Thermal Investigation (per group):

- Hot plate
- Beaker
- Thermometer or temperature probe
- Thermometer clamp
- Ring stand

Students will continuously obtain, evaluate, and communicate information. This is not a linear process. Students will communicate through writing and discussions to allow for formative assessment. This benefits the teacher, student, and whole group to guide instruction to clarify misconceptions or extend content.

Engaging Learners	**Phenomenon** This series of demonstrations show phenomena of energy transformations in different objects. • Turning on classroom lights. • Hold a bouncy ball high above the table or floor and drop several times. • Pour a full beaker of water from above the table into an empty beaker. • Show/turn on a battery powered device/toy. • Short videos or pictures could be shown of wind turbines, hydroelectric dams, or other energy conversions. • Chemical reaction that produces heat, for example: calcium chloride in water. Discuss with students (or elicit student questioning) what these demonstrations have in common; while all show different changes—the same basic thing is happening in each case (energy transformation). Write a list of ways you have observed energy transformation. *Teacher Notes: Have students work together to brainstorm a list of energy transformations they have observed. This is just a list to begin the thinking process. No explanations are needed at this time. This formative assessment will let you know how much each student knows.* Energy Transformation Brainstorm
	Obtaining Start flipping your lights on and off and pose the question, "I wonder how this works?" Ask students to get out a piece of paper and spend one-minute writing an explanation of how this works. After a few seconds if all students have written is "you flip a switch" tell the students what you are looking for is where the ENERGY to power the lights comes from. Tell students NOT to write their names on their paper. *Teacher Notes: Power plants are taught in 6th grade, and energy transformations are addressed in 8th. It is also likely that students have talked about fossil fuels in 3rd grade, so students will have some background on this topic but have not made the connections.* *Once the time has finished, have all students ball their papers up and throw them somewhere nearby. (If you think this will be too much for your students, collect all of the papers and re-distribute them.) Ask the students to read what is on the paper. (This will allow students anonymity of ideas and "cover" if the ideas are wrong- it will give a safe environment for opinions- important for adolescent learners.)*
	Communicating Have the students share their ideas in small groups and then have the groups summarize what they thought for the whole class. Students who have had 8th grade physical science may get this correct, but do not tell students if they are right or

	wrong during this engagement phase. *Additional Teacher Notes on topic, focus, and phenomena*
Exploring	Prior to the class beginning have several items arranged at the back of the classroom. Include the following- a fan, a flashlight, a toy car, hot plate, and a golf ball and meter stick. Students will actually visit six stations (one station will be friction). If your class is large, double the items to create 12 stations (with groups of 3 this will cover a class of up to 36 students). Students will travel from station to station and fill in a chart. At each station, place the appropriate station card (types of energy vocabulary is provided for students to use if needed.
	Obtaining Ask students to create a data sheet for the activity (or use the sample data sheet). Students will be visiting six stations to look at energy transformations for simple objects. Students will be asked to identify the initial form of energy and the final type(s) of energy as well as how the energy is transferred. Students will be provided with a word bank of terms for types of energy, be sure students understand what each of the terms means (terms taken from the Georgia Milestones EOC Study Guide for Physical Science). Place students in groups of no more than three. Give students only 2-3 minutes per station, so that their focus is not lost. While students are working be sure to walk around and help students who are having difficulty by asking questions to help them discover the answer. It may help to have a textbook or other printed resource available at each station with the definitions of the types of energy. *Teacher Notes: Do not allow students to use electronic sources during this phase as you do not want them to have access to the "answers" but rather want to reveal their thinking through this activity.*
	Evaluating: Once students have completed the stations, pair groups together into slightly larger groups (5-10 students) and allow students to engage in productive argumentation about the energy transformations they saw. Allow students to change their answers or add to them as new understandings arise. You may choose at this point to allow students to use electronic resources to check their work. It is important that the teacher allows the students to discuss their ideas with as little intervention as possible so that the students are constructing their own understanding of the core idea that energy is transformed or transferred but not lost. *Communicating:* After allowing the student groups to work together for about 10 minutes, have one member from each group share their groups' conclusions on a chart shared by the class. Spend a few minutes going over the answers and note any misunderstandings. When working with students to get them to the correct conclusions, use the device from the lab to demonstrate the correct answer. Call the students' attention to the ball drop station. Ask students why the ball did not return to the same height that it started. Ask the students where the extra energy

	was transferred. Have the students make a prediction (or share) from their data sheets, then talk in their small groups and then larger groups about why this occurred. Emphasize to students that energy cannot be created or destroyed. After a group discussion have the students spend five minutes writing an individual answer to explain where the energy was transferred out of the system. Student answers to this question can be used to look for areas in which understanding needs to be clarified or as an assessment of learning. *Teacher Notes: There are many answers to this including- transformed to heat when striking the floor, transformed to sound, and transferred in elastic potential energy as the ball deforms when it strikes the floor. You will need to use your professional judgement as to the detail you would like your students to understand this concept. But the underlying concept students should grasp is that the energy is not "less" (because energy is conserved), but that it is transformed.* *Some students, especially those who have skipped the 8th grade curriculum, or students who have not had physical science in several years, may need some background prior to this unit. For a brief overview of the types of energy can be found in this video- Types of Energy*
Explaining Finalizing Model	*Obtaining* **Phenomenon**: **Heat Capacity of Water Balloon** Shows what happens when a water balloon and a regular balloon are held over a fire. A balloon filled with water is brought into contact with the candle flame. Due to the heat capacity of the water, the balloon does not pop. An air balloon is then brought in contact with the candle and it does pop as one would expect. Video showing heat capacity of water balloon (0:18) Why didn't the water-filled balloon burst? Have students generate initial claims about the phenomenon. Explain: As we have seen, there are several forms of energy that transfer and transform into other forms of energy. What might seem as lost energy, is simply a change into a different kind of energy. *Teacher Background:* This segment will work through each one listed in the GSE SPS7a to give a better understanding to each one separately and then as a whole. There is not a sequence. Teach these in any order that works for your class. Several are represented in different instructional segments. The intent is that students are constructing explanations for the different energy transformations. **Thermal**: **Heat transfer** is the way the heat moves from one physical system (or body) to another. Heat transfer requires a difference in temperature. Heat moves from the hotter body (higher temperature) to the colder one (lower temperature). The bodies in question may be in a solid state, a liquid state or a gaseous state. There are three modes of heat transfer: conduction, convection and radiation.

Microwaves heat food through radiation.

Microwaves are a good example of radiation that is easily observable for students. Microwaves

Heating and cooling curves:
Have students focus on the temperature during a phase change. If they understand that the energy is going into the phase change and the temperature remains steady, they can recognize when a solid becomes a liquid or a liquid becomes a gas by noting the steady temperature of a substance. It is important that students know the freezing and boiling points of water to see the phase changes at those temperatures.

Set up the materials for students to investigate thermal energy transfer in air, water, and sand. Provide materials and have students plan and carry out an investigation to determine how the air, water, and sand are heated by radiation, convection, and/or conduction. Have students explain what is happening, diagram the movement of thermal energy and label the process as radiation, convection, and/or conduction. Allow time for students to also measure the effects of cooling on each of the media.

Challenge: Students in elementary school learn basic information about thermal energy and the way it transfers. Plan and carry out an investigation that can demonstrate how heat is transferred explaining conduction, convection and radiation. Include diagrams, temperature data, and simple investigations younger students can conduct using materials such as water, hot pots, thermometers, heat sources, etc.

Thermal Energy Transfer Investigation Handout

Communicating
Share these investigations and presentations with the elementary teachers and students by visiting the school, sending information by email or PowerPoint, or videoing the information for classroom use.

Changes in the states of matter is graphed to communicate thermal data. When heat is added to a substance, such as water, it can change from frozen to liquid to gas. A graph can show this data. Plateaus on the graph show when the substance is changing phase-- (the freezing point) ice to water (the melting point); water to gas (the boiling point).

Background information:
Heating and Cooling Curves:
Heating and Cooling Curves: Graphs used to describe changes of state

Assessment practices of Heating and Cooling Curves
10 online practice questions on Heating and Cooling Curves

Thermal:
Specific heat and material selection:
Energy is not always converted equally based on materials. Consider showing students a demonstration (or conducting a mini-lab) of specific heat differences of a

	plastic sample and metal sample by heating samples up for equal times and placing in cool water to observe temperature change. Possible guiding questions: • If samples were close in initial temperature, why did they heat up the cool water differently? • How are the samples transferring energy to the water? • Which material would better serve as an insulator/conductor of heat? Why? A different demonstration or lab investigation is to show how ice melts differently on various surfaces, for example a piece of aluminum compared to plastic. Materials will be at the same initial temperature, but the ice will melt at different rates.
	Chemical: The fuel sources to power a car are a combination of elements, compounds, mixtures, and their changes or reactions. Refer to the idea of the transformations of energy that occur during these reactions that power vehicles and other apparatus. • What is fuel? What is happening at the particle level when something burns or combusts? • Why do some things react and others do not? • What role does energy play in the rearrangements of atom, and where does the energy come from? • What propels a car or airplane if just the combustion of fuel itself does not cause motion? This section refers to the following instructional segment. You can use it as a review or as an introduction to chemical reactions or elements and compounds. The instructional segments in high school physical science are • *Structure and Function of Matter: Elements and the Compounds They Form, The Salt I Used for Lunch Came from What?* • *Chemical Reactions-Acids and Bases in Everyday Life: Acids and Bases I Use Everyday*
	Nuclear: *Nuclear energy heats water to generate electricity* This section refers to the following instructional segment. You can use it as a review or as an introduction to nuclear changes and energy. The instructional segment in high school physical science is *Changes in Nuclear Structure.*
	Electrical: There are numerous examples of converting electrical energy into other types or of electricity being generated by different means. This section refers to the following instructional segment. You can use it as a review or as an introduction to electricity. The instructional segment in high school physical science is *Limit the Resistance to Learn About Electricity*
	Electromagnetic: *Copper affects the motion of a magnet.* -When a magnet falls through a copper pipe it induces a current. The current creates a magnetic field that opposes the magnet, so it falls more slowly than expected.

	Magnet falling through a copper pipe
	Light and Sound: Vehicles are equipped with and cause changes in light and sound. Referring back to the introductory phenomenon, how does the energy transform into those needed lights and sounds. How does motion affect those? The instructional segment dealing with sound and light is *Patterns in Waves Instructional Segment: Doppler Effect: Can You Hear That?*
	Mechanical: It is so logical that the movement of objects, such as the ones from the introductory phenomenon, is focused on the mechanical energy. You can refer to the instructional segment: *Force and Motion - Newton's Laws and Inertia: Car Stop: Seatbelts and Airbags.*
	Communicating Share these investigations and presentations with the elementary teachers and students by visiting the school, sending information by email, PowerPoint, or videoing the information for classroom use.
Elaborating Applying Model to Solve a Problems	*Obtaining:* Challenge students to think of an example not already covered in class of an energy transformation (refrigerators, boom boxes, smartphones, etc.). Students will work in groups to make an energy diagram of this system. Students should have at least two transformations in their diagram. (One suggestion would be to have them do this for the year-long anchoring phenomena of a car or rocket- have them produce an energy transformation diagram for the energy needed to move these vehicles.) *Communicating:* Students will make an energy transformation diagram for their chosen example. Challenge students to show, not just the transformations within the system, but also any transformations that cause energy to be transferred outside the system.
	Evaluating Ask: Why do inventors and designers need a clear understanding of energy transformation?
Evaluation	***Assessment of Student Learning***
	Following the lab station activity and follow-up, have students return to a guiding phenomena for this lesson- turning on the classroom lights. Explain to students that unlike the stations, we are looking for a deeper understanding of energy transformations that take place in this system. Have students prepare a Claims-Evidence-Reasoning chart for the energy transformations that take place in order to turn on the classroom lights. Sample C-E-R chart ● Students will make an energy transfer diagram (model) using types of energy. ● Students will demonstrate that energy is always conserved. ● Students will demonstrate that energy can be transferred outside of the

	system (or "changed").
SEP, CCC, DCI	**Science Essentials**
Science and Engineering Practices	● Asking questions and defining problems ● Planning and carrying out investigations ● Analyzing and interpreting data ● Constructing explanations
Crosscutting Concepts	● Energy and Matter ● Cause and Effect ● Systems and System Models
Disciplinary Core Ideas	From *A Framework for K-12 Science Education*: **PS3.A: Definitions of Energy** **PS2.B: Types of Interactions** **PS2.C: Stability and Instability in Physical Systems** **PS3.B: Conservation of Energy and Energy Transfer** **PS3.C: Relationship Between Energy and Forces** **PS3.D: Energy in Chemical Processes and Everyday Life**

Additional Supports for struggling learners:

The following supports are suggestions for this lesson and are not the only options to support students in the classroom. These supports target students that struggle with science material, this lesson or a previous lesson. These are generalized supports and do not take the place of IEP accommodations as required by each student's Individualized Education Program.

General supports for the following categories:

Reading:	Writing:	Math:
1. Provide reading support by reading aloud or doing partner reads 2. Have the teacher model what they are thinking when reading the text 3. Annotate the text with students so that they may refer to it as they work through the lab	1. The teacher can provide a sentence starter for the students. 2. The teacher can give students an audience to write to (i.e. Write a letter to your sibling explaining this topic). 3. The teacher can provide constructive feedback during the writing process to help students understand the expectations.	1. Provide calculators as needed. 2. Provide graph paper as needed.

Supports for this specific lesson if needed:

Performance expectations for instruction:

1. The teacher should provide information to students in various formats to reach as many students as possible.
2. The students should be given adequate time to complete each part of the lesson.
3. The students should be allowed to express their knowledge in various formats.
4. The teacher should be sure to provide multiple ways for the students to communicate their knowledge of the material.

Engage:

1. The teacher may need to show some of the examples of energy transformations more than once.
2. The teacher should have students make observations about what they see when looking at different energy transformations.
3. Then have students see if they can come up with some other energy transformations that they have observed. The teacher can list them on the board and then the class can return to them later in the lesson to decide if they are actually energy transformations.
4. After asking the question about how the light works the teacher should remind students that at this

point there is no right answer.

5. Writing the explanation without the students' name is a good scaffold. However, some students may require text to speech to get their thoughts on paper. This will allow students that struggle with writing to participate in the activity. The teacher might consider giving some students that are not struggling computers to help preserve anonymity.
6. The teacher could, also, consider providing students with sentence starters.
7. The teacher should have guidelines set up for group work to assist students in feeling comfortable working with other students.
8. The teacher should be listening to the student groups and making note of any misconceptions.
9. The teacher should address any misconceptions as quickly as possible and provide high quality, constructive feedback.

Exploring:

1. The teacher should provide instructions for completing stations. The teacher should make the amount of time at each station very clear and have a timer where students can see and attempt to keep themselves on track.
2. The teacher should provide a data sheet for the students to record observations, data and terms as they move through the stations.
3. Printed resources can be used for students, but the teacher should consider providing online resources to struggling students. This way students that struggle with reading can use a text to speech feature to help them read the material.
4. The teacher should remind students of what scientific argumentation means and how to engage in it appropriately.
5. The students may need additional time to revise their arguments.
6. Consider providing a rubric or other resource for students to check their work. This will increase student ownership of the work.
7. The teacher should have clear and consistent guidelines set up for classroom discussions. These guidelines should help students feel safe in the classroom.
8. The teacher should help students make connections between energy not being created or destroyed and what they are learning in this lesson. The teacher should explicitly link this to Newton's laws.
9. The teacher should consider using some of the background information provided in the explore section to help struggling students.

Explaining:

1. The teacher may need to show the demo more than once and have students make observations about the balloons as the demo progresses.
2. The teacher could also consider showing a video that is another example of this phenomena.
3. The teacher should consider providing a CER sheet for students to begin recording their initial claims.
4. The teacher should consider giving students some sort of graphic organizer to organize their thoughts on the modes of heat transfer. The teacher will need to explicitly teach students how to use the graphic organizer.
5. Have students discuss the time difference between cooking in an oven and in the microwave.
6. When discussing phase changes the students need to know the boiling and freezing points. The teacher can use videos to show the boiling and freezing points of water.

7. The teacher can then use videos to show other phase changes and discuss temperature in those changes.
8. The teacher should provide a template for students to plan their investigations and collect data.
9. The teacher should provide students with a template to put their diagrams on and the teacher should consider providing a word bank to assist students in labeling the diagram.
10. The students may need additional time to complete their investigation and presentation.
11. The teacher should consider having students share the investigation and presentation with their classmates. This may be more comfortable for some students that do not like change.
12. The teacher should consider having students label a heating and cooling curve. Then have students practice reading the heating and cooling curves.
13. The teacher should consider providing discussion questions to students in advance. This will allow struggling students to formulate responses prior to the classroom discussion. This may help students feel more comfortable with the discussion and be more likely to participate.

Elaborating:

1. The teacher should use flexible and intentional grouping. Best practice would be to use data to drive grouping.
2. The teacher should consider providing a rubric to students so that students may evaluate their own work on the energy diagram. This will increase their ownership of their learning.
3. The students can then share their work and revise as needed.
4. Students may need additional time to complete their energy diagram.
5. The teacher may want to provide sentence starters for the final question.

Evaluating:

1. The teacher should be sure to check for understanding throughout the lesson and build in re-teaching, review and enrichment as needed by each student.
2. The teacher should provide tangible and constructive feedback for students throughout the lesson.
3. The teacher should provide multiple formats for students to express their knowledge. These formats could include writing, drawing or designing a play.
4. Students may need additional time to complete their CER.

Energy Transformation Brainstorm

Example: Flipping on an electrical switch causes the light bulb to glow.

Type of Energy	Example	What transformed?
Chemical		
Mechanical		
Electrical		
Light		
Sound		
Nuclear		
Electromagnetic		
Thermal		

Return to Instructional Segment

Energy Station Cards

FAN

-Turn on the fan

-Observe what happens

-Record your ideas of how energy is being transformed

TYPES OF ENERGY- WORD BANK

Kinetic- Potential

Chemical • Electrical • Electromagnetic • Mechanical • Nuclear • Radiant (Light) • Sound • Thermal (Heat)

FLASHLIGHT

-Turn on the flashlight

-Observe what happens

-Record your ideas of how energy is being transformed

TYPES OF ENERGY- WORD BANK

Kinetic- Potential

Chemical • Electrical • Electromagnetic • Mechanical • Nuclear • Radiant (Light) • Sound • Thermal (Heat)

TOY CAR

-Push the car across the table

-Observe what happens

-Record your ideas of how energy is being transformed

TYPES OF ENERGY- WORD BANK

Kinetic- Potential

Chemical • Electrical • Electromagnetic • Mechanical • Nuclear • Radiant (Light) • Sound • Thermal (Heat)

HOT PLATE

-Turn on the hot plate

DO NOT TOUCH THE HOT PLATE- IT MAY STILL BE HOT FROM OTHER GROUPS AND COULD BURN YOU

-Observe what happens

-Record your ideas of how energy is being transformed

TYPES OF ENERGY- WORD BANK

Kinetic- Potential

Chemical • Electrical • Electromagnetic • Mechanical • Nuclear • Radiant (Light) • Sound • Thermal (Heat)

HANDS

-Rub your hands together vigorously for 20 seconds

-Observe what happens to the temperature of your hands

-Record your ideas of how energy is being transformed

TYPES OF ENERGY- WORD BANK

Kinetic- Potential

Chemical • Electrical • Electromagnetic • Mechanical • Nuclear • Radiant (Light) • Sound • Thermal (Heat)

GOLF BALL

-Place the meter stick on the ground with the 0cm mark on the floor

-Hold the ball at the 100cm mark and release

-Make note of what the height on the meter stick reads is the max height the ball bounces back to

-Observe what happens

-Record your ideas of how energy is being transformed

TYPES OF ENERGY- WORD BANK

Kinetic- Potential

Chemical • Electrical • Electromagnetic • Mechanical • Nuclear • Radiant (Light) • Sound • Thermal (Heat)

Return to Instructional Segment

Energy Transformation Data Sheet

Student Names

____

____

____

Fill in the table below-

Item	Initial Type(s) of Energy	How is the energy converted or transferred?	Final Type(s) of energy	Can you identify any other forms of energy that are transferred to the environment during the activity?
EXAMPLE: Striking a match	Chemical (potential/ stored)	Friction- striking match	Thermal and Radiant	Sound
Fan				
Rubbing Hands				
Toy Car				
Golf Ball and Meter Stick				
Hot Plate				
Flashlight				

Return to Instructional Segment

Thermal Energy Transfer

Materials: Hot plate, beakers, thermometer or temperature probe, thermometer clamp, ring stand, water, sand, timer, graph paper

Your challenge is to use the materials above to design an investigation to show the three methods of thermal energy transfer: radiation, conduction, and convection.

You must show pictures or draw sketches of how you set up each investigation. Label these models showing molecule movement and method of transfer. Collect, analyze and communicate your data using graphs, charts, etc. When your plans are approved by the teacher, you can begin your investigations.

Part A. The Plan:

To demonstrate radiation, our group will

To demonstrate conduction, our group will

To demonstrate convection, our group will

Part B. Attach evidence collected

Labeled sketches or pictures of radiation, convection, and conduction set up and investigations

Data as collected

Analysis of data

Communication of data: graphs, charts, tables, etc.

Return to Instructional Segment

Sample CER Chart

<table>
<tr><td colspan="4">What causes the classroom lights to come on?</td></tr>
<tr><td>Initial claim:</td><td colspan="3">The classroom lights came on because of the following energy transformations: ____</td></tr>
<tr><td>Initial Reasoning:</td><td colspan="3">1.______________________________________
2.______________________________________
3.______________________________________</td></tr>
<tr><td>Revised Claim after investigation and class discussions:</td><td colspan="3"></td></tr>
<tr><td rowspan="4">Supporting Evidence for claim:</td><td>1.</td><td rowspan="4">Reasoning for final claim:</td><td>1.</td></tr>
<tr><td>2.</td><td>2.</td></tr>
<tr><td>3.</td><td>3.</td></tr>
<tr><td>4.</td><td>4.</td></tr>
</table>

Return to Instructional Segment

Energy and Matter

GSE: SPS7 a, b, c, d

Anchoring Phenomenon:

Turning on your classroom lights requires many transformations of energy.

Students explain the phenomenon using the following concepts:

- The transformations of energy from chemical (coal) to heat (steam) to electrical (turbine) to light when you turn on your classroom lights represents excellent observable phenomena.
- Energy transformations occur constantly.
- Some of the energy is lost when transformation takes place.

Topic	Focus	Lesson Phenomenon	GSE/Notes/Language
Heat energy	• Students will explain how conduction (heating particles that are touching), convection (heating in fluids) and radiation (heating through electromagnetic waves) allows heat to transfer from one object to another. • Students will relate this understanding to what they learned in previous instructional segments on particle movement. • Using known specific heat values, students will predict what types of materials can be used for different applications. • Students will understand that the specific heat capacity is a measurement of the amount of heat a material can absorb without changing temperature. • Students will understand how temperature and pressure affect the state of a material in phase change. This understanding is related to the previously studied phases and molecular movements.	*Microwaves heat food through radiation.* *A water-filled balloon will not burst over flame like air-filled.*	SPS7b. Plan and carry out investigations to describe how molecular motion relates to thermal energy changes in terms of conduction, convection, and radiation. SPS7c. Analyze and interpret specific heat data to justify the selection of a material for a practical application (e.g., insulators and cooking vessels). SPS7d. Analyze and interpret data to explain the flow of energy during phase changes using heating/cooling curves. Equations- Heat loss or gain

Energy transformations	• Students should understand that energy is not always in one form and that energy is often transformed. • When energy is transformed, some is released (but not truly "lost" as energy cannot be created or destroyed). • Students will model (diagram) the transformations of energy along a simple pathway (ex. coal to classroom lights).	*Turning on classroom lights requires a number of energy transformations.*	SPS7a. Construct explanations for energy transformations within a system. (Clarification statement: Types of energy to be addressed include chemical, mechanical, electromagnetic, light, sound, thermal, electrical, and nuclear.) All types of energy and energy transformations should be included in this unit, however- light and sound will be covered more in-depth in future units.

Return to Instructional Segment