Science Stations

Energy, Energy, Everywhere

Energy , Transfer of Energy, and Forces



Fourth Grade

Jessica Boschen & Jill Elliott

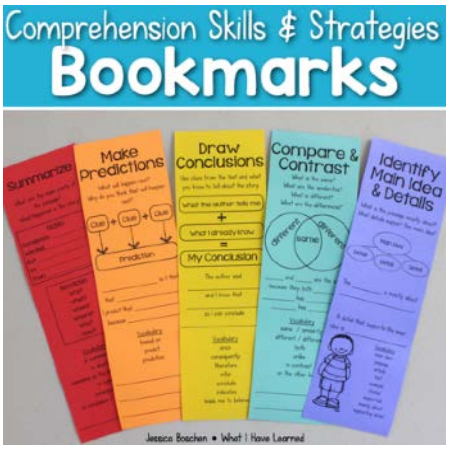
NGSS 4-PS3.A-D & ETS1.A

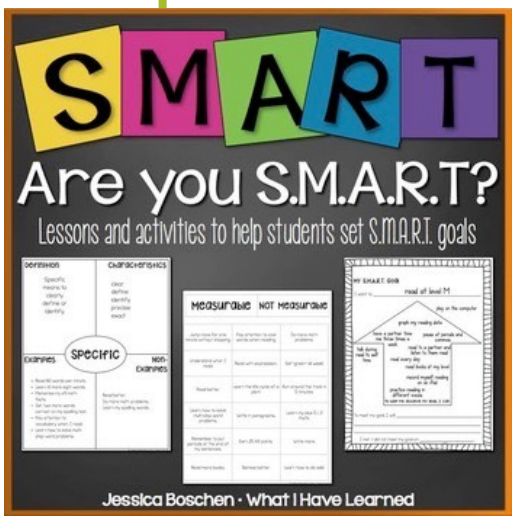
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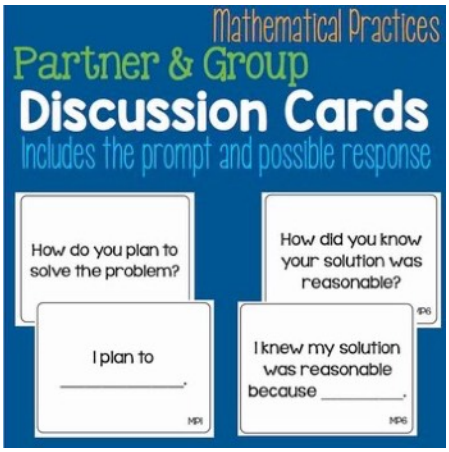
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Science Stations Overview

Watch a Video

At this station, students will watch a video relevant to the topic and answer questions. You have the option of the included worksheet with the questions or use task cards and have students respond in their science journals.

Read a Passage

Students read a short passage about the topic and answer questions about the information in the passage. You have the option of the included worksheet with the questions or use task cards and have students respond in their science journals.

Play a Video Game

Students play an online video game and answer questions about the experience. You have the option of the included worksheet with the questions or use task cards and have students respond in their science journals.

Create a Model

Students use materials to illustrate the science concept and answer questions. You have the option of the included worksheet with the questions or use task cards and have students respond in their science journals.

Investigate

Students use materials to investigate the science topic by following directions and recording results. Students answer questions about the investigation.

Explore

Students create a sample and manipulate it using the new science concepts they have learned. Students answer question based on the effects.

Draw a Diagram

Students draw and label a diagram specific to certain requirements. Students then explain how their diagram meets the requirements.

Sort

Students sort cards into groups or put them in a specific order. Students record the sort and then describe their reasoning.

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Energy, Energy, Everywhere

Science Stations

In Fourth Grade, the Engineering Standards are incorporated within the Disciplinary Core Ideas (DCI) of these science standards. For this reason, we incorporated the engineering standards within the science stations for the Physical, Life, and Earth Science standards. For example, In 4-PS3, 4-ETSI.A is listed as one of the DCIs. We created the 4-PS3 station set to include, not only the physical science concept of "energy," but also the engineering practice of "defining engineering problems." We will always use the "Investigate" science station in the science station set to meet this engineering DCI, and may use I or more other station as well.

In 4-PS3, energy, energy transfer, and conservation of energy are closely related topics that are build upon and intertwine with each other. For this reason, we chose to combine the four physical science Disciplinary Core Idea (DCI) standards into one mega-station station set. There would have been much overlap between station sets had we created four separate sets of stations. Here is how the DCIs are intertwined:

- The DCI 4-PS3.A defines energy, relates energy and speed, and discusses how energy is moved through light, sound, and electricity. This DCI integrates all three main topics of 4-PS3.
- The DCI 4-PS3.B discusses energy transfer and conservation in moving and/or colliding objects, light energy, and the transfer of energy from electrical to other types of energy. This DCI integrates all three main topics of 4-PS3, as well as incorporating all the information in 4-PS3.A.
- The DCI 4-PS3.C discusses energy transfers in collisions, which is also part of 4-PS3.B. This DCI also integrates the energy and energy transfer topics of 4-PS3, and it is not unreasonable to also introduce and discuss how energy is conserved in collisions.
- The DCI 4-PS3.D discusses conservation of energy as energy is transferred from one form to another. This DCI integrates all three topics of 4-PS3, and is a topic that is covered in great detail in 4-PS3.A and B.

By working through this mega-set of stations, students will gain a robust understanding of energy, energy transfer, and conservation of energy.

These Science Stations have several different ways students can display their understanding. Most of the variations are similar to each other, but differentiated for various classrooms and learning styles. Included are worksheets for both short-answer and fill-in-the-blank and task cards for both short-answer and multiple choice responses. To provide even more support, give students a word list for the fill-in-the-blank options. Also included are vocabulary cards in two formats which could become a ninth station if needed.

Students are encouraged to use their Science Journals with the task cards, but worksheets are provided as well. Use the checklist to monitor student progress through the stations. The Science Stations are designed to last about 20 minutes each. Students may do one a day for 8 days or 2 a day for four days. The following checklists will help you organize the stations.

<u>Watch a Video</u>

Students watch a video about energy or a video to learn about kinetic and potential energy. They answer questions to review what they learned.

<u>Play a Video Game</u>

Students play a game to learn about different forms of energy or light energy. They answer questions to reinforce what they have learned.

<u>Investigate</u>

Students build a roller coaster to investigate kinetic and potential energy. They will discuss design challenges, constraints, and criteria in this engineering investigation. They answer questions to reinforce what they have learned.

<u>Draw a Diagram</u>

Students read about thermal energy and complete a diagram showing the different ways heat is transferred. Students answer review questions to reinforce what they learn.

<u>Read a Passage</u>

Students read an article about sound energy. They will answer a question in order to reinforce what they have learned.

<u>Create a Model</u>

Model #1: Students read about and create a model of the Law of Conservation of Energy. They answer questions to reinforce what they have learned.

Model #2 Students read about electrical energy in batteries. They make their own battery and answer questions in order to reinforce what they have learned.

<u>Explore</u>

Explore #1: Students read about and explore electrical energy. They answer questions in order to reinforce what they have learned.

Explore #2: Students read about different light energy. They explore a laser light and answer questions in order to reinforce what they have learned.

<u>Sort</u>

Students read about different types of energy. They then sort pictures into categories matching the type of energy each picture uses.

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Materials Checklist
Energy, Energy, Everywhere

Use the following checklist to make sure you have all the materials for your stations.

Watch a Video
- ☐ Computer / Device
- ☐ Directions Card
- ☐ Worksheet
- ☐ Task Cards
- ☐ Science Journal

Play a Video Game
- ☐ Computer
- ☐ Directions Card
- ☐ Worksheet
- ☐ Task Cards
- ☐ Science Journal

Investigate
- ☐ Student Directions
- ☐ Student Worksheet
- ☐ Response Sheet
- ☐ Task Cards
- ☐ Science Journal
- ☐ Several tubes of 1-inch foam pipe insulation, cut in half down the length to make the track
- ☐ Heavy duty tape (duct tape, packing tape, masking tape)
- ☐ Marble
- ☐ Fabric of different textures
- ☐ Cotton batting or cotton balls
- ☐ Any other high-friction material that can be used to line the track.
- ☐ Scissors
- ☐ Boxes (or other materials to make hills) of varying heights

Draw a Diagram
- ☐ Student Instructions
- ☐ Response Sheet
- ☐ Task Cards
- ☐ Science Journal

Read a Passage
- ☐ Reading Passage
- ☐ Student Response Sheet
- ☐ Task Cards
- ☐ Science Journal

Sort
- ☐ Directions Card
- ☐ Sort Cards
- ☐ Scissors
- ☐ Glue
- ☐ Response Sheet
- ☐ Task Cards
- ☐ Science Journal

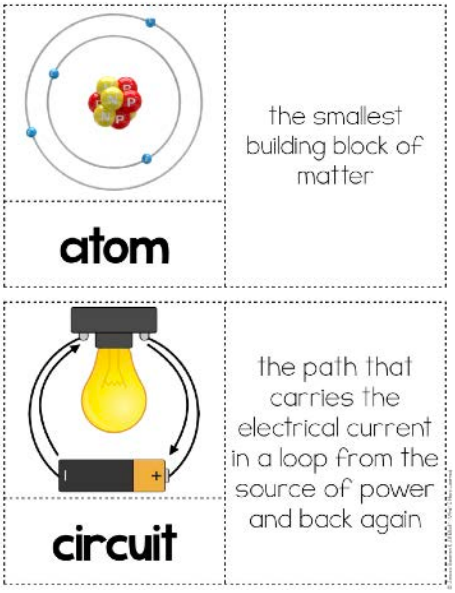
Create a Model #1
- ☐ Directions Cards
- ☐ Student Sheet
- ☐ Task Cards
- ☐ Science Journal
- ☐ Student Sheets
- ☐ 2 same-sized toy cars with no weights. Label these Car A and Car B.
- ☐ 2 same-sized toy cars with weights fastened (hot glued, taped, etc.) on them.
- ☐ Label these Car C and Car D.
- ☐ Weight suggestion: 2 stacks of 4 nickels hot-glued together, 2 20-gram weights
- ☐ Yard/meter stick
- ☐ Masking tape

Create a Model #2
- ☐ Directions Cards
- ☐ Student Chart
- ☐ Task Cards
- ☐ Science Journal
- ☐ Electrolyte solution: ¼ cup vinegar + 1 Tbs salt
- ☐ 5 pieces of thick paper towel, mat board, or other absorbent material (see Teacher Instructions)
- ☐ 5 pennies (washed with dish soap and dried)
- ☐ 5 nickels (washed with dish soap and dried)
- ☐ Aluminum foil, approximately 1 inch by 4 inches
- ☐ Tweezers
- ☐ Light and wires (see Teacher Instructions)

Explore #1
- ☐ Directions Card
- ☐ Worksheet
- ☐ Response Sheet
- ☐ Task Cards
- ☐ Science Journal
- ☐ 3-4 lights
- ☐ 3-4 wires
- ☐ Various metal objects (Paper clip, pipe cleaner, penny, washer, nail, etc.)
- ☐ Various wooden objects (Toothpick, wooden skewer)
- ☐ Various plastic objects (Plastic stirrer or other straight plastic stick)
- ☐ Object with both conducting and insulating materials (Tack with plastic head, etc.)
- ☐ 2 AA batteries
- ☐ Scotch tape

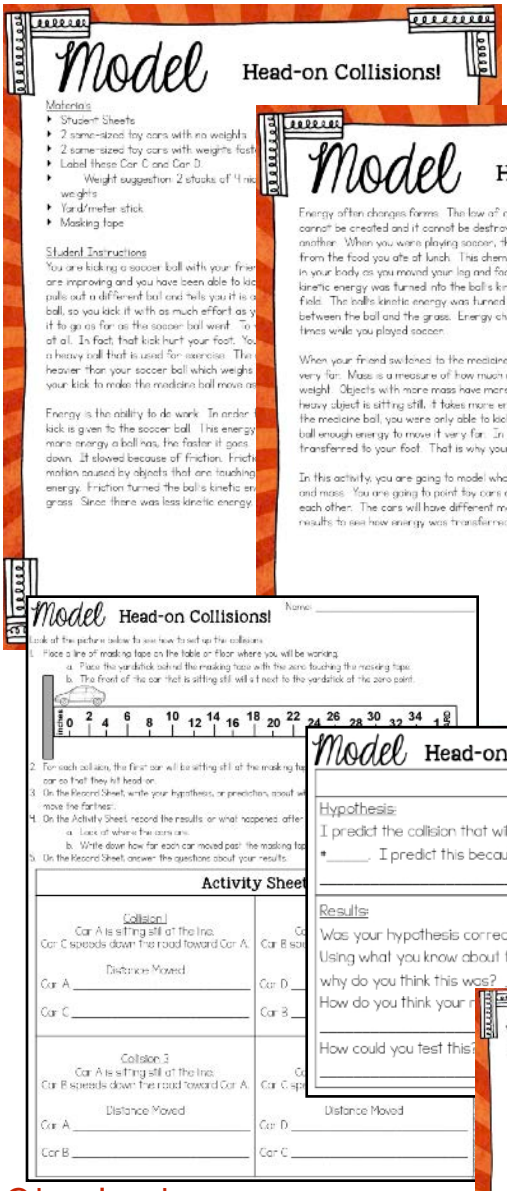
Explore #2
- ☐ Directions Card
- ☐ Worksheet
- ☐ Response Sheet
- ☐ Task Cards
- ☐ Science Journal
- ☐ 5 or more mirrors, at least 2 inches in diameter (see Teacher Notes)
- ☐ Laser pointer (see Teacher Notes)

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Vocabulary Cards in Two Formats

All activities have the same basic components: Student Directions, Short Answer Worksheet, Fill-in-the-Blank Worksheet, Short Answer Task Cards, Multiple Choice Task Cards. Some activities have more reading to build background knowledge and an additional worksheet to help organize the new information.

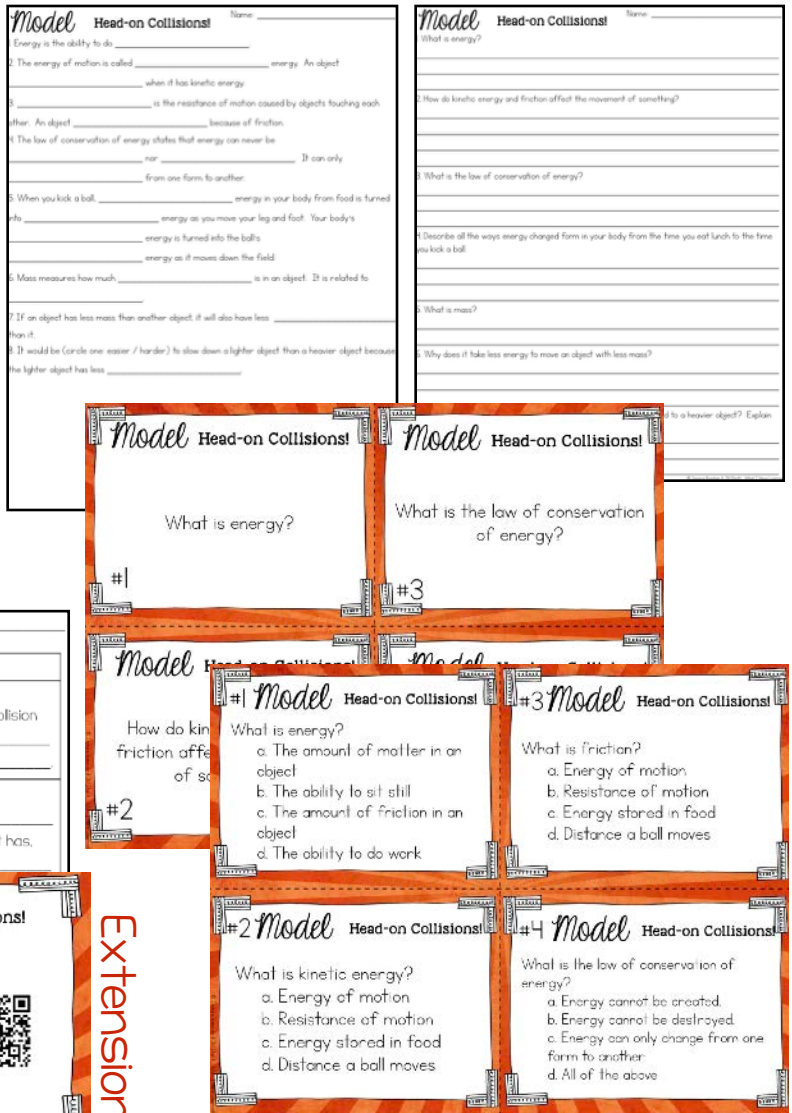


Direction Cards

Short Answer & Fill-in-the-Blank Worksheets

Extension

Student Worksheet



Task Cards in Two Formats

Watch a Video

Use your computer or device and watch Energy

http://bit.ly/EnergySS

Play a Video Game
Different Types of Energy

Use your computer to play the video game at the following web address:
http://bit.ly/Differenttypesofenergy

Be sure to read the instructions and screens along the way.

Watch a Video — What is energy?

Watch a Video — What is kinetic energy?

Watch a Video — What is energy?
a. Movement in an object
b. The ability to do work
c. The ability to sit still
d. When an object stops moving

Watch a Video — What is kinetic energy?
a. Energy that is in motion
b. Total energy that is in an object
c. Energy that is stored in an object
d. All of the above

Watch a Video — What are forms in which energy can be found?
a. Food
b. Sunlight
c. Lamps
d. All of the above

Watch a Video — What is potential energy?
a. Energy that is in motion
b. Total energy that is in an object
c. Energy that is stored in an object
d. Energy released when food is broken down

Watch a Video — Name: ____ Energy
Watch the video Energy and answer the following questions.
1. What is energy?
2. What are three forms in which energy can be found?

Watch a Video — Name: ____ Energy
1. Energy is the ability to do ____
2. Energy can be found in ____, ____, and ____
3. Kinetic energy is energy that is ____
4. Potential energy is energy that is ____
5. An example of potential energy is a ball ____
6. Energy can neither be ____ nor ____. It can ____ from one form of energy to ____
7. Mechanical energy is the total ____ energy and ____ energy in an object
8. Chemical energy is released when ____ is broken down.

Play Video Game — What sorts of things do we need energy for?

Play Video Game — What types of things have chemical energy?

Play a Video Game — What sorts of things do we need energy for?
a. Playing
b. Running a computer
c. Cooking our food
d. All of the above

Play a Video Game — What types of things have chemical energy?
a. Food
b. Bells
c. Solar Cells
d. Bikes

Play a Video Game — What is light energy used for?
a. Solar cells turn electrical energy into light energy.
b. Solar cells turn light energy into food.
c. Plants use light energy to grow.
d. Plants use solar cells to make light energy.

Play a Video Game — How does a light bulb use energy?
a. It turns light energy into electrical energy.
b. It turns electrical energy into light and heat energy.
c. It turns chemical energy into light energy.
d. It turns kinetic energy into light energy.

Play a Video Game — Name: ____ Different Types of Energy
1. What sorts of things do we need energy for?
2. What is light energy used for?
3. What types of things have chemical energy?
4. How do light bulbs use energy?
5. What kind of energy does a battery have?
6. How does chemical energy help you?
7. Click on the up arrow. What happens to the energy in the bike?
8. Click on the down arrow. What happens to the energy in the bike?
9. Click on the arrow at the brakes. What happens to the energy in the bike?

Play a Video Game — Different Types of Energy
1. We need energy to ____, run a computer, and cook our ____
2. Solar cells turn ____ energy into ____ use light energy to grow.
3. Chemical energy is found in ____ and ____.
4. A light bulb turns ____ energy into ____ energy and ____ energy.
5. When you eat breakfast you put ____ energy into your body.
6. ____ energy is turned into ____ energy as you m
7. Click on the up arrow. You have to pedal very hard as you give your bike ____ energy.
8. Click on the down arrow. You do not need to pedal as you go down the hill because the ____ energy is being turned into ____
9. Click on the arrow at the brakes. When you press the brakes, ____ turned into ____ energy.

Investigate Marble Engineering Challenge — What is energy?

Investigate Marble Engineering Challenge — As a roller coaster car is moving down a hill, what is happening to the potential energy and kinetic energy?

Investigate Marble Engineering Challenge — What is the Law of Conservation of Energy?

Investigate Marble Engineering Challenge — Does all the energy in a roller coaster stay as potential energy and kinetic energy? Explain your answer.

Investigate Marble Engineering Challenge — How does the Law of Conservation of Energy explain how roller coasters

Investigate Marble Engineering Challenge — Draw a roller coaster like this. Write PE on this roller coaster where there is the most potential energy. Write KE where there is the most kinetic energy.

Investigate Marble Engineering Challenge — What is energy?
a. Energy stored in an object
b. The amount of energy in food
c. Energy in an object in motion
d. The ability to do

Investigate Marble Engineering Challenge — What is potential energy?
a. Energy stored in an object
b. The amount of energy in food

Investigate Marble Engineering Challenge — On the diagram, which point has the most potential energy?
a. Point A
b. Point B
c. Point C
d. Point D

Investigate Marble Engineering Challenge — On the diagram, which point has the most kinetic energy?
a. Point A
b. Point B
c. Point C
d. Point D

Investigate Marble Engineering Challenge — Name: ____
Draw your roller coaster here:
Describe how you stopped your marble:
When you first made your roller coaster, what did not work well?
How did you change things to make it work better?
If you could use anything to make a roller coaster, what would you
The marble had the greatest amount of potential energy when it ____ I knew this because ____
The marble had the least amount of potential energy when it was ____ I knew this because ____
The marble had the greatest amount of kinetic energy when it was ____ I knew this because ____
The marble had the least amount of kinetic energy when it was ____ I knew this because ____

Investigate Marble Engineering Challenge — Student Notes
Roller coasters are exciting rides. They are thrilling because they seem dangerous. Yet children ride roller coasters every day without getting hurt. How is this possible? It all comes down to
A roller coaster
potential energy
higher a roller co
the top of the hill
the energy that
potential energy
As the car moves
energy is the ene
more kinetic ener
because of gravit
time it loses pote
into kinetic energ
motor. There is
now being change
During the ride,
kinetic energy. T
conservation of
be created nor d

Investigate Marble Engineering Challenge — Student Notes
While most of the kinetic energy is changed into potential energy, some is changed into heat energy. This happens because of friction between the wheels and the tracks. Friction is the resistance of motion caused by objects touching each other. Friction turns kinetic energy into heat energy, taking away some of the energy for motion. This causes the tracks to heat up and the car to slow down. With enough friction, the roller coaster car will come to a complete stop and the ride will be over.

In this investigation, you will design and build a roller coaster. Your roller coaster needs to safely bring the marble to a full stop at the end. You may use any of the materials offered to you by your teacher. You may not use other materials that are not offered.

Your roller coaster can be any design, as long as it has the following:
1. The beginning of your track should be high. You will place your marble from this starting place, and it needs to be at the top of a hill.
2. You may tape together as many track pieces as you need.
t counting the starting hill).
end of the track.
t at the end of the track. The end of
h surface) to make this happen. You
marble. You may not build a wall, net,
t stop the marble.
e some changes and try it again. Keep
stop at the end of the track.

Investigate Marble Engineering Challenge — Extension
Materials:
- Computer

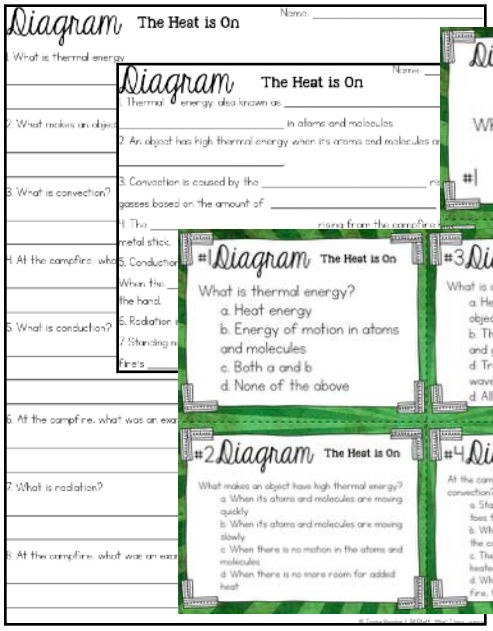
Watch this fast-paced video on energy:
http://bit.ly/EnergyFastPaced

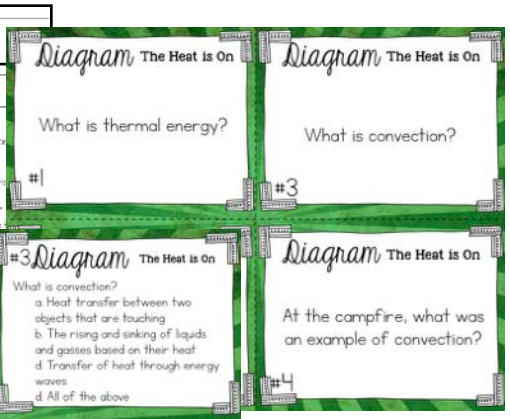
Investigate Marble Engineering Challenge — Teacher Notes
Materials
- Student Sheets
- Several tubes of thick foam pipe insulation, cut in half down the length to make the track
- Heavy duty tape (duct tape, packing tape, masking tape)
- Marble
- Fabric of different textures
- Cotton batting or cotton balls
- Any other high-friction material that can be used to line the track.
- Scissors
- Boxes (or other materials to make hills) of varying heights

This investigation meets engineering standards for fourth grade. Students are offered general instructions
are (1) the marble
does, (2) no materi
roller coaster, and

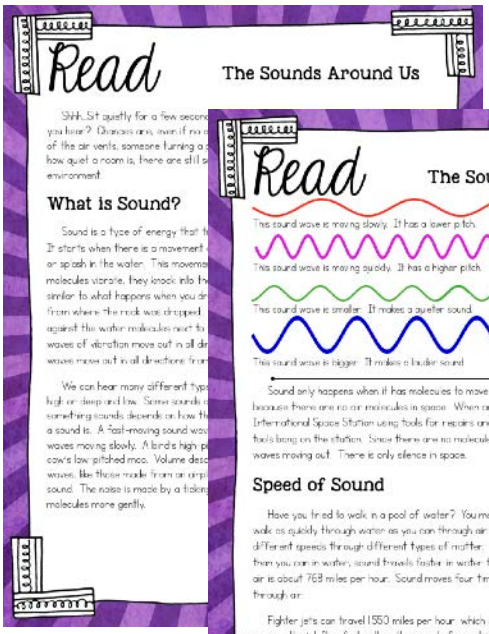
A sample of some of the pages in each section.

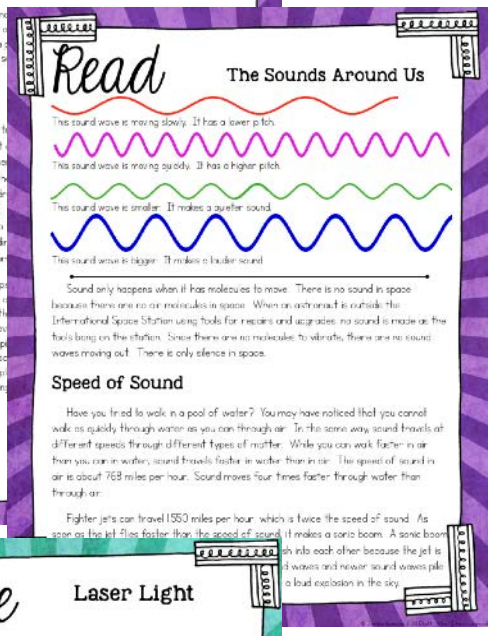




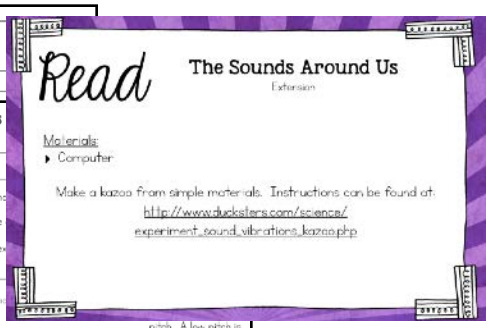


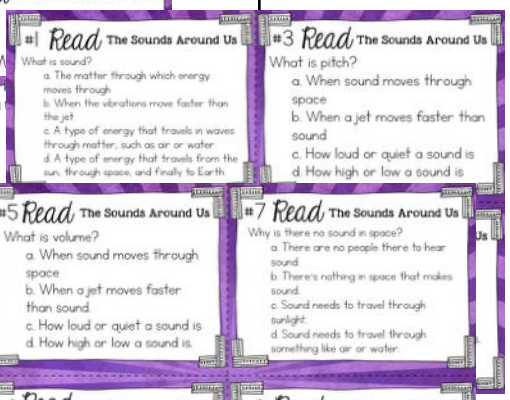




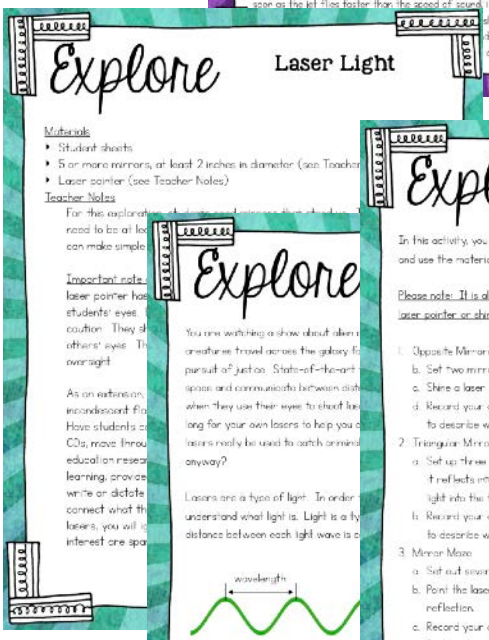


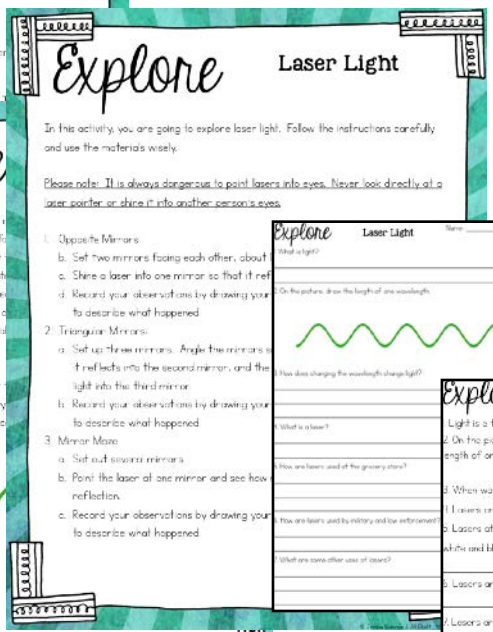


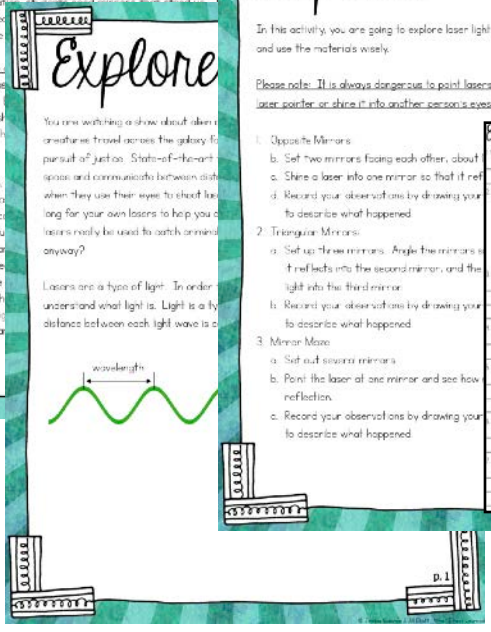


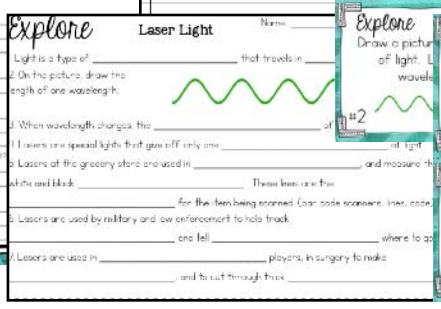


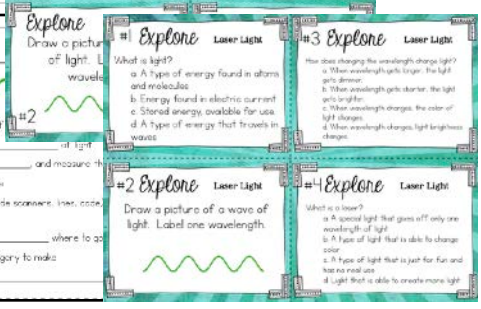




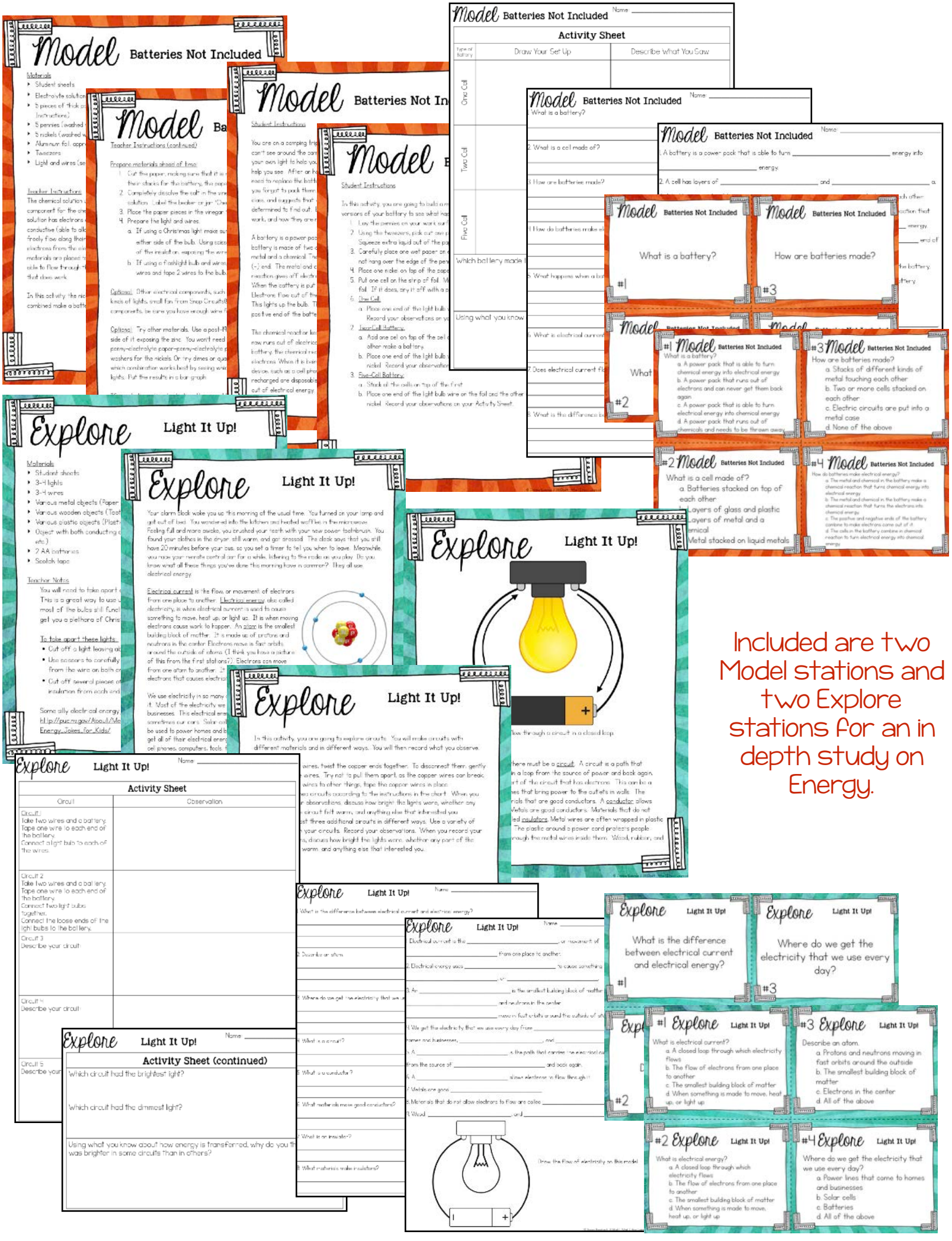


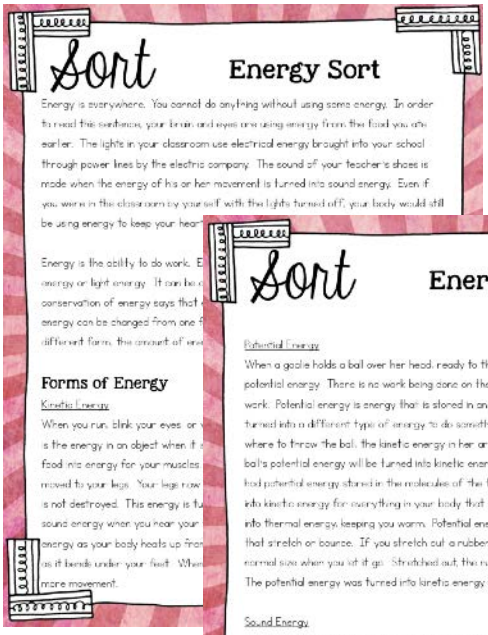


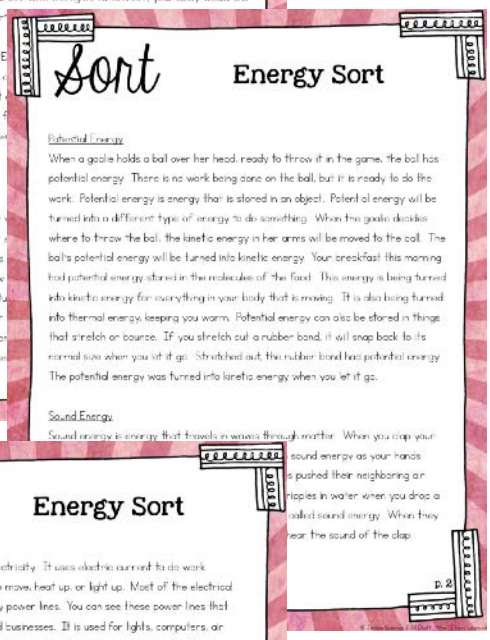


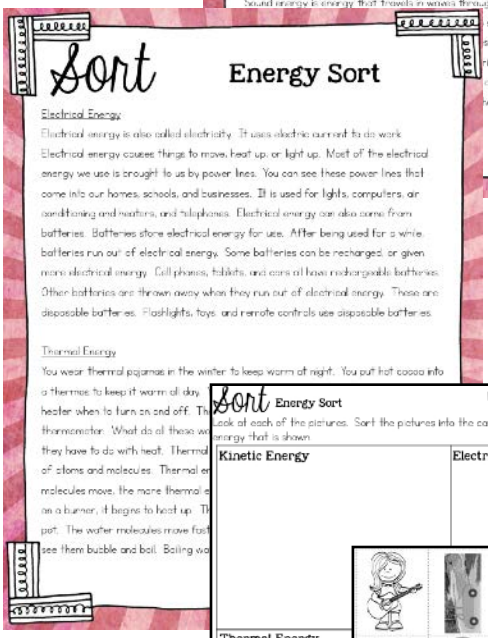


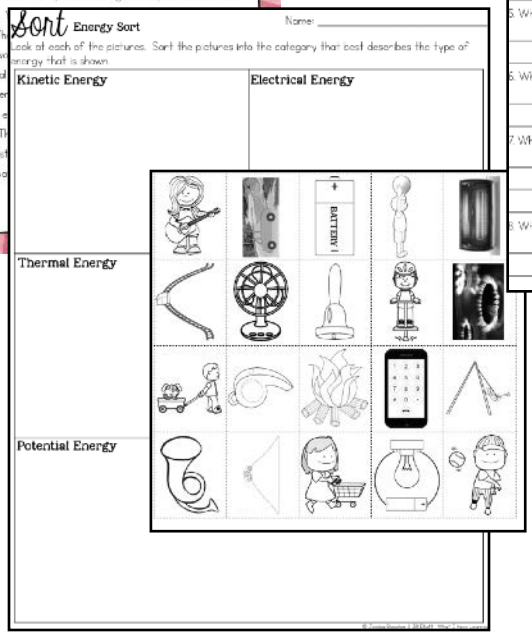
A sample of some of the pages in each section.


Model
Batteries Not Included
Activity Sheet
Explore
Light It Up!
Activity Sheet
Activity Sheet (continued)
Included are two Model stations and two Explore stations for an in depth study on Energy.



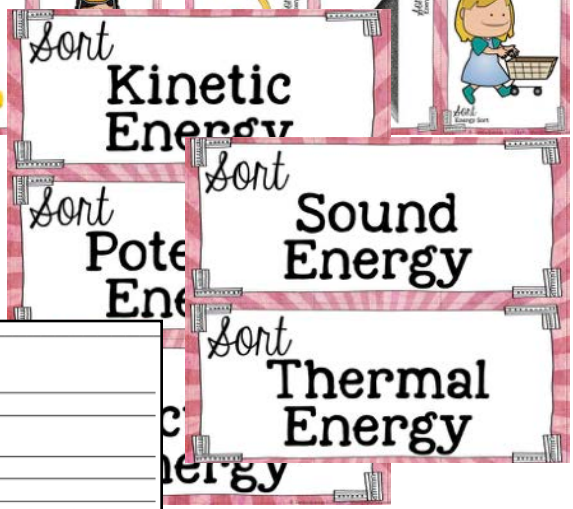


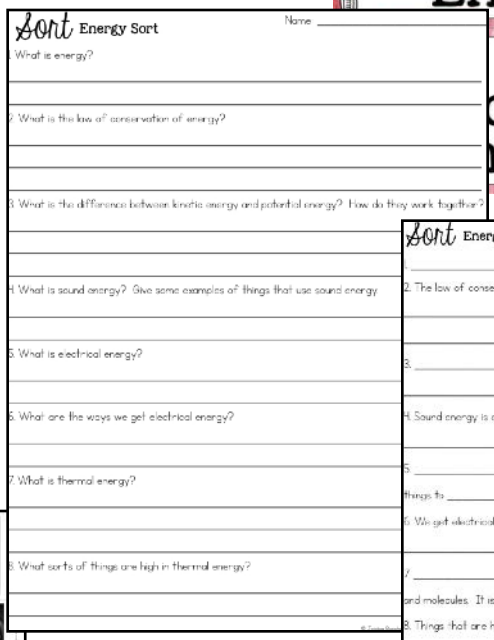


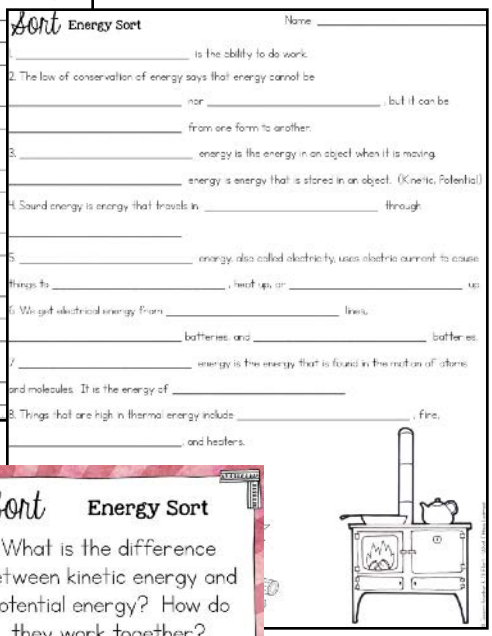


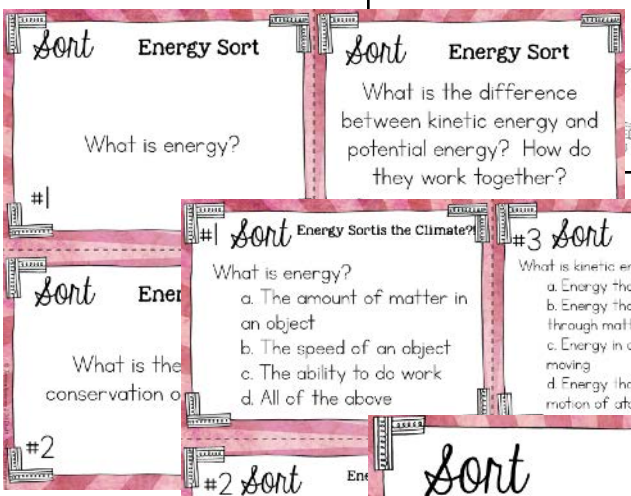


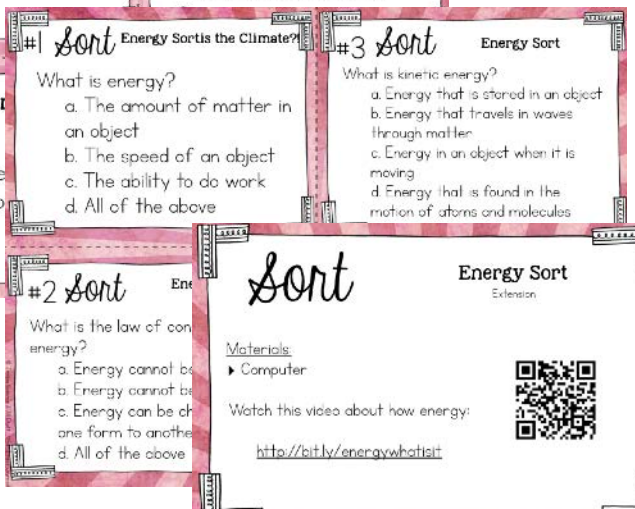












The sort comes in both a color format for small group and a black and white copy for individual sorting. Also included in an extension video about energy.