Heat, Light and Sound

Submitted by:
Regina Kimbrel
Central Elementary School
Francis Howell School District
(636) 441-5210

Subject Area: Science

Grade Level: Lower Elementary (grade 2)

Show Me Standard: SC 1
GOAL 1.2, GOAL 1.6

Time Allowance: This unit is divided into 30-40 minute lessons

Description:
This unit is designed to encourage students to investigate the properties of energy: heat, light, and sound. Through fun activities, class discussions, and demonstrations the students will understand and explain the importance of energy.

Objectives:

- The student will discover ways energy changes from one form to another.
- The student will create sound from vibrations in matter and examine ways to change loudness and pitch and how sound travels at different rates through materials.

Day One: Energy

Materials Needed:

- paper or notebook (begin student journals)
- writing utensil
- books and/or video from accompanying list

Activities:

1. Begin with a class discussion of the following:
    a. heat, light, and sound are forms of energy
    b. the main source of energy is the sun (human, plant, and animal life depend on the sun's energy for life)
    c. we can see light, feel heat, and hear sound
    d. forms of energy can change into one another (ex: fire = see light, feel heat, hear crackling sound)
2. Using the chalkboard, chart paper and/or student journals record some of the information discussed.
3. Discuss ways you use heat, light, and sound in everyday life.
4. Watch video "What Energy Means"

Evaluation:

The student will be able to list at least two ways energy from heat, light and sound is useful in everyday life.

Evaluation form:

List two ways energy from heat, light, and sound is useful. Draw a picture for each example.

1.

_____

_____

_____

2.

_____
_____
_____

Scoring:

- student listed two examples and drew pictures = S+
- student listed two examples = S
- student began assignment but was unable to complete = S-
- student made no attempt = N

Resources:
Videos:

- What Energy Means
- The Magic School Bus getting energized using new energy sources
- The Power Puzzle
- Science sound and energy
- the Magic School Bus inside the haunted house

Literature:

1. Light
    - All About Light, by Melvin Berger
    - Discover Light and Sound, by Francis Reddy
    - Energy and Light, by Peter Lafferty
    - Fun with Light, by Maria Gordon
    - Light, David Burnie
    - Light, by Angela Webb
    - Light, by Joy Richardson
    - Light Action!, by Vicki Cobb
    - Light and Sound, by Peter Lafferty
    - Light Science Tricks with Professor Solomon Snickerdoodle, by Peter Murray
    - Science Magic with Light, by Chris Oxlade
    - The Super Science Book of Light, by Graham Peacock

- What Do You See & How Do You See It? Exploring light, color and vision, by Patricia Lauber
- Wonders of Heat and Light

2. Heat
    - Heat, by Irving Adler
    - Heat, by Peter Lafferty
    - Heat, by Vicki Cobb
    - Heat and Cold, by Peter Lafferty
    - Heat and Energy, by Kathryn Whyman
    - Hot or Cold?, by Nicola Baxter
    - The Magic School Bus in the Arctic: a book about heat, by Anne Schreiber
    - Wonders of Heat and Light, by Owen Stanley Lieberg
3. Sound
    - All About Sound, by David C. Knight
    - Crash! Bang! Boom! A Book of Sounds, by Peter Spier
    - Discover Light and Sound, by Francis Reddy
    - Do You Hear What I Hear?, by Helen Borten
    - Let's Find Out About Sound, by David Carpenter Knight
    - Light and Sound, by Peter Lafferty
    - The Magic of Sound, by Larry Kettelkamp
    - Science Magic with Sound, by Chris Oxlade
    - Sound, by Terry Cash
    - Sound, by Barbara Taylor
    - Sound: an experiment book, by Marian E. Baer
    - The Super Science Book of Sound, by David Glover
    - Understanding Sound, by Beulah Tannenbaum

Day Two: Heat - The Movement of Heat

Materials Needed:

- vocabulary terms
    a. temperature - how hot or cold something is
    b. degree - the unit of measurement for temperature
    c. heat - a form of energy that makes things warmer
    d. insulator - a material that heat doesn't travel through easily
    e. conductor - a material that allows heat to travel easily
- paper or notebook
- hot water
- large bowl
- three spoons - metal, plastic, and wooden

Activities:

1. Have a class discussion about what is hot and what is cold.
   Use the chalkboard, chart paper, or student journals to list items.
   Introduce vocabulary: temperature, degree, and heat.
   (Extension: In Math class use thermometers to teach Fahrenheit and Celsius degrees.)
2. Student Investigation: The Movement of Heat
    a. Show the students the three types of spoons and have them feel each one. The students should determine that they are the same temperature.
    b. Tell the students that you will place the spoons into hot water and have them predict which spoon will warm up the fastest. Have the students record their predictions in their journals.
    c. Put the three spoons into the bowl with the hot water. Be sure to leave the handles hanging outside the water.
    d. After a few minutes have the students feel the spoons testing their predictions. Have the students record the following information in their journals: Which spoon handle warmed up the fastest? Why do you think this happens?
    e. Introduce the vocabulary: insulator and conductor
    Have the students brainstorm examples and generate a list on the board.

Evaluation:

The student will accurately sort pictures according to whether they are conductors or insulators.

Evaluation form:

Cut out the pictures below and glue them under the correct heading.

- conductor - a material that allows heat to travel easily
- insulator - a material that heat does not travel through easily


frying pan


pot holder


oven mitt


cattle branding iron


hat and coat


cookie sheet


thermos


wood stove

Conductor		Insulator	

Day Three: Heat Melts Ice and Ways to Prevent It

Materials Needed:

- paper or notebook (student journals)
- For each group of students:
  - two ice cubes
  - Styrofoam cup
  - paper
  - cloth
  - paper towels
  - plastic wrap
  - aluminum foil
  - paper plates

Activities:

1. Review from the previous lesson the vocabulary terms conductor and insulator. Discuss the evaluation worksheet from the previous lesson stating the correct answers and why the pictures were grouped as such.
2. Student Investigation: How to melt ice and how to prevent ice from melting. Divide the students into groups.

   Part One:
   a. Tell the students the object of the lesson if to see how fast each team will melt its ice cube. (The ice cube may not be broken up)
   b. Give each group one ice cube and a plastic bag.
   c. Have them record the following information in their student journals as they are working:
      - prediction: the ice cube will melt in _____ minutes
      - the ice cube melted in _____ minutes
      - what the group did to melt the ice cube

Evaluation: Group Presentations

After every group's ice cube has melted; have the groups present to the class their results from the experiment. Discuss which groups ice melted the fastest and the reasons for it.

Part Two:

d. Tell the students the object of the lesson is to see which group can keep their ice cube the longest.
e. Display the different insulating materials (such as: paper, cloth, foil, plastic wrap, etc.) on a table. Give each group an ice cube and tell them to choose items from the table to help them insulate their ice cube to prevent it from melting.
f. Have the students record the following information in their journals while they are working:
    - prediction - the ice cube will last for _____ minutes
    - the ice cube lasted for _____ minutes
    - what the group did to keep the ice cube from melting

Evaluation: Group Presentations

After every group's ice cube has melted, have the groups present to the class the results of their experiment. Discuss which group's ice lasted the longest and the reasons for it.

Group Evaluation for Ice Cube Experiments:

Assign points (5 being the highest and 1 the lowest) for the following categories:

_____* Everyone in the group participated

_____* The individuals in the group worked together well

_____* The group followed directions for the experiments

_____* Each person in the group completed the journal assignments

_____* The group presented their results for each experiment

_____* The group was able to state reasons for the success of their experiment

_____* The group gave suggestions to improve their results

30-35 points = S+
20-30 points = S
10-20 points = S-
below 10 points = N

Day Four: Gases expand and contract

Materials Needed:

- paper or notebook (student journals)
- balloon
- two liter plastic bottle
- bucket of hot water
- bucket of cold water

Activities:

1. Teacher Demonstration
   Concept: Expand and Contract - what happens to gases when heated and cooled
   a. Stretch the opening of the balloon over the opening of the bottle
   b. Ash the students to record the following predictions in their journals:
      - what will happen to the balloon when the bottle is placed in the hot water?
      - what will happen to the balloon when the bottle is placed in the cold water?
   c. Test the predictions:
      - place the bottle in the hot water and record the results
      - place the bottle in the cold water and record the results
   d. Draw conclusions:
      - what happened to the air particles in the balloon when the bottle was in warm water? in cool water?

Evaluation:

The students will accurately complete the journal assignment.

Air Particles Expand and Contract

Draw a picture for each experiment and answer the question.

1. The bottle is placed in the hot water:

   What happened to the air particles in the balloon?

   _____

   _____

   _____

2. The bottle is placed in cold water:

   What happened to the air particles in the balloon?

   _____

   _____

   _____

Day Five: Light and Objects that are Opaque, Translucent, and Transparent

Materials Needed:

- vocabulary terms:
  - opaque - does not allow light to pass through
  - transparent - allows light to pass through easily
  - translucent - allows some light to pass through and scatters the rest
- paper or notebook (student journals)
- chalkboard
- items needed to each group of students:
  - flashlight
  - glass
  - paper
  - construction paper
  - aluminum foil
  - tissue paper
  - waxed paper
  - plastic wrap
  - cardboard

Activities:

1. Begin with a class discussion of light:
   - what they know about the uses of light
   - how they depend on light

   Read a story from the list of resources attached to lesson one.

2. Introduce the vocabulary: opaque, transparent, and translucent.
   During the lesson the students will need to know:
   - opaque = blocks all light, the students will see a dark shadow
   - transparent = lets light through, the students will not see a shadow
   - translucent = blocks some light, the students will see a faint shadow
3. Student Investigation
   a. Divide the students into groups
   b. Distribute the supplies to each group
   c. Explain to the students that they will be using the flashlight to investigate these items; write names of these on the board. They will need to determine: what happens when light hits these objects and if it will make a shadow? They will need to record the items under the proper headings (opaque, transparent, and translucent) in their journals.

d. After completing the journal assignment, have the students share their results.

Evaluation:
The students will give examples of objects that are opaque, translucent, and transparent.

Dear Parents,

During the last few days, the students have been studying about energy. Today we covered the concept of light. Using flashlights, we investigated objects and determined if they were:

opaque = object blocks all light, you will see a dark shadow
translucent = object lets light through, you will not see a shadow
transparent = object blocks some light, you will see a faint shadow

Homework Activity

Find an example of something in your home for each of the categories. List, draw, or paste a picture in the space provided.

1. Opaque = does not allow light to pass through

2. Transparent = allows light to pass through easily

3. Translucent = allows some light to pass through and scatters the rest

Day Six: Light and Reflections

Materials Needed:

- vocabulary terms:
  - reflection - when rays of light hit a surface or an object they bounce back off
- paper or notebook (student journals)
- two mirrors
- flashlight
- piece of tag board
- scissors
- comb
- aluminum foil
- metal spoon

Activities:

1. Look for reflections in foil, cans, bottles, and spoons. The students should determine that flat, shiny surfaces produce the best reflections. The students should record their findings in their journal.
2. Have the students wave at themselves in a mirror with their left hand. Ask the students" Which hand is the reflection using? Why? The students should record in their journal the results; determining that mirrors reverse images.
3. Teacher Demonstrations: Investigate Reflections
   a. Cut a hole in the piece of tag board about one inch in diameter and tape the comb across the hole.
   b. In a darkened room, place the card in front of the flashlight so that narrow beams of light come through the teeth of the comb. (Note: You will see the beams more clearly on a dark surface.)
   c. Hold the mirror in the beams of light so that it reflects the light. What do you see?
   d. Move the mirror to a different angle. What happens to the beams of light? (The angle of the reflected light rays changes as well.)
   e. Have the students draw a picture and write a sentence in their journals to explain the findings of the activity.
4. More things to try:
   a. Stand two mirrors side by side and put a small object between them. How many reflections can you see?
   b. Move the mirrors closer together and then further apart. What happens to the number of reflections?

    c. Place two mirrors facing each other with an object between them. Now what do you see?
5. Extension activities:
    - make a Kaleidoscope
    - make a Periscope

Evaluation:

The students will independently complete an activity demonstrating and understanding the principle of reflection.

1. Write messages using mirror code. Place a piece of paper in front of a mirror. Look in the mirror and carefully write your message on the paper. When you look at the paper, you will see the message back to front in mirror code. Have a friend use a mirror to decode the message.

Day Seven: Sound - Pitch

Materials Needed:

- paper or notebook (student journals)
- five glass bottles
- water
- red, blue and yellow food coloring
- metal spoon
- wooden spoon

Activities:

1. Student Investigation: Listening to Sounds
    a. Tell the students that they are going to be listening for sounds that they hear inside. Have the students close their eyes and be very quiet. After one minute, have the students open their eyes and take turns sharing the sounds that they heard. Make a list of these indoor sounds on the board while the students record them in their journals.
    b. Tell the students that they will now go outside and listen for sounds that they hear outside. Take the students outside with their journals. Have them sit quietly, shut their eyes, and listen for one minute. After one minute, have the students record as many sounds as they can remember. Then take the students back inside to share sounds heard and to generate lists both on the board and in the journals.
    c. Have a class discussion:
        - How were the sounds alike?
        - How were the sounds different?
2. Class discussion: What is sound?
    - Sound is a kind of energy created by objects that vibrate.
    - Read a book or watch a video from the list of resources attached to lesson one.
3. Teacher Demonstration:
   Pitch - the highness and lowness of sound
    . Fill the five glass bottles with different levels of water.
    a. Color each bottle a different color with the food coloring.
    Lesson extension: Art - the colors red, blue, and yellow are the Primary Colors. These colors are mixed to create other colors. Mix the colors to create orange and green.
    b. Ask the students to predict:
    What will happen when each bottle is tapped with the metal spoon? Which bottle will have the highest pitch? Which bottle will have the lowest pitch?
    c. Test the predictions and have the students record the results in their journals. Pitch changes according to the level of the water in the bottles.

d. Ask the student to predict:
   What will happen when each bottle is tapped with the wooden spoon?
   How is the pitch different?
e. Test the predictions and have the students record the results in their journals.

Evaluation:

The students will accurately complete the journal assignment: What is pitch? How can we change the pitch?

Day Eight: Sound - How Sound Travels

Materials Needed:

- paper or notebook (student journals)
- desks
- two Styrofoam cups per student
- six meters of string per student
- two paper clips per student

Activities:

1. Begin by reviewing the concepts taught in the last lesson. Have a class discussion about how sound travels. (Sound is a kind of energy created by objects that vibrate.)
2. Student Investigation:
    a. Assign the students a partner to work with for this lesson.
    b. Have the students sit at their desks - be sure that the desk tops are cleared. Have one student place their ear on the desk while the other student tape lightly on the desk. Then have the student sit up while their partner taps on the desk again.
    c. Have the partners switch positions and do the activity again.
    d. Ask the students to describe the loudness of the sound that they heard while sitting up compared to the loudness of the sound they heard when their ear was on the desk.
    e. Have the students write their findings in their journal.
    f. Ask students to also discuss the sounds they have heard when swimming under water.
3. Student Activity:
    a. Distribute the cups, paper clips, and string to the students.
    Lesson extension: Math - Have the students use a meter stick to measure their own six meters of string.
    b. Have the students make a small hole in the center of the bottom of each cup with a pencil.
    c. Have the students pull each end of the string through the holes in each cup and tie it to a small paper clip. Pull the string tight.
    d. Allow the students time to test their phones with their partners.
    e. Have a class discussion: How did your voice reach the other person's ear? (Through the vibrations of the string, when one person speaks into the cup the sound travels in waves along the string and makes the other cup vibrate.)

Evaluation:

The students will complete a journal assignment. Have the students write two sentences

and draw a picture about their phones and working with a partner. Have them answer the questions: Did they enjoy the activity? What did they learn about how sound travels? Did they learn anything about working with a partner?

Day Nine: Sound - Investigating Different Sounds

Materials Needed:

- plastic eggs
- various items to hide in the eggs such as: marshmallows, paper clips, cotton balls, buttons, dice, beans, macaroni, rice, toothpicks, an eraser, pennies and paper squares

Preparations:

1. Place one object inside each egg. Tape the ends closed to that they do not pop open during the activity. Write a number on the outside of each egg.

Activities:

1. Tell the students that they will be investigating different sounds.
2. List on the board in random order the objects inside the eggs. Explain that these objects are hidden inside the eggs and that they are to use their listening skills and the knowledge that they have about sounds to determine which object is in which egg.
3. Have the students write the numbers one through twelve in their journals. Allow them time to investigate the eggs and to record their answers in their journals.
4. After everyone has had a chance to finish the activity ask the students: What object do you think is in each egg? Why? What clues led you to your decision? Open each egg to see what is inside.

Evaluation:

The students will complete an individual evaluation.

Student Evaluation

Activity: Egg Search

How many objects were you able to identify correctly? _____
Look below to find your score:
12 = Super Detective Work - Awesome Results!
9-11 = Excellent Listening Skills - Way to Go!
6-8 = Very Good - You listened very carefully - Wonderful Work!
3-5 = Good Work - Remember to listen carefully and compare sounds to other sounds you know
1 or 2 = Needs to brush up on listening skills