



The HEAT is ON!!!

Grade Levels 3 - 6

Unit Overview

Materials

Lesson 1

Web access at multiple computers or a teacher access with classroom viewing capability
Pencil for each student
Sheet of drawing paper for each student
10 gloves or mittens
10 thermometers
10 empty plastic water or soda bottles – two for each group
10 balloons – two for each group
10 tubs (shoe box size) – two for each group
Hot and cold water
Index card for each student

Lesson 2

Tug of War rope
4 Word cards 9x 12 inches with the words solid, liquid, gas and friction written on them

Lesson 3

Web availability for every group of 5 students (or copies of the article for each group)
Poster – 1 for each group of 5 students
Markers – 1 pack for each group

Lesson 4

Thermometer for every group
Tub of ice water for every group
T-chart paper for each group
Graph paper for each group
Pencils
Clock and/or timer
Index card for each student

Lesson 5

2 thermometers for every group
2 pizza boxes for each group
Plastic wrap
Ruler
Black construction paper
Aluminum foil
Tape or glue

Lesson 6

Access to a teacher presentation station and the Web
Student computers. If there is not one for every student, try to have groups of no larger than 4 at the computers
Index card and pencil for each student

Lesson 7

Drawing paper

Writing/lined paper

Pencils

Crayons or colored pencils

Lesson 8

Teacher computer presentation capability

PowerPoints

Cards with vocabulary words on it

Lesson 9

Go Temps

Logger Lite software

Laptops that are in the STEM Lab

Styrofoam cup for every group

Metal cup for every group

Ice water

Copies of the packet for every group

Pencils

Index cards for every student

Lesson 10

12 x 18 inches drawing paper for each student

Magazines that can be cut up for pictures

Glue

Colored pencils

Crayons

Markers

List of vocabulary words and definitions posted where students can refer to them

Standards

Unit Content Standards	Unit Youth Development Standards
<ul style="list-style-type: none"> • SC.3.P.11.2: Investigate, observe, and explain that heat is produced when one object rubs against another such as rubbing one’s hands together. • SC.4.P.10.1: Observe and describe some basic forms of energy, including light, heat, sound, electrical, and the energy of motion. • SC.5.P.10.1: Investigate and describe some basic forms of energy including light, heat, sound, electrical, chemical, and mechanical. 	<ul style="list-style-type: none"> • 3 - Child receives support from adults other than her or his parent(s). • 5 - Relationships with teachers and peers provide a caring, encouraging environment. • 10 - Child feels safe at home, at school, and in his or her neighborhood. • 12 - School provides clear rules and consequences. • 18 - Child participates two or more times per week in co-curricular school activities or structured community programs for children. • 22 - Child is motivated and strives to do well in school. • 34 - Child knows and is comfortable with people of different racial, ethnic, and cultural backgrounds and with her or his own cultural identity. • 37 - Child feels like he or she has some influence over things that happen in his or her life. • 38 - Child likes and is proud to be the person that he or she is.

Extension Ideas

- Students can investigate solar energy and heat.
- Items can be cooked in the solar oven.
- Discovery Education has more pages on temperature to explore.

ELL Modifications

- Pre-Assessment – Use of non-linguistic representation to explain what the learner knows
- Lesson 1 – Use of video to show demonstration of heat
- Lesson 2 – Use of groups and word cards for activities
- Lesson 3 – Use of group support and graphic representation of material
- Lesson 4 – Making graphs—non-linguistic representation of the information
- Lesson 5 – Use of realia to help understand the concept
- Lesson 6 – Use of pictorial representation of the concepts on Discovery Education
- Lesson 7 – Individual drawing and group discussion before they write
- Lesson 8 – Working in groups to develop words
- Lesson 9 – Using technology to log and record data
- Lesson 10 – Personal expression through art

Pre/Post Assessment

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Lesson 1: What is Heat?

Essential Question:

What is heat?

Content Standards:

- SC.3.P.11.2: Investigate, observe, and explain that is heat is produced when one object rubs against another such as rubbing one’s hands together.
- SC.4.P.10.1: Observe and describe some basic forms of energy, including light, **heat**, sound, electrical, and the energy of motion.
- SC.5.P.10.1: Investigate and describe some basic forms of energy including light, **heat**, sound, electrical, chemical, and mechanical.

Youth Development Standards:

- 3 – Child receives support from adults other than her or his parent(s).
- 5 – Relationships with teachers and peers provide a caring, encouraging environment
- 12 – School provides clear rules and consequences.
- 22 – Child is motivated and strives to do well in school.
- 34 – Child knows and is comfortable with people of different racial, ethnic, and cultural backgrounds and with her or his own cultural identity.

Teacher Background Knowledge:

- The teacher will be using United Streaming. Information is included in the script.
- The video is named Heat, Temperature and Energy. On United Streaming (www.discoveryeducation.com), the video can be shown in segments. The students will be viewing the first five segments:
 1. Thinking About Energy and Temperature: an introduction
 2. Thermal Energy: All matter contains energy
 3. Heat: The flow of energy from one thing to another
 4. How Heat Affects Expansion and Contraction of Matter
 5. How Temperature and Heat are Different
(script for video is included)

The parts viewed are about a total of 10 minutes.

Vocabulary

- Celsius
- Energy
- Fahrenheit
- Heat
- Matter
- Molecule
- Temperature
- Thermal Energy
- Thermometer

Materials:

- Web access at multiple computers or a teacher access with classroom viewing capability, pencil for each student, sheet of drawing paper for each student, 10 gloves or mittens, 10 thermometers, 10 empty plastic water or soda bottles – two for each group, 10 balloons – two for each group, 10 tubs (shoe box size) – two for each group, hot and cold water, index card for each student

Procedure:

1. Begin with the Pre-Assessment. Give each student a sheet of drawing paper and pencil and ask them to draw or write a description of what heat is (about 10 minutes). Collect the papers when finished.
2. Explain to students that they are going to watch a video that helps explain what heat is. Begin showing the segments. At the end of each segment students can turn and talk to a shoulder partner about what they learned about heat.
3. After the video, students will complete two activities. Students need to be broken up into groups of four. The students will also need partners inside the groups of four.
4. For the first activity, the partners will work together. Each set of partners will need a glove and a thermometer. Have a student in each pair measure the inside temperature of the glove. Have the partner wear the glove for 10-15 minutes.
5. While students are wearing the gloves, they will conduct another activity. Stretch the opening of a balloon over each bottle. Fill one bucket with cold water and one bucket with hot water.
6. Caution: the water should not be hot enough to burn you. Have the students put one bottle in hot water and one bottle in cold water. Watch and compare what happens to the two bottles. (The bottle in the warm water should inflate slightly and the cold water will not inflate.)
7. Have the students swap the bottles in each tub. See what happens. (The inflated balloon should deflate and the deflated balloon should inflate.)
8. Use 5 minutes to discuss what the students saw happen.
9. Remove the glove. Have the first student measure the temperature of the glove again.

Discuss the results.

Formative Assessment:

- Have students write on the index card the answer to the following question:

What is heat?

Script for Video for United Steaming – Heat, Temperature, and Energy

Female Narrator:

When we think of heat, different images come to mind.

We may think of a fire blazing on a cold winter day, or the hot lava erupting from a volcano.

We might associate heat with temperature, like the temperature of the water from a faucet, or the number of degrees marked by the rising alcohol in a thermometer, and we might think of heat in terms of energy, such as energy from a hot burner that fries an egg, or the enormous energy of the sun, the ultimate source of almost all the energy on earth.

This program is about heat, temperature, and energy. It is about how these things are related...but also different.

Male Narrator:

All matter on earth contains energy. There is energy in the gases of the earth's atmosphere, and the water that forms in the oceans.

There is energy in the steel and concrete of a bridge, and even in grains of salt. All matter contains energy because of the way matter is put together.

Matter is made up of much smaller, invisible particles: atoms and molecules. The smallest particle of salt, for example, is a molecule consisting of a single sodium atom linked to a single chloride atom. This is why the chemical name for salt is sodium chloride.

In a grain of salt, these molecules are bunched tightly together and hold each other firmly in place, forming a regular pattern; but even in something solid like salt, the molecules are constant in motion, vibrating back and forth. This internal energy, or energy inside matter, is called thermal energy.

Female Narrator:

Even something as cold as ice has thermal energy. The water molecules that make up ice vibrate somewhat.

But the water molecules in a glass of warm water move around many times more rapidly and have much more thermal energy.

When you put ice into warm water, the water gives up some of thermal energy in the ice. The flow of thermal energy from one place to another is called heat. Heat always flows from something warmer to something colder. When heat is added to a substance, its molecules move faster. When heat is taken away, the molecules slow down.

Male Narrator:

Heat energy can be converted into other forms of energy, and other forms of energy can be converted into heat energy.

In a power plant, heat can turn water into steam that turns turbines. The mechanical energy of turbines, in turn, can be converted to heat, as when the coils on this electric burner get red hot.

Another illustration of how difficult forms of energy can be converted to heat energy is provided by this pad, which contains special heat-sensitive chemicals that change color.

When you put your hand on the pad, it leaves a slight impression caused by the heat in your skin.

If you then rub your hands together vigorously, this mechanical energy causes friction that excited the molecules in your skin, making your hands hotter, and if you place a hand on the pad again, it will leave a much brighter impression.

Female Narrator:

In addition to making their molecules get more excited, adding heat causes most substances to change in other ways.

A simple experiment shows how. This metal ball was designed so that it just fits through this ring.

But observe what happens when this student heats the ball. An experiment involving fire should be done under the supervision of a teacher or other adult.

After the ball is heated, it no longer fits because the excited molecules in the ball have moved farther apart, causing it to expand.

Now look at what happens when she puts the ball into some cold water to cool it off. When most substances lose heat, they contract because their molecules are less excited and move closer together.

Builders and engineers have to take into account that steel, concrete and other building materials expand when heated and contract when they lose heat. Bridges, for example, have expansion joints that give the steel and concrete sections room to expand in the hot summer months.

Water is an important exception to how substances expand and contract when heated and cooled. When water freezes and becomes ice, it expands rather than contracts because of a special way water molecules, in ice, bond to each other.

Male Narrator:

As they become hotter or cooler, gases and most liquids, other than water, expand and contract much more than solids.

The base of this thermometer contains liquid alcohol. When this liquid is heated by putting it into hot water, its molecules become more excited and move farther apart. The alcohol expands and rises up a very thin tube that runs the length of the thermometer.

When it is cooled, the alcohol contracts as its molecules become less active. As it contracts, the alcohol falls down the tube. A scale along the tube marks temperature.

Some thermometers use the Celsius scale, which is based on the fact that water always boils and freezes at the same temperatures when the pressure in the atmosphere is the same. At sea level pressure, 100 degrees Celsius marks the boiling point of water, and 0 degrees marks the temperature at which water freezes.

Other thermometers use a different scale. With a Fahrenheit thermometer, the freezing point of water is 32 degrees Fahrenheit, and boiling point is 212 degrees. The numbers of the two scales are different, but the temperatures they mark are the same.

Female Narrator:

No matter what kind of scale it has a thermometer measures temperature, not heat. Temperature and heat are different in important ways.

Temperature is a measure of how fast the molecules in a substance are, on average, moving. Measure the temperature in a tub of warm water. Then fill a cup with water from the tub and measure the temperature of this water.

The two temperatures will be the same. This is because the molecules of water in the cup are moving around, on average, as much as the molecules of water in the tub.

But the tub has much more thermal energy because it has many times the number of water molecules as the cup does. Because it has so much more thermal energy, more heat can flow from the water in the tub than from the water in the cup. The water in the tub, for instance, could quickly melt a pitcher of ice.

Male Narrator:

Which do you think has a higher temperature, the flame of a candle, or a radiator?

Which has more heat?

The flame of a candle, and a radiator, show the differences between heat and temperature. The flame has a much higher temperature. But the radiator has much more thermal energy because it has more molecules than the flame. It can give off a great deal more heat, enough heat, in fact, to warm a whole room.

Lesson 2: Feeling the Heat

Essential Question:

What is heat?

Content Standards:

- SC.3.P.10.2: Recognize that energy has the ability to cause motion or create change.
- SC.4.P.10.2: Investigate and describe that energy has the ability to cause motion or create change.
- SC.5.P.8.4: Explore the scientific theory of atoms by recognizing that all matter is composed of parts that are too small to be seen.
- SC.5.P.10.2: Investigate and explain that energy has the ability to cause motion or create change.

Vocabulary

- Heat
- Energy
- Friction
- Gas
- Liquid
- Matter
- Molecule
- Solid

Youth Development Standards:

- 3 – Child receives support from adults other than her or his parent(s).
- 5 – Relationships with teachers and peers provide a caring, encouraging environment.
- 12 – School provides clear rules and consequences.
- 18 – Child participates two or more times per week in co-curricular school activities or structured community programs for children.
- 22 – Child is motivated and strives to do well in school.
- 34 – Child knows and is comfortable with people of different racial, ethnic, and cultural backgrounds and with her or his own cultural identity.
- 38 – Child likes and is proud to be the person that he or she is.

Teacher Background Knowledge:

- Heat is created from friction – when two things rub together.
- In a solid object, molecules move very slowly and are very close together.
- In a liquid, molecules are linked loosely and move a little faster.
- In a gas, molecules are not linked and move very quickly.
- Students will be playing games that center around these concepts.

Materials:

- Rope long enough for tug of war, 4 Large cards – 9 x 12 – one that reads **solid**, one that reads **liquid**, one that reads **gas**, and one that reads **friction**, CD or cassette player with music that you can cue and stop.

Procedure:

1. Begin by asking the students what they know about MATTER. Go through the different stages of matter—solid, liquid, and gas. Tell the students that they are going to be playing a molecules game. If needed, clarify the word molecules.
2. Break the students up into groups of five or six. Have the students begin by practicing to be molecules of solids. Tell them that to be a molecule for solids, they have to get very close together and be very still. Have one group demonstrate at the front of the class.
3. Tell students that you are going to play music and the students are to walk around. When the music stops, they have to find their group and become a solid. When the music starts again, have the students begin walking around again.
4. Introduce what a LIQUID looks like. The students would be attached loosely (like holding hands like a train or circle). Have them practice being a liquid. Next have them walk to the music. When the music stops, hold up a card with either the word solid or liquid on it and have the students demonstrate.
5. Repeat step 4 for the word GAS. (As a gas, the group will run around each other, but never touch.)
6. After reviewing all three states of matter, get ready for tug of war.
7. Explain to the students the word FRICTION. Have students rub their hands together to make friction. Hold up the card and have them do it on cue. Ask the students where they think heat will be created if they play tug of war. Break the students up into two teams and have them play tug of war. Ask them how their hands feel. Have the students turn and talk and discuss what it felt like to heat their hands or to have friction.
8. Now use the four word cards to check their understanding. Hold up one of the cards and see how quickly the students can act it out. Hold up different cards and have the students act them out. Repeat until students are able to act it out quickly and correctly.

Formative Assessment:

- Students act out the vocabulary words when they see them on a card.

Lesson 3: Heat – Friend or Foe

Essential Question:

How can heat be harmful?

Content Standards:

- HE.3.B.3.6, HE.4.B.3.3, HE.5.B.3.5, HE.6.B.3.6: Choose healthy alternatives over unhealthy alternatives when making choices.
- LA.3.1.7.3, LA.4.1.7.3, LA.5.1.7.3, LA.6.1.7.3: The student will determine the main idea or essential message in grade level text through inferring, paraphrasing, summarizing, and identifying relevant events.

Vocabulary

- Heat
- Heat Illness

Youth Development Standards:

- 3 – Child receives support from adults other than her or his parent(s).
- 5 – Relationships with teachers and peers provide a caring, encouraging environment.
- 10 – Child feels safe at home, at school, and in his or her neighborhood.
- 12 – School provides clear rules and consequences.
- 18 – Child participates two or more times per week in co-curricular school activities or structured community programs for children.
- 22 – Child is motivated and strives to do well in school.
- 34 – Child knows and is comfortable with people of different racial, ethnic, and cultural backgrounds and with her or his own cultural identity.
- 37 – Child feels like he or she has some influence over things that happen in his or her life.
- 38 – Child likes and is proud to be the person that he or she is.

Teacher Background Knowledge:

- http://www.ehow.com/how_2069654_survive-heat-wave.html?ref=fuel&utm_source=yahoo&utm_medium=ssp&utm_campaign=yssp_art retrieved June 27, 2009.
- <http://thechildrenshospital.org/wellness/info/parents/34201.aspx#Article> retrieved June 27, 2009.
- <http://www.edoctoronline.com/family-children-health.asp?Help-for-Kids-Heat-Injuries=0&c=2&articleid=1004> retrieved June 27, 2009.
- http://kidshealth.org/parent/firstaid_safe/emergencies/heat.html retrieved June 27, 2009.

If the websites are unavailable, the article information has been saved at the end of this document and can be reproduced for the students.

Materials:

- Materials: Web availability for every group of 5 students (or copies of the article for each group), poster–1 for each group of 5 students, markers–1 pack for each group

Procedure:

1. Tell students they will be reading web pages for Main Idea and Details.
2. Give each group a web page to investigate. They should read and investigate for at least 15 minutes.
3. Give them poster and markers so that they can draw a poster depicting the main idea and details of the articles they are reading. Students need to make sure they outline why it is important to know about heat related illnesses.
4. Tell students they can illustrate or use a graphic organizer to explain their article.
5. Walk around and give help to those students who need assistance. This should take about 30 minutes.
6. Students should present as a group. Use about 15 minutes. Each group presents 3-4 minutes.

Formative Assessment:

- Posters that the students present for main idea and details.

Article 1

Our bodies create a tremendous amount of internal heat. We normally cool ourselves by sweating and radiating heat through our skin. Under certain circumstances, such as unusually high temperatures, high humidity, or vigorous exercise in hot weather, this natural cooling system may begin to fail, allowing internal heat to build up to dangerous levels. The result may be heat illness, which can come in the form of heat cramps, heat exhaustion, or heatstroke.

Heat Cramps: Heat cramps are brief, severe cramps in the muscles of the legs, arms, or abdomen that may occur during or after vigorous exercise in extreme heat. The sweating that occurs with vigorous exercise causes the body to lose salts and fluids. And the low level of salts causes the muscles to cramp. Children are particularly susceptible to heat cramps when they haven't been drinking enough fluids. Although painful, heat cramps aren't serious.

What to Do: Most heat cramps don't require special treatment. A cool place, rest, and fluids should ease your child's discomfort. Massaging cramped muscles may also help.

Heat Exhaustion: Heat exhaustion is a more severe heat illness that can occur when a person in a hot climate or environment hasn't been drinking enough fluids. Symptoms may include:

dehydration

fatigue

weakness

clammy skin

headache
nausea and/or vomiting
hyperventilation (rapid breathing)
irritability

What to Do: Bring your child indoors or into the shade. Loosen or remove your child's clothing. Encourage your child to eat and drink. Give your child a bath in cool (not cold) water. Call your child's doctor for further advice. If your child is too exhausted or ill to eat or drink, intravenous fluids may be necessary.

If left untreated, heat exhaustion may escalate into heatstroke, which can be fatal.

Article 2

The most common heat illnesses—and what to do. Kids, especially those under 4, are susceptible to heat-related illness because their small bodies generate more heat than their few sweat glands can handle. And they don't always drink enough to replace the fluid they lose in sweat, leading to dehydration. Here are the most common heat illnesses—what to look for and how to help.

* **Heat cramps:** Painful leg or stomach cramps are caused by dehydration and a loss of minerals. Have him rest in a shady spot and give him fluids. Massaging tight muscles helps relieve the pain, but if it persists for an hour, get medical attention.

* **Heat exhaustion:** Fatigue, headache, nausea, and pale or clammy skin indicate a child is becoming seriously overheated. Put him in the shade, loosen tight clothing, and sponge him down with cool water. If symptoms last more than an hour despite your efforts, get medical attention.

* **Heat stroke:** If a child is disoriented, has hot dry skin, a rapid pulse or is unconscious, his temperature-regulating system has failed, and his temperature may rise to 106°. Call for emergency help. While waiting, bring him indoors and sponge him with cool water or put him in a tub of cool water. Do not give fluids.

Find out more information on how to protect your child from a heat related illness at <http://cdc.gov>.

Rachelle Vander Schaaf, a mother of two, lives in eastern Pennsylvania and writes frequently about children's health.

Article 3

Heat Exhaustion and Heatstroke




Signs and Symptoms:

Heat Exhaustion:

- severe thirst
- muscle weakness
- nausea, sometimes vomiting
- fast, shallow breathing
- irritability
- headache
- increased sweating
- cool, clammy skin
- elevation of body temperature to less than 104 degrees Fahrenheit (40 degrees Celsius)

Heatstroke:

- severe, throbbing headache
- weakness, dizziness, or confusion
- difficulty breathing
- decreased responsiveness or loss of consciousness
- may not be sweating
- flushed, hot, dry skin
- elevation of body temperature to 104 degrees Fahrenheit (40 degrees Celsius) or higher



During hot, humid weather, the body's internal temperature can rise and can result in heat exhaustion and heatstroke. If not quickly treated, heat exhaustion can progress to heatstroke, which requires immediate emergency medical care and can be fatal.



What to Do:

If the child has a temperature of 104 degrees Fahrenheit (40 degrees Celsius) or more, or shows any symptoms of heatstroke, seek emergency medical care immediately. In cases of heat exhaustion and while awaiting help for a child with possible heatstroke:

1. Bring the child indoors or into the shade immediately.
2. Undress the child.
3. Have the child lie down; elevate feet slightly.
4. If the child is alert, place in cool (not cold) bath water, or sponge bathe the child repeatedly. If outside, spray the child with mist from a garden hose.
5. If the child is alert, give frequent sips of cool, clear fluids (clear juices or sports drinks are best).
6. If the child is vomiting, turn his or her body to the side to prevent choking.
7. Monitor the child's temperature.

Think Prevention!

Teach children to always drink plenty of fluids before and during any activity in hot, sunny weather – even if they aren't thirsty. Make sure kids wear light-colored loose clothing and only participate in heavy activity outdoors before noon or after 6 PM. Teach children to come indoors immediately whenever they feel overheated.

Note: All information is for educational purposes only. For specific medical advice, diagnoses, and treatment, consult a doctor. Review this with a doctor prior to use.

Reviewed by: [Larissa Hirsch, MD](#) Date reviewed: June 2007

Article 4

How to Survive a Heat Wave

Introduction

A heat wave is miserable for adults as well as children. Playing outdoors is out of question due to the risk of heat stroke and sunburn. Rolling blackouts become a common occurrence because everyone is draining the power supply running air conditioners and fans. People suffer from dehydration and heat exhaustion. Follow these steps to learn how to survive a heat wave.

Difficulty: Challenging

Steps:

Step One

Drink plenty of fluids to survive a heat wave. This includes water, juices and caffeine-free beverages.

Step Two

Play outside in the early morning during a heat wave when the air quality is at a healthier level and the temperatures are a little cooler.

Step Three

Run high energy appliances at night. Running the dryer and dishwasher during the day heats up the house and puts a strain on the electrical system. With the heat outside you can hang clothes up and the sun will dry them just as fast as a dryer would.

Step Four

Call your utility company and notify them if someone in your house is on life support. Heat waves increase the frequency of rolling blackouts. If a planned interruption is going to occur you will be notified so you can provide emergency life-saving measures with a generator or move the patient to a hospital if needed to survive during the heat wave.

Step Five

Keep the air flowing in your house. Use fans to circulate the air conditioner. Put heavy shades on the windows to block the sun which can heat up the house.

Step Six

Use the microwave to cook your meals. The stove and oven add heat to the house but, of course, you need to eat to survive. Eat light meals with less protein to reduce your metabolic heat.

Step Seven

Snack on frozen treats. Eat frozen grapes or berries, popsicles and ice cream.

Tips & Warnings:

Caffeinated sodas, coffees and energy drinks can dehydrate you.

Lesson 4: Measuring Up!!

Essential Question:

How do we know how hot heat is?

Content Standards:

- MA.3.S.7.1: Construct and analyze frequency tables, bar graphs, pictographs and line plots from data, including data collected through observation, survey, and experiments.
- MA.5.G.5.3: Solve problems requiring attention to approximation, select the appropriate measuring tool, and precision of measurement.
- MA.5.S.7.1: Construct and analyze line graphs and bar graphs.
- HE.6.B.1.7: Investigate a variety of technologies to gather health information.

Vocabulary

- Heat
- Temperature
- Thermometer

Youth Development Standards:

- 3 – Child receives support from adults other than her or his parent(s).
- 5 – Relationships with teachers and peers provide a caring, encouraging environment.
- 10 – Child feels safe at home, at school, and in his or her neighborhood.
- 12 – School provides clear rules and consequences.
- 18 – Child participates two or more times per week in co-curricular school activities or structured community programs for children.
- 22 – Child is motivated and strives to do well in school.
- 34 – Child knows and is comfortable with people of different racial, ethnic, and cultural backgrounds and with her or his own cultural identity.
- 37 – Child feels like he or she has some influence over things that happen in his or her life.
- 38 – Child likes and is proud to be the person that he or she is.

Teacher Background Knowledge:

- Second grade standards for science include students' capability to measure using a thermometer.
- SC.2.P.8.1: Observe and measure objects in terms of their properties, including size, shape, color, temperature, weight, texture, sinking or floating in water, and attraction and repulsion of magnets.
- SC.2.P.8.5: Measure and compare temperatures taken every day at the same time.

Materials:

- Thermometer for every group, tub of ice water for every group, T-chart paper for each group graph paper for each group, pencils, clock and/or timer, index card for each student

Procedure:

1. Explain to students that they will be tracking temperature on ice water over a period of time.
2. Have students make predictions about how cold they think the temperature of the ice water is and how warm it will become within the hour of the class. Use about 5-7 minutes.
3. Write the predictions down on the top of the T-chart pages.
4. Tell the students to place the thermometer in the ice water. On the T-chart, record the time on the left side and the temperature of the water on the right side.
5. Tell the students they are going to check the temperature every 10 minutes.
6. As the students wait for the 10 minutes to pass, explain that they will be graphing their results on a line graph.
7. When students have collected 3 to 4 points of data, have them graph the data on the line graph.
8. Have students predict from the information they have where they think the next measurement will be.
9. Have them graph their predictions with a dotted line.
10. Have students finish the graph with actual data.

Students complete the question on the index card as their ticket out the door.

Formative Assessment:

On the index card explain what the line graph represents.

Names in Group _____

Prediction: _____

Lesson 5: Let's Make an Oven

Essential Question:

How do we know how hot heat is?

Content Standards:

- SC.3.N.3.2: Recognize that scientists use models to help understand and explain how things work.
- SC.4.N.3.1: Explain that models can be three dimensional, two dimensional, an explanation in your mind, or a computer model.
- SC.5.N.1.4: Identify a control group and explain its importance in an experiment.
- SC.6.N.3.4: Identify the role of models in the context of the sixth grade science benchmarks.

Vocabulary

- Heat
- Temperature
- Thermometer
- Solar Energy

Youth Development Standards:

- 3 – Child receives support from adults other than her or his parent(s).
- 5 – Relationships with teachers and peers provide a caring, encouraging environment.
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Teacher Background Knowledge:

- All directions are included.
- Discuss with students how using models helps scientists. Also discuss what it means to have a control item during an experiment. This is an item that is a constant and does not change during the experiment.
- Information for making the solar oven was taken from this web page:
- http://www.tidbitsandstuff.com/articles/household/solar_oven.shtml, retrieved June 27, 2009.

Materials:

- Two thermometers for every group, 3 pizza boxes for each group, plastic wrap, ruler, black construction paper, aluminum foil, tape or glue, a knife to cut a hole in the box is also needed (an adult will need to do this), and a stick to prop open the door on your solar cooker/oven.

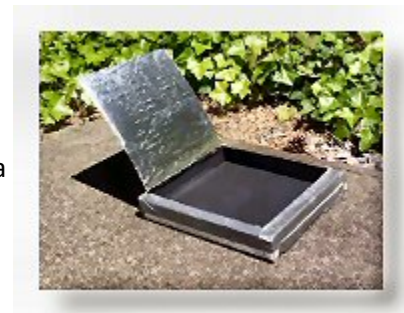
Procedure:

Explain to students that they will be constructing a solar oven and tracking the temperature in it. They will also have a control box (regular pizza box) that they will also track the temperature of during the same time period.

Here are the steps:

Cutting the Lid

The first thing when building your solar oven or cooker is to cut a hole into the lid of your pizza box . So that the lid can flap open, cut around three edges, leaving about 1 inch of space on each edge. Do not completely remove the lid. If you make a mistake, just tape it on with a heavy duty tape.



Building the Solar Reflector

Fold the flap out so that it can stand up on its own. Use the stick to secure it on a desirable position. Completely cover the inside of the lid with aluminum foil, and use the tape or glue. This foil will reflect the sun's rays to the pizza box.

Making the Window

Get your plastic wrap and create a window over the hole on the pizza box. Open the box and flip it over so you will be able to look through the hole. Put the plastic wrap over the hole and tape it.

Heating things up

Take the aluminum foil and line the inside of the box with it. Cover the aluminum with the black construction paper. This will absorb the heat that is produced in your pizza box. The heat absorbent construction paper and the heat reflective aluminum foil will create an oven atmosphere in your solar oven.

Now that you have created a homemade solar oven or cooker, it's time to use it. Bring it to a sunny spot and open the lid. Also adjust the opening so that sunlight is reflected off the lid and into the plastic window. You now know how to make a solar oven or cooker.

After the ovens are constructed, students place the ovens and the regular pizza boxes outside in the sun and measure the temperature. Take the temperature at different intervals, hopefully about every 5 minutes for about 15-20 minutes. Have the students compare the increase in temperature in the two boxes.

Formative Assessment:

- During the activity have students think about and discuss in groups how an experiment with a model helps scientific investigation. Also ask students how the regular pizza box is helpful in gathering information. Each group gives an answer during the activity. Help guide thinking and correct misconceptions.

Lesson 6: Heat on the Move

Essential Question:

How does heat transfer?

Content Standards:

- SC.4.P.10.1: Observe and describe some basic forms of energy, including light, heat, sound, electrical, and the energy of motion.
- SC.5.P.10.1: Investigate and describe some basic forms of energy including light, heat, sound, electrical, chemical, and mechanical.

Vocabulary

- Convection
- Conduct
- Radiation

Youth Development Standards:

- 3 – Child receives support from adults other than her or his parent(s).
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- 10 – Child feels safe at home, at school, and in his or her neighborhood.
- 12 – School provides clear rules and consequences.
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- 38 – Child likes and is proud to be the person that he or she is.

Teacher Background Knowledge:

- The information for this activity will be taken from Discoveryeducation.com.
- Teachers can register to get a free 60 day trial if their school does not subscribe.

Materials:

- Access to a teacher presentation station and the Web.
- Student computers. If there is not one for every student, try to have groups of no larger than 4 at the computers.
- Index card and pencil for each student.

Procedure:

1. Sign into Discovery Education and choose Science Education

2. Choose Physical Science – Intro to Sound, Heat and Light
3. Choose Heat and then Heat Transfer
4. Begin under Learn. If you do not have access to student computers, display on the teacher station.
5. Under Learn – Do the Reading Passage – Don't Let it In or Out. Discuss for 5-7 minutes.
6. If students are on their own computers, list the activities to view on the board and have the students choose what order to go through them. If not, go through and demonstrate each activity with the students. About 5-10 minutes on an activity.
7. Explore – Heat Transfer
8. Extend – Exploration – Heat on the Move
9. Extend – Reading Passage – Turning up the Heat

If students finish early, have them investigate other choices about heat in the Learn, Explore and Extend sections.

Formative Assessment:

- At the end of class, have the students write three things they have learned about heat on the index cards.

Lesson 7: Have You Been Using Heat?

Essential Question:

How do you use heat?

Content Standards:

- LA.3.3.2.1: The student will draft writing by using a prewriting plan to develop the main idea with supporting details that describe or provide facts and/or opinions.
- LA.4.3.2.1: The student will draft writing by using a prewriting plan to focus on the main idea with ample development of supporting details that shows an understanding of facts and/or opinions.
- LA.5.3.2.1: The student will draft writing by using a prewriting plan to focus on the main idea with ample development of supporting details, elaborating on organized information using descriptive language, supporting details, and word choices appropriate to the selected tone and mood.
- LA.6.3.2.2: The student will draft writing by developing main ideas from the prewriting plan using primary and secondary sources appropriate to purpose and audience.

Vocabulary

- Heat
- Matter
- Temperature
- Thermometer

Youth Development Standards:

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Teacher Background Knowledge:

- In this lesson, students will draw, discuss and write about what life would be like without heat.

Materials:

- Drawing paper, writing/lined paper, pencils, crayons or colored pencils

Procedure:

1. List the key vocabulary for students to review.
2. Ask students to take a few minutes and draw a quick sketch of their house. To this house, they need to add all the ways they can think of that they use heat. Help them to think of ways they use heat (i.e., fireplace for heat, stove for cooking, heater or furnace, blankets). Remind them that any way they use sunlight outside is using heat. Allow them to color it and make their picture attractive. Allow students about 10 minutes.
3. Next, students need to share with their partners the different ways they use heat.
4. Now students need to redirect their thinking. They need to think about what it would be like to live without heat.
5. Writing prompt: Everyone uses heat. You have thought about the ways you use heat each day. Now write and explain the different ways you use heat every day.

Formative Assessment:

- Student drawings and writings.

Lesson 8: What Does it Mean?

Essential Question:

What is heat?

Content Standards:

- LA.3.1.6.7, LA.4.1.6.7, LA.5.1.6.7, LA.6.1.6.7: The student will use meaning of familiar base words and affixes to determine meanings of unfamiliar complex words.

Youth Development Standards:

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Vocabulary

- -tion
- -al
- Therm
- Solar
- Conduct
- Convection
- Radiate

Teacher Background Knowledge:

- Teacher will use a PowerPoint to explain Prefixes and Suffixes and how they are added to root words.
- PowerPoints are located at <http://languagearts.pppst.com/affixes.html>, retrieved May 31, 2009

Materials:

- Teacher computer presentation capability, PowerPoints, cards with vocabulary words on it

Procedure:

1. Use the PowerPoint to help explain Prefixes and Suffixes. Discuss how they change words.
2. Review the vocabulary words and talk about how these words can change when added to suffixes or roots.
3. Using the PowerPoint again, have the students work in groups and review the prefixes and see how many words they can come up with for each prefix – **10-12 minutes**.
Anti = against: anti-war

De = opposite: destroy
Dis* = not, opposite of: disagree
En(m) = cause to: encode, embrace
Fore = before: forecast
In(m) = in: intake, implant
Inter = between: interact

4. Share their words –**10 minutes**.

Next, practice suffixes from the PowerPoint

–ful = full of: careful, joyful
–ic = having property of: linguistic
–ing* = present participle: running
–(t)ion = act, process: action
–(i)ty = state of: infinity, sanity
–(t)ive = adjective: motive, votive
–less = without: fearless, careless

Make as many words with the suffixes that they can. Again allow students 10-12 minutes. Share their words – **5- 10 minutes**.

Have the students try and come up with the definitions of these words:

Disapprove, reaction, forefront, antifreeze, intercostals
Thermal, conduction, convection, radiation

When students are finished, there is a jeopardy PowerPoint game that can be played for a review.

Formative Assessment:

- Student comes up with a new word and meaning using prefixes, roots and suffixes.

Lesson 9: GO! TEMPS

Essential Question:

How do we measure heat?

Content Standards:

- MA.3.S.7.1: Construct and analyze frequency tables, bar graphs, pictographs and line plots from data, including data collected through observation, survey and experiments.
- MA.5.G.5.3: Solve problems requiring attention to approximation, select the appropriate measuring tool, and precision of measurement.
- MA.5.S.7.1: Construct and analyze line graphs and bar graphs.
- HE.6.B.1.7: Investigate a variety of technologies to gather health information.

Vocabulary

- Conductor
- Insulator

Youth Development Standards:

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Teacher Background Knowledge:

- Teacher will need to acquaint themselves with the Go Temps thermometers in the STEM lab and the Logger Lite software <http://www.vernier.com/go/gotemp.html>

Materials:

- Go Temps, Logger Lite software, laptops that are in the STEM Lab, Styrofoam cup for every group, metal cup for every group, ice water, copies of the packet for every group, pencils, index cards for every student

Procedure:

1. Use PDF document with directions and illustrations.
2. Information comes from <http://www.vernier.com/go/gotemp.html>, retrieved June 3, 2009.

Formative Assessment:

- Ticket out the door – describe the difference of measuring and graphing with the Go Temps and Logger Lite software and manually taking the temperature and graphing it.

Lesson 10: What Does HEAT Look Like?

Essential Question:

What is heat?

Content Standards:

- VA.A.1.2.1: The student understands and applies media, techniques, and processes. Uses and organizes two-dimensional and three dimensional media, techniques, tools, and processes to produce works of art that are derived from personal experience, observation, or imagination.

Vocabulary

- All Vocabulary from the Unit

Youth Development Standards:

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Teacher Background Knowledge:

- This is the culminating activity for the Unit. The teacher should be familiar with key terms and how they were used in other lessons. Refer to other lessons if necessary.

Materials:

- 12 x 18 inches of drawing paper for each student, magazines that can be cut up for pictures, glue, colored pencils, crayons, markers, list of vocabulary words and definitions posted where students can refer to them

Procedure:

1. Review the vocabulary words and encourage discussion about each one. Ask students to share how they might represent the word in a picture. This should take about 15 minutes.

2. The students are going to make a drawing or collage of what heat is. They need to somehow incorporate three vocabulary words into their drawing.
3. This is the final assessment for the students.

Formative Assessment:

- Walk around and have students explain their vocabulary words in their pictures.

Key Vocabulary by Lesson

Celsius – temperature scale setting the melting point of ice as 0 degrees and the boiling point of water at 100 degrees at sea level pressure

Energy – ability to do work

Fahrenheit – temperature scale setting the melting point of ice as 32 degrees and the boiling point of water at 212 degrees at sea level pressure

Heat – form of energy associated with molecules in motion

Matter – substance from which all things are made

Molecule – smallest particle of matter

Temperature – measure of how hot or cold a substance is

Thermal energy – measure of the internal energy of a substance

Thermometer – device that gives the measure of temperature

Energy – ability to do work

Friction – the force between two objects that makes it hard for the objects to move and that produces heat

Gas – matter that has no definite shape and no definite volume

Heat – form of energy associated with molecules in motion

Liquid – matter that has definite volume but no definite shape

Matter – substance from which all things are made

Molecule – smallest particle of matter

Solid – an object that has a definite volume and a definite shape

Heat – form of energy associated with molecules in motion

Heat Illness – sickness caused from getting too hot

Heat – form of energy associated with molecules in motion

Temperature – measure of how hot or cold a substance is

Thermometer – device that gives the measure of temperature

Heat – form of energy associated with molecules in motion

Temperature – measure of how hot or cold a substance is

Thermometer – device that gives the measure of temperature

Solar Energy – energy from the sun

Convection – the transfer of heat by the movement of currents within a fluid

Conduct – to allow to pass through easily

Radiation – the transfer of energy by electromagnetic waves

Heat – form of energy associated with molecules in motion

Matter – substance from which all things are made

Temperature – measure of how hot or cold a substance is

Thermometer – device that gives the measure of temperature

-tion – suffix added to make a verb a noun

-al – suffix added to make a noun an adjective – means characteristic of

Therm – base word that means heat

Solar – base word that means sun

Conduct – to pass through easily

Convect – using wind to move energy

Radiate – using electromagnetic waves to move energy

Conductor – allows heat to pass easily

Insulator – does not allow heat to pass easily

Celsius – temperature scale setting the melting point of ice as 0 degrees and the boiling point of water at 100 degrees at sea level pressure

Conduct – to allow to pass through easily

Conductor – allows heat to pass easily

Convection – the transfer of heat by the movement of currents within a fluid

Energy – ability to do work

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Molecule – smallest particle of matter

Radiation – the transfer of energy by electromagnetic waves temperature

Solid – an object that has a definite volume and a definite shape

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Temperature – measure of how hot or cold a substance is

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