

Investigation One – Is It Hot in the Light?

Standard V Students will understand that the sun is the main source of heat and light for things living on Earth. They will also understand that the motion of rubbing objects together may produce heat.
Objective 1 Provide evidence showing that the sun is the source of heat and light for Earth.
Intended Learning Outcomes <ol style="list-style-type: none">1. Use science process and thinking skills4. Communicate effectively using science language and reasoning

Standard
V
Objective
1

Background Information

Careful observation and measuring are important steps in scientific investigation. Students at this age are usually encouraged to observe similarities and differences or even changes in objects. Good observations include using as many of the senses as possible – sight, touch, hearing, taste, and smell. It includes picking things up and touching them, feeling them, etc. Challenge students to observe carefully, so they can notice when changes are happening.

Learning to use a thermometer will help students make quantitative observations, in which they will be able to tell exactly what the temperature is, or whether something is becoming warmer or colder. Students should practice holding the thermometer by the edges, and not on the glass bulb, to get an accurate reading.

Heat is the name given to the flow of energy from hotter to cooler objects. Temperature is the measurement of how hot or cold something is. In hotter substances, the molecules are moving very rapidly, while in colder substances, the molecules slow down.

Most of the heat found on Earth comes from the sun and is used by all living things. This heat travels by radiation through invisible rays from the sun.

In this activity, students will make observations that things in direct sunlight are warmer than things that are not in as much sunlight. Also, they may notice that there may be more heat near asphalt, brick, or cement because heat can be stored and radiated from these also.

Pre-Assessment/Invitation to Learn

Before handing out thermometers: Start a game of I Spy in the classroom, in which students are given clues to certain things in the room, which they identify. (For example: I spy something that is a round sphere. It can spin around. One of its colors is blue. Can anyone guess what it is? You're right – it's a globe). Tell students that one of the things scientists do very well is to make good observations.

Hand out materials to be observed to students (peanuts, shells, buttons, types of cereals, etc.). Encourage students to make observations.

Hand out two UV beads per students. Do not tell them what they are, but ask students to make observations about them. Tell students you would like them to make a bracelet for these, and they can wear them all day while they make observations. At the end of the school day, you will ask them what observations they made.

Pre-Assessment/Invitation to Learn – Option 2

Have the students go on an imaginary hike to a cave with you (an optional script is attached, or just tell the students about going in a cave). Have students imagine they are hiking up the trail with you, and it is a long, hot hike. They describe how cold it is in the cave. When the lights are turned off, have the students close their eyes and shiver with you. With their eyes closed, they can't see anything. They can rub their hands together to try to get warm, but it is cold and dark. When they are finally through the cave, they can open their eyes, and stretch out their arms to the sun to get warm. Ask how many have been in caves. Is it hard to see? Is it cold? It is so nice to have light! Where do our lights come from?

Materials

- Shells, peanuts, etc. for observation
- 2 UV beads and a pipe cleaner per student
- 8 Thermometers (1 per group)
- 8 Cups of rice water
- “How Hot or Cold Is It?” Worksheet and clipboards per student or group
- “From Hottest to Coldest” Worksheet per student

Instructional Procedure

1. While writing on a poster or on the board, have students share examples of light sources.
2. Do we get heat from light sources? What are some examples? Could it be cold in the light? What are some examples?
3. Tell students they will be going outside as a class to find some warm places in the light and some cool places. Divide the groups in half and have half try to find the coolest place they can on the school grounds, and the other half try to find the warmest.
4. Instruct students how to use thermometers. You may want to have them practice taking the temperature of the room, cold water, etc., to be sure that they know how to read the thermometer. Each group will be given a thermometer and a worksheet and they must stay together as a group. After a few minutes of exploring, they must choose a spot, set out the thermometer, and wait several minutes for an accurate thermometer reading

Some suggested rules while students are outside:

- They must stay within site of the teacher.
 - They must choose a spot in five minutes.
 - The teacher will call off each minute, so everyone is taking a temperature reading each minute for 3 to 4 minutes.
 - While they are waiting, they may draw on their worksheet where they are relative to the school building.
 - Students will show how much sunlight is by their spot: not colored in at all for full sun, or partially/fully colored in if in partial sunlight or shade.
 - They should write down the temperature each time the teacher calls out a minute.
 - Everyone in the group should agree on the final temperature.
5. Return with students to the classroom and write down each group number along with their recorded temperature(s) and amount(s) of sunlight.
 6. Students will draw on their thermometers what the temperature and sunlight was for each group, then place the temperature in order on the chart from hottest to coldest.
 7. Discuss with students what might have made the difference in temperature and discuss how things in direct sunlight are usually warmer than those not in direct sunlight.

Curriculum Extensions

Math –

- Read and record the temperature to the nearest ten degrees using a Fahrenheit thermometer. (*Standard IV, Objective 2*)
- Collect, read, represent, and interpret data using tables, graphs, and charts. Make predictions based on a data display. (*Standard V, Objective 1*)

Science –

- If students are wearing UV bracelets during this activity, discuss what is happening when they observe the changes in the beads. Are the beads as bright in the shade as they are in the direct sunlight? Are they all the same color? Students may want to experiment with putting sunscreen on some to see if it changes the bead color. (*ILOs 1, 3, 4*)
- Discuss the different temperatures found in ecosystems around the world. What do animals that live in a hot desert do to survive the heat? Does the temperature effect cold-blooded animals differently than warm-blooded animals? How? (*ILOs 2, 3*)

Resources

Books:

- Byles, Monica, *Life in the Polar Lands*, “Crow Steals Some Daylight” p. 24-28 Scholastic Inc., ISBN 0-590-46130-3.
- Caduto, Michael J., and Bruchac, Joseph; *Keepers of the Earth*, “How Grandmother Spider Stole the Sun” p. 49-51, ISBN 1-55591-027-0. (This is a Muskogee Indian legend. Included are the story, discussion information, questions, and an activity.)
- *The Magic School Bus in the Arctic: A Book About Heat*, ISBN 0-590-18724-4.
- Troughton, Joana, *Who Will Be the Sun?* The Wright Group, ISBN 0-1-5524-498-3
- Solar Folklore and Art
<http://solar-center.stanford.edu/folklore/folklore.html>
- Tolman, Marvin N., Activity 15.3, “What Other Type of Energy Accompanies Light From the Sun?” *Hands-On Science Activities for Grades 3-4*. Parker Publishing Co., ISBN 0-13-011339-5

Videos:

- Jordan District Media Minder on the Web
 - *All About the Sun* VH, Catalog Number 15623
 - *Aesop’s Fables III* VH, Catalog Number 5451
 - *All About Food Chain* VH, Catalog Number 15606

Web sites:

- <http://www.ajkids.com/> search heat, light, sun
- <http://solar-center-standford.edu/>
- <http://kids.msfc.nasa.gov/%24/solarsystem/sun.asp>
- <http://www.nasaexplores.com/lessons/02/002/k-4index.html> lesson on the sun
- <http://www.solar-center.standord.edu/webcast/wcpdf/SunBurns204.pdf> (Lesson Plans for using UV beads, “As the Sun Burns”)
- http://www.nasaexplores.com/lessons/01-009/K-4_2-t.html (Lesson Plans for “Solar S’mores”)

Assessment Suggestion

Check student worksheets to see if students correctly drew the temperature for each group and correctly put the temperatures in order from highest to lowest.

Homework & Family Connections

Mention in a parent letter that students are learning to measure with thermometers and ask parents to point out thermometers around the house.

Cave Hunt

By Annette Van Wagemen

We're going on a cave hunt.
We're visiting Timpanogos.
We're hiking up the long trail.
The trail is steep and winding.
The summer sun is very hot.
But we've got a canteen of water.

At last we're at the entrance.
A guide will take us through.
Loot at all the cave tunnels and caverns.
This cave is beautiful, wet, slippery, and cold (brrr)
We forgot to bring our jacket.
Let's rub our hands together.
We're creating heat through friction.

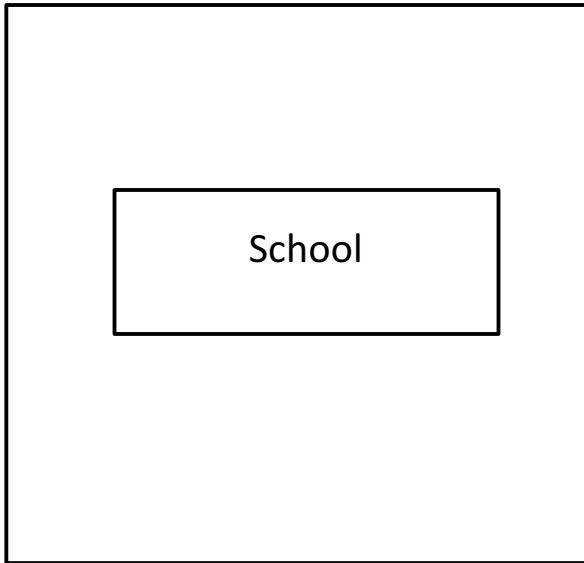
The guide says he's turning out the electric lights.
No, they are dim and barely illuminate.
He now is turning off his flashlight.
I can't see my friends standing near me.
Aaah, it's too quiet;
But now, what is that noise?
Could it be bats?

Grab a flashlight and
Let's get out of here.
We run past the stalactites,
Pass the stalagmites, the cave coral and the soda straws:
The columns, the flowstone, and the draperies. We
Keep going until at last we come to the end of the cave tunnel and go outside.
It will take a few minutes for our eyes to adjust to the bright sunlight. The
Hot summer sun feels good after being inside the cold cave. Let's go down
The trail now. But we won't run, we'll walk!

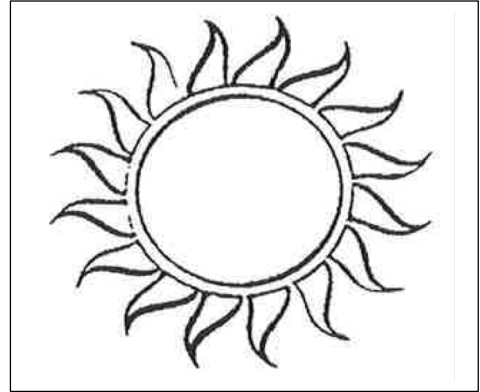
Name: _____

How Hot or Cold Is It?

Location:

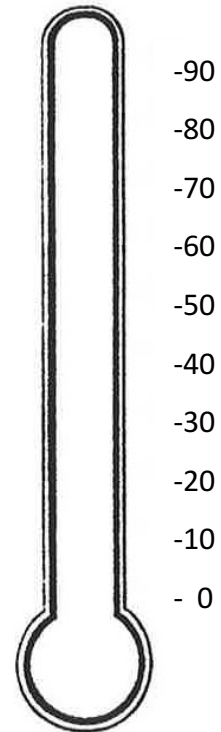


Amount of sunlight:



Final Temperature

1 minute	
2 minutes	
3 minutes	

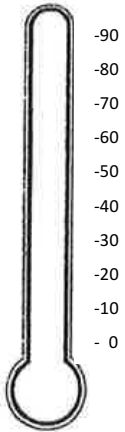


Name: _____

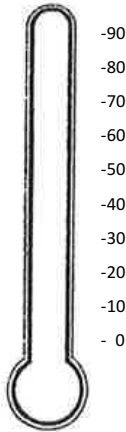
From Hottest to Coldest

Draw the Temperature of each group, then place them in order from hottest to coldest.

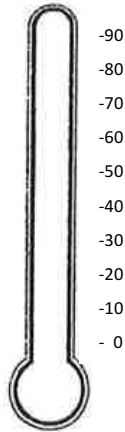
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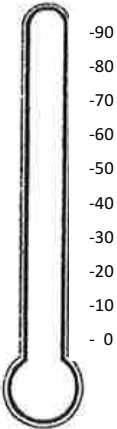
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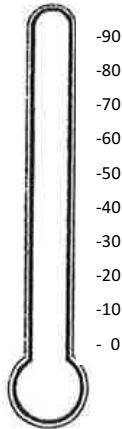
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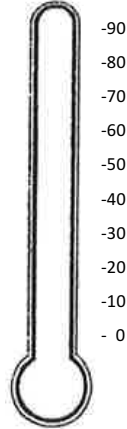
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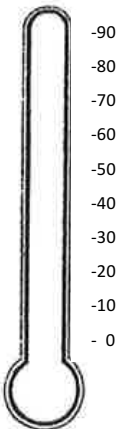
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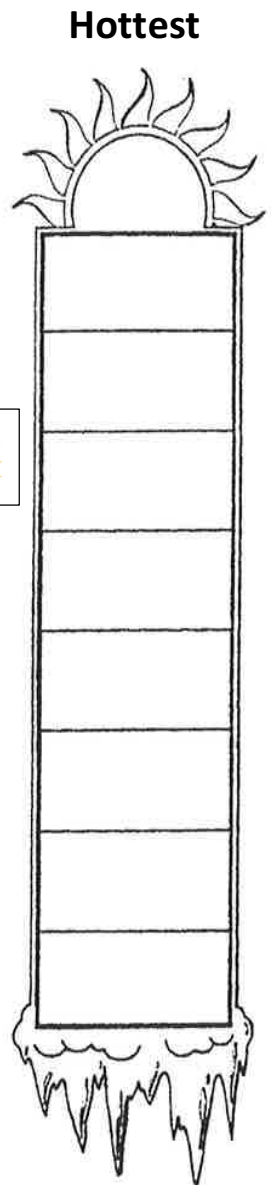
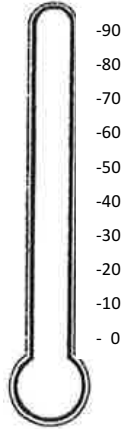
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8



How much light was in the hottest areas? _____

How much light was in the coolest areas? _____

My Book About Heat and Light

Name: _____

Insulators

Question: Which material will keep heat in the longest?

Hypothesis: I think _____

Materials: You will need 1 styrofoam container, 1 folded newspaper, 1 towel, 3 small cups, and a thermometer.

Steps:

1. Fill 3 small cups with hot water.
2. Take the temperature of each cup.
3. Wrap each cup with an insulator.
4. Measure the temperature of each cup every minute for 4 minutes.

Conclusion:

	0 minutes	1 minute	2 minutes	3 minutes	4 minutes
Cup in newspaper					
Cup in styrofoam					
Cup in towel					

Hot to Cold

Question: Which room is the hottest? Which room is the coldest?

Hypothesis: I think _____

Materials: Thermometers

Steps:

1. Measure the temperature in six rooms.
2. Leave the thermometers for 5-10 minutes.
3. Also observe how much sunlight is in each room.

	Room	Temperature
1.		
2.		
3.		
4.		
5.		
6.		

Solar Cooking

Question: How can I use the sun's heat to cook my food?

Hypothesis: I think _____



Materials:

1 bowl covered in foil (shiny side out)
clear plastic wrap to cover top
marshmallows

1-2 graham cracker squares
chocolate chips

Steps:

1. Place graham cracker in bowl.
2. Place the chocolate chips and marshmallows
On top of cracker.
3. Cover with plastic wrap
4. Place in direct sunlight.

Conclusion:

Sprouts!

Question: Do seeds need heat to sprout?

Hypothesis: I think _____

Materials:

- 2 plastic bags
- Seeds
- 4 cotton balls

Steps:

1. Place 2 cotton balls in each bag.
2. Place a few seeds on the cotton and slightly moisten with water.
3. Place 1 seed bag in a cool or cold area.
4. Place 1 seed bag in a warm area.
5. Observe for one week

Conclusion: Which seeds grew better?

Observations:

Heat From Rubbing!

Question: Which two things rubbed together make the most heat?

Hypothesis: I think _____

Materials:

- 1 thermometer or heat sensor
- Items to test

Steps:

1. Choose items around the house to rub together (wood, rubber, plastic).
2. Take the temperature before and after rubbing.

Conclusion:

Item 1	Item 2	Time	Temperature

Heat From Machines



Question: Which machines in your house give off the most heat?

Hypothesis: I think _____

Materials:

Thermometers from the Science Kit

Steps:

1. Take the temperature of the machine.
2. Tape or attach a thermometer to it.
3. Turn the machine on for five minutes.
4. Test the temperature after another 5 minutes.

Conclusion:

Machine	Temp. While Off	5 Minutes	10 Minutes	Difference
