

Science Benchmark: 03 : 05

Light is produced by the sun and observed on Earth. Living organisms use heat and light from the sun. Heat is also produced from motion when one thing rubs against another. Things that give off heat often give off light. While operating, mechanical and electrical machines produce heat and/or 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.

STUDENT BACKGROUND INFORMATION

Heat and Light

Have you ever been inside a cave? An interesting cave to visit is Timpanogos Cave just north of Provo, Utah. The best time to hike to the cave is during the summer when the snow is gone.



The hike is a mile and a half long, with a steep trail to the cave entrance. As you hike up the steep, winding trail, you will notice that the summer sun is hot and bright. You will need to take water with you.

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A guide will take you through the cave's tunnels and caverns. Inside the cave it will be very dark except for your guide's flashlight and the electrical lights that have been placed in the cave to help visitors. This cave is beautiful, wet, slippery, and cold. Even when it is very hot outside, most people need to take a jacket to wear inside the cave.

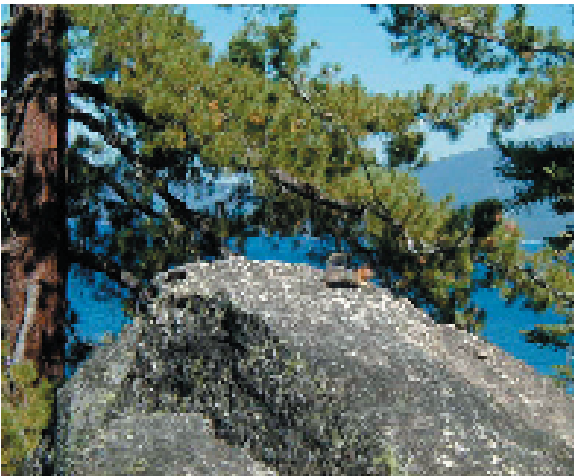


Your guide will ask you to stand still while the lights are off. You will see what it is like to be in total darkness. With no light inside the cave, you cannot see your friends standing near you, your own hands, or anything at all. Most people are happy when the lights are turned back on.

Soon you will come to the other end of the cave tunnel and go outside. It will take a few minutes for your eyes to become used to the bright sunlight that is all around you. The hot summer sun feels good after being inside the cold cave.



Where do we get light and heat?

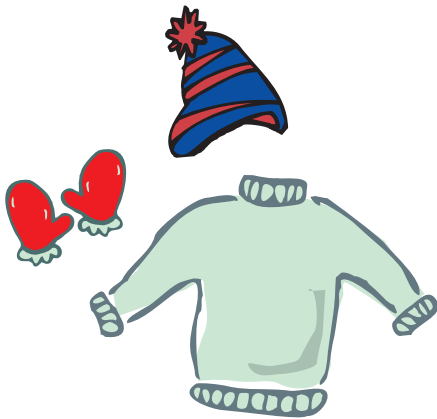


Natural Light

When you are inside a dark cave, even with your eyes wide open, you see nothing. If it is daytime and you are outdoors, you see many objects all around you. You can see the objects because of light bouncing off them. Light is produced by the sun.

The sun is the main source of heat, warmth, and light for organisms living on Earth. Without the sun's energy, Earth would be completely dark and freezing cold. Living organisms use heat and light from the sun. Plants need sunlight to make food. Animals cannot make their own food. They must eat plants or other animals in order to live. Without sunlight there would be no living things on Earth. Have you ever noticed that house plants bend toward sunlit windows? What will happen to seeds if they are planted and watered but left in a dark room or under a box?

Anything that gives off heat is a *heat source*. The sun is the main source of heat for Earth. Have you noticed that you feel hotter in the sunlight than in the shade? You can measure the difference in *temperature* with a thermometer. A thermometer uses a scale with each unit called a *degree*.



Some people have *misconceptions* about heat sources. For example, ice cubes do not give off cold. When you place an ice cube in your glass of water the ice cube takes heat from the water as it cools. Wool clothing does not produce heat. The loose fibers of the wool clothing trap your body heat and make you feel warmer.

What is true about heat? The motion of rubbing things together may produce heat. On a cold day you can rub your hands together to try to warm them. Can you think of ways heat is produced from motion when one thing rubs against another?



When you are riding your bike and brake, stopping quickly, your brake becomes warm. The motion of rubbing on the brake produced heat. If you cut a piece of wood with a saw, the saw blade becomes warm. When you sand a piece of wood with a piece of sandpaper, the sandpaper becomes warm.

misconceptions - *misunderstandings*



a lubricant

Imagine walking on a tile floor and slipping on a wet spot. The water *lubricates* the surface, making it easier for you to slide. Lubricants such as oil, water and lotion reduce heat and make it easier for machine parts to move. Oil is added to car engines to reduce the heat made by moving parts in the engine.

Have you noticed that it is harder to turn a door knob with lotion covered hands than it is with dry hands? Here is something you can try. Rub dry, clean hands together for a few minutes. Then try rubbing your hands together with lotion on them. When did your hands warm up more quickly?



While operating, mechanical and electrical machines produce heat and/or light. *Machines* need energy to operate. Machines can be *mechanical* or *electrical*. Mechanical machines can use burning fuel, human strength, flowing water or even horsepower to give them energy. Electrical machines need electricity and usually plug into an electrical outlet or use batteries. Can you make a list of machines and sort or categorize them? Are they mechanical or electrical? Mechanical machines could include; car engines, scissors, staplers, and lawn mowers. Electrical machines include computers, projectors, televisions, electrical pencil sharpeners, and electric motors.

electrical - *uses electricity*

lubricate - *to make a slippery surface*

machines - *tools with fixed or moving parts for doing work.*

mechanical - *does not use electricity.*



Mechanical Heat Sources



Electrical Heat Sources

Light sources can also be sorted into electrical and mechanical groups. Can you sort a candle, gas lantern, electric light, flashlight, overhead projector, computer screen, glow stick, or fire into these two groups?

On a cold winter day, students at school could come into the classroom from recess and put their hands on the back of a computer that has been left on. The computer has produced heat and is warm. Have you noticed that it is warmer in the computer lab than in other rooms in the school? How much warmer is the computer room than one without computers? You could guess or predict, then use a thermometer to measure the temperature of each room. Try it!

Science Language Students Need to Know and Use

1. **degrees** - a unit of measure for temperature on a thermometer
2. **electrical** - uses electricity
3. **heat source** - makes things warm
4. **lubricated** - to make a slippery surface
5. **machine** - tools with fixed or moving parts for doing work
6. **mechanical** - does not use electricity
7. **misconception** - misunderstanding
8. **temperature** - how warm or cold

Resources:

Books:

- Byles, Monica, *Life in the Polar Lands*, “Crow Steals Some Daylight” p. 24-25, 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
- *The Magic School Bus Gets Eaten: A Book About Food Chains*, ISBN 0-590-48414-1
- *The Magic School Bus Gets Planted: A Book About Photosynthesis*, ISBN 0-590-92246-7
- *The Magic School Bus in the Arctic: A Book About Heat*, ISBN 0-590-18724-4
- *The Magic School Bus Plays Ball: A Book About Forces and Friction*, ISBN 0-590-92240-8
- Throughton, Joanna, *Who Will Be the Sun?* The Wright Group, ISBN 1-55624-498-3

Solar Folklore and Art

<http://solar-center.stanford.edu/folklore/folklore.html>

Web Sources:

- <http://www.ajkids.com/> seach heat, light, sun, friction
- <http://umbra.gsfc.nasa.gov/images/latest.html> pictures of the sun
- http://www.surweb.org/seach/collections_imatrix.asp Timpanogos Cave
- <http://solar-center.stanford.edu/>
- <http://www.nasaexplores.com/cgi-bin/index.pl>