

# Investigation Six – Heat From Machines

<b>Standard V</b> 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.
<b>Objective 2</b> Demonstrate that mechanical and electrical machines produce heat and sometimes light.
<b>Intended Learning Outcomes</b> <ol style="list-style-type: none"><li>1. Use science process and thinking skills</li><li>4. Communicate effectively using science language and reasoning</li></ol>

Standard  
V  
Objective  
2

## Background Information

Heat energy can be produced by mechanical and electrical machines. Light can also sometimes be produced. Mechanical machines are those which do not use electricity, such as machines that use fuel (cars, lawn mowers), human strength (bikes, skateboards), or flowing water (water turbine). Classroom examples of mechanical machines include using scissors, a stapler, or a pencil sharpener. To use these machines, a student would provide the energy. So to measure the temperature difference, a student could measure the temperature of his/her hand before using the machine and measure the temperature of the hand after using the machine for a minute or two.

Electrical machines include those which use electrical power and would have a plug or use batteries. Classroom examples include an overhead projector, electrical pencil sharpener, computer, heat lamp, TV, or VCR.

## Pre-Assessment/Invitation to Learn

Review with students how mechanical and electrical machines can produce heat. Have students identify as many machines as possible in the classroom. Ask them how scientists would measure how much heat is produced. Scientists use measurements, so they would measure the temperature of the machines before it is turned on, and after it has been on for a while.

## Instructional Procedure

### Materials

- 4 thermometers
- Heat worksheet
- Classroom machines: projector, electric pencil sharpener, heat lamp, toaster, computer, manual pencil sharpener, scissors, and paper, etc.

1. Divide students into four groups.
2. Students will fill out the worksheet by predict which machines will produce measurable heat.
3. Decide as a class which four machines will be tested and assign a group to measure the temperature before and after being turned on. Decide as a class how long the temperature will be measured and how it will be measured.
4. Students should check thermometers before to see that they all measure the same temperature. Then they will record the temperature of the machine before being used. (For accuracy, the experiment could be repeated several times and the results averaged).
5. If the machine being used is a mechanical one, with the energy being provided by the student, you could measure the temperature of the student before and after using the machine.
6. Students complete the worksheet for their machine, then write in the information from the other groups. The temperatures will be drawn in and graphed on the second part of the worksheet.

## Curriculum Extensions

### *Math –*

- Read and record the temperatures to the nearest ten degrees using a Fahrenheit thermometer. (*Standard IV, Objective 2*)
- Collect, read, represent and interpret data using tables, charts, and graphs. Make predictions based on the data displayed. (*Standard V, Objective 1*)
- Students may measure the heat difference on other machines in the school or at home. (*Standard I, Objectives 3 and 5*)
- For mechanical machines being powered by the student, the temperature difference could be found using a heat sensitive liquid crystal sheet (thermal heat sensor), and watching how long it takes to see the fingerprints before using the machine and after using it. (*Standard I, Objectives 3 and 5*)

## Assessment Suggestions

Grading student worksheet:

10 points	correct, complete, detailed
8 points	partially correct, complete, detailed
6 points	partially correct, partially complete, lacks some detail
5-1 points	incorrect or incomplete, missing data, needs help

## Resources

### *Books:*

- *Dorling Kindersley Eyewitness Books: Electricity* by Steve Parker
- *Dorling Kindersley Eyewitness Books: Energy* by Steve Parker

### *Web sites:*

- [www.energyquest.ca.gov/index.html](http://www.energyquest.ca.gov/index.html) (This is a great web site and includes interactions for students, parents, and teachers)
- [www.sciencenetlinks.com](http://www.sciencenetlinks.com) (search for links on heat)

## Homework and Family Connections

Students may measure temperatures of machines at home.

Name(s) \_\_\_\_\_

## Heat From Machines

**Question:** Which machines will produce heat?

**Hypothesis:** \_\_\_\_\_

**Experiment:** Try some mechanical and electrical machines to see which produce heat.

	Machine	Elec.	Mech.	Heat?	Off	On	Difference
1							
2							
3							
4							

**Conclusion:**

**Conclusion:**

**Conclusion:** I found out that \_\_\_\_\_

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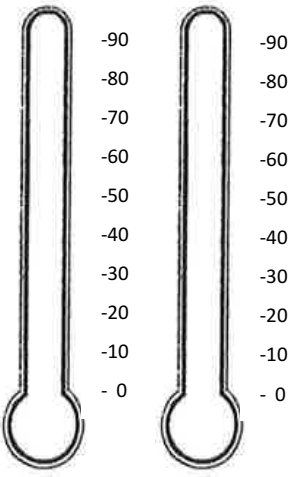
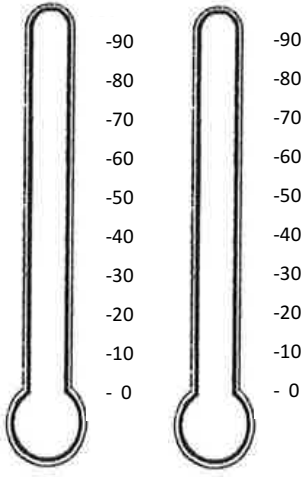
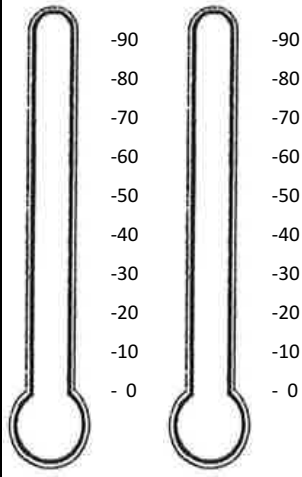
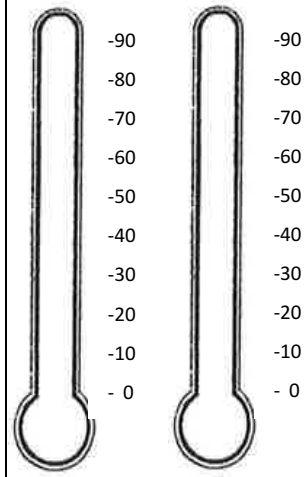
**Discovery:** The most interesting thing I observed \_\_\_\_\_

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## Temperature Tracking

<p>1. Off                      On</p>  <p style="text-align: center;">Difference _____</p>	<p>2. Off                      On</p>  <p style="text-align: center;">Difference _____</p>	<p>3. Off                      On</p>  <p style="text-align: center;">Difference _____</p>	<p>4. Off                      On</p>  <p style="text-align: center;">Difference _____</p>
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F°	Off	On	Off	On	Off	On	Off	On
150°								
140°								
130°								
120°								
110°								
100°								
90°								
80°								
70°								
60°								
50°								
40°								
30°								
20°								
10°								
0°								