

4<sup>th</sup> Grade  
Science  
Home Packet  
Riverside Elementary  
March 23-27,  
2020

**“HEAT ENERGY”**

Monday	Read pages 314 – 319. Work Heat Worksheet #1. Use the pages read.
Tuesday	Reread p. 314 – 319 Work Heat Worksheets #2 - Use pages 318 – 319 to work worksheet #3 – “Finding Out About Heat”.
Wednesday	Watch “HEAT” video on “studyjams.com” (free) or Reread p. 314-319. Work Worksheets #4 - “Heat Travels”, #5 - “Cause & Effect”, #6 - “Energy WS”, Conduction, Convection, Radiation
Thursday	Watch “HEAT” video on Study Jams again (from Wed.) Work the <u>Test</u> on “HEAT” Study Jams – 7 Q. Work Worksheets #7 - “Can You Take the Heat?” #8 - Heat Transfer Worksheet
Friday	Worksheets # 9 - Read “ <u>How Does Geothermal Energy Work?</u> ” #10 - Answer Questions. #11 - Word Search

## Read and Learn

### Essential Question

How does heat flow? 2g

### Vocabulary

heat, p. 314

conduction, p. 316

convection, p. 316

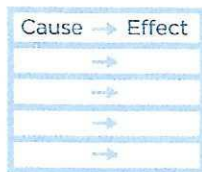
radiation, p. 317

insulators, p. 318

conductor, p. 318

### Reading Skill

#### Cause and Effect



### Technology

e-Glossary and e-Review online  
at [www.macmillanmh.com](http://www.macmillanmh.com)



## What is heat?

Energy is needed for animals to stay warm. Whether it's from the Sun or your body, thermal energy keeps you warm. *Thermal energy* is the energy of the moving particles of matter. The faster the movement of particles, the greater the amount of thermal energy.

**Heat** is the movement of thermal energy from one object to another. Heat always moves from warmer objects to cooler objects.

## Sources of Heat

Some sources of heat include burning wood and fossil fuels. The Sun is Earth's main source of heat. Inside Earth, it is very hot. This source of heat is called geothermal energy.

Try rubbing your hands together. When you rub your hands together you produce *friction*. Friction is another way to produce heat.



Friction between the match head and the surface creates heat.



## Changing Temperature

Heating can change an object's temperature (TEM•puh•ruh•chur). *Temperature* is related to the thermal energy of the particles in a substance.

We measure temperature with a *thermometer* (thur•MAH•muh•tur). Inside most thermometers is a liquid such as alcohol. As the thermometer warms, the particles of the liquid move faster and farther apart. This movement makes the liquid expand and rise inside the thermometer.

Have you ever had a fever? You probably measured your temperature in degrees Fahrenheit (F). Scientists often use the Celsius (C) scale to measure temperature.

The thermometer on this page shows the Fahrenheit and Celsius scales. Water freezes at  $32^{\circ}\text{F}$ . This is in the same place on the thermometer as  $0^{\circ}\text{C}$ . Water boils at  $212^{\circ}\text{F}$ . As you can see, that is the same as  $100^{\circ}\text{C}$ .

### Quick Check

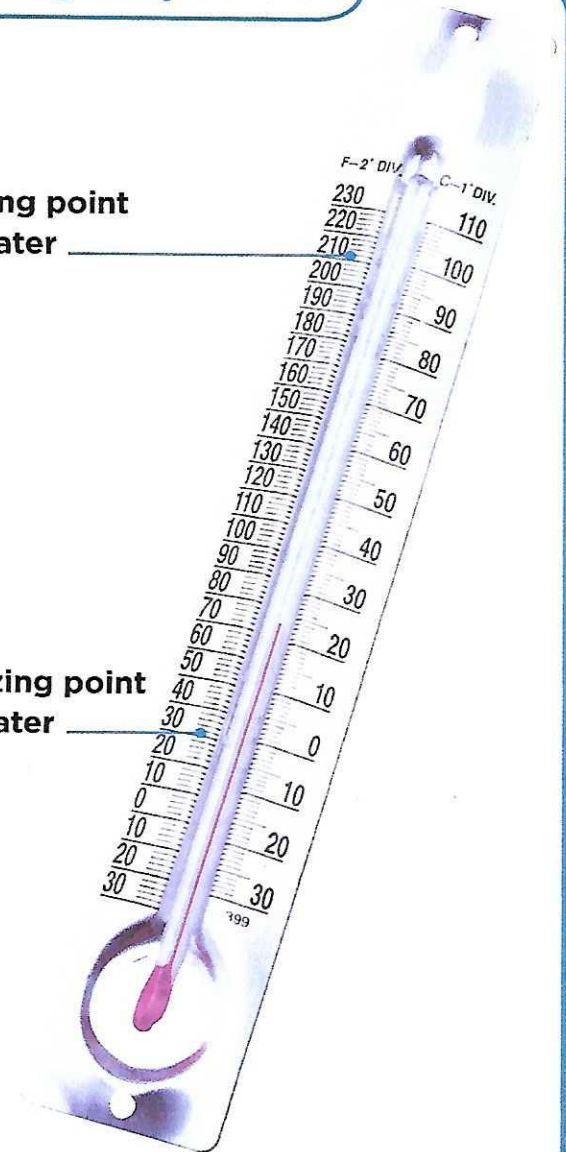
**Cause and Effect** What happens to the particles of an ice cube when placed in a glass of juice?

**Critical Thinking** How are heat and temperature related?

## Measuring Temperature

boiling point  
of water

freezing point  
of water



### Read a Photo

**What is the temperature in Fahrenheit? In Celsius?**

**Clue:** Find the marks near the top of the red line.

## How does heat travel?

You have learned that heat is the movement of thermal energy. Heat can travel in three basic ways.

### Conduction

Solids are heated mainly by conduction (kun•DUK•shun).

**Conduction** occurs between two objects that are touching. Conduction can also occur within an object, such as a metal pot.

What happens when you heat a pan on a stove? The fast moving particles of the burner or flame hit the cooler particles of the pan. The collision gives the cooler particles more thermal energy. The particles of the pan start to move faster. Soon, the entire pan gets hot.

### Convection

If you want to boil water, you can heat it in a pot. First the pot heats by conduction. Then the water heats by convection (kun•VEK•shun). **Convection** transfers thermal energy through liquids or gases.

As the pot heats, it transfers energy to the water. The water particles at the bottom of the pot heat first. They move faster and farther apart. The hot water particles become less *dense*, or packed together. The denser, cooler water at the top sinks. It replaces the hot water. Convection transfers heat as these hotter and cooler particles change places and mix.



Heat Transfer

Heat is transferred through the water by convection.

Heat is transferred from the flame to the pot by conduction.

### Read a Diagram

Describe how heat is flowing in this pot of water.

**Clue:** The red circles are hot particles. The blue circles are cooler particles.



## Radiation

Radiation (ray•dee•AY•shun) is the third way heat is transferred. Radiation is the transfer of heat by wave energy, such as light waves. Radiation can travel through space. Conduction and convection require matter to transfer heat.

Without radiation, energy from the Sun would not reach Earth. When the Sun's energy reaches Earth, it heats land and water surfaces. The surfaces then warm the air.

### Quick Check

**Cause and Effect** The end of a metal spoon in hot water gets hot. Why?

**Critical Thinking** How is radiation different from conduction and convection?

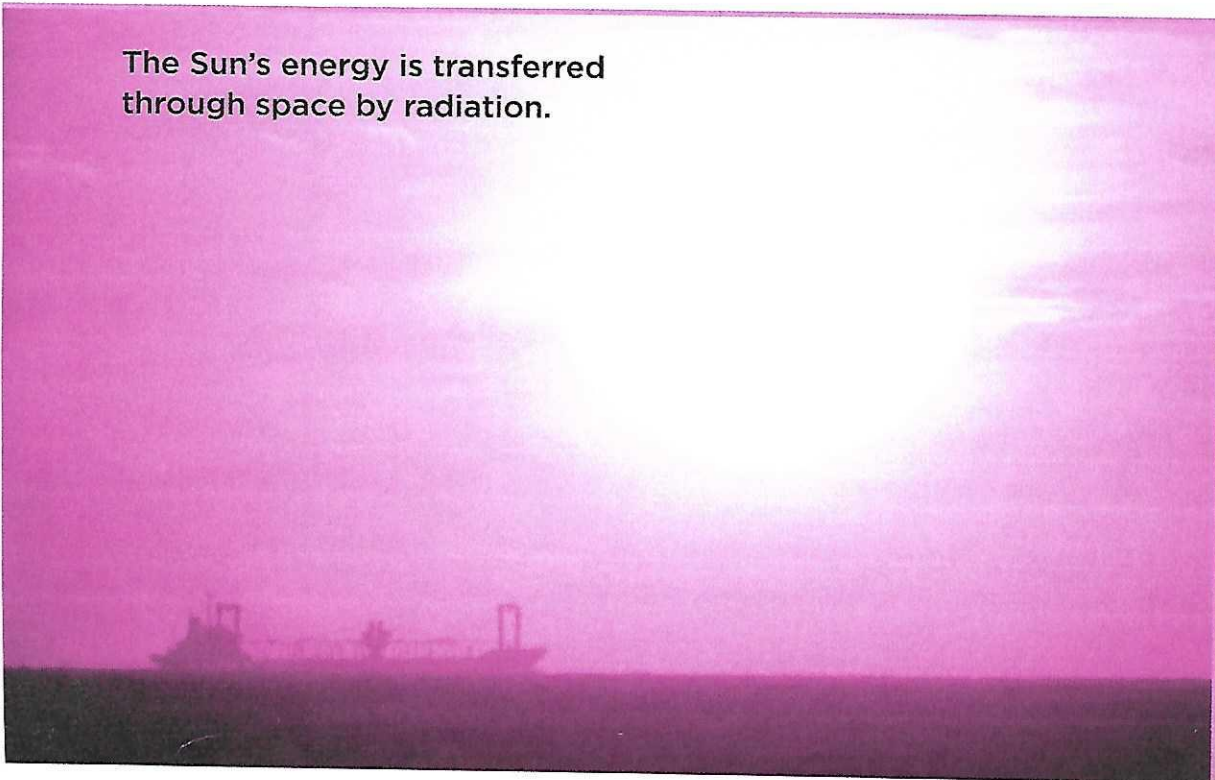
## Quick Lab

### Temperature and Air

- 1 Predict** Place a deflated balloon over the mouth of an empty plastic bottle. What will happen if you put the bottle in hot water? In cold water?
- 2 Observe** Place the bottle in a bucket of warm water. Wait five minutes. What happens to the balloon?
- 3** Now place the bottle in a bucket of ice water. What happens?
- 4** What do you think caused the balloon to inflate and deflate?



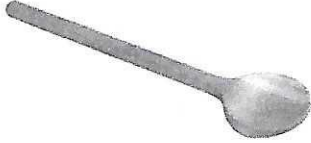



The Sun's energy is transferred through space by radiation.



# What materials are insulators and conductors?

In winter, you might wear a fleece jacket to stay warm. Fleece is an insulator (IN•suh•lay•tur). **Insulators** do not transfer heat easily. Fat is an insulator that many animals have in their bodies. It helps keep their body heat from escaping into the cold air.

The opposite of an insulator is a conductor (kun•DUK•tur). A **conductor** transfers heat easily. Metal is a good conductor. That is why many pots and pans are made of metal. A metal spoon feels cool to the touch because it conducts heat away from your body.

Insulators and Conductors			
<p>Wood and plastic are good insulators of heat transferred by conduction. One end of a wooden spoon will not be too hot to touch when left in boiling water.</p>		<p>Trapped air is a good insulator. Warm coats and hats trap air against our bodies and keep us warm.</p>	
<b>Insulators ▲</b>			
<p>Metals are good conductors. The thermal energy from a stove is quickly conducted to the food inside a metal cooking pot.</p>		<p>On sunny days, the asphalt will conduct heat. The asphalt will be hot to the touch.</p>	
<b>Conductors ▲</b>			

## ✓ Quick Check

**Cause and Effect** A metal object feels cooler than a wood object at room temperature. Why?

**Critical Thinking** How does a beach umbrella help keep you cool on a sunny day at the beach?

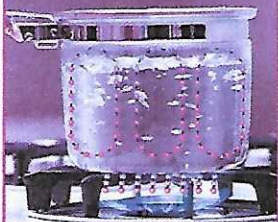


# Lesson Review

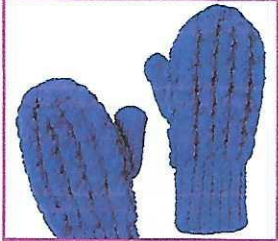
## Visual Summary



**Heat is** the flow of thermal energy from a warmer object to a cooler object.



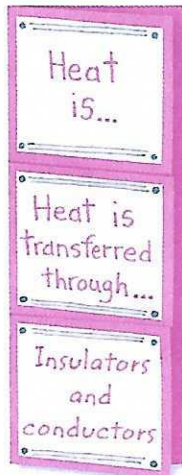
**Heat is transferred through** conduction, convection, and radiation.



**Insulators** are materials that do not transfer heat well. **Conductors** are materials that transfer heat well.

## Make a **FOLDABLES** Study Guide

Make a three-tab book. Use it to summarize what you learned about heat.



## Writing Link

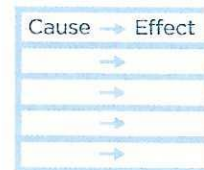
### Compare and Contrast

Write a paragraph comparing a metal cup and a foam cup. Which would you choose for a hot drink? A cold drink? Explain your choices.

## Think, Talk, and Write

1 **Vocabulary** The transfer of heat by objects that are touching is called \_\_\_\_\_.

2 **Cause and Effect** What happens when heat is transferred to ice? To liquid water? To air in a balloon?



3 **Critical Thinking** Explain why heat does not flow from an ice cube to a hot drink.

4 **Test Prep** Why are many pots and pans made of metal?

- A Metal is a good conductor.
- B Metal is a good insulator.
- C Metal is a good heat source.
- D Metal is a good radiator.

5 **Essential Question** How does heat flow?



## Art Link **Objective 2g**

### Heat Transfer Picture

Draw a picture that shows examples of the three ways that heat is transferred. Add labels and captions to your picture.



# Heat Energy WS #1

Name \_\_\_\_\_

1. \_\_\_\_\_ energy is the energy of the moving particles of matter.
2. Heat - \_\_\_\_\_  
\_\_\_\_\_
3. The \_\_\_\_\_ is Earth's main source of heat.
4. Inside Earth, it is very hot and this source of heat called \_\_\_\_\_.
5. When you rub your hands together you produce \_\_\_\_\_.  
Friction is another way to produce heat.
6. \_\_\_\_\_ is related to the thermal energy of the particles in a substance.  
Heating can change an object's temperature.
7. We measure temperature with a \_\_\_\_\_.
8. Water freezes at \_\_\_\_\_ F or \_\_\_\_\_ C.      Water boils at \_\_\_\_\_ F or \_\_\_\_\_ C.
9. Heat travels in three basic ways - \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_
10. **conduction** - \_\_\_\_\_  
\_\_\_\_\_
11. **convection** - \_\_\_\_\_  
\_\_\_\_\_
12. **radiation** - \_\_\_\_\_  
\_\_\_\_\_
13. **insulators** - \_\_\_\_\_  
\_\_\_\_\_
14. **conductor** - \_\_\_\_\_  
\_\_\_\_\_

# Heat Energy WS #2

Science

Name \_\_\_\_\_

Pages 318-319

1. \_\_\_\_\_ - a material that does not transfer heat easily.
2. \_\_\_\_\_ - a material that does transfer heat or electricity easily
3. In winter, you might wear a fleece jacket to stay warm. \_\_\_\_\_ is an insulator.
4. \_\_\_\_\_ is an insulator that many animals have in their bodies to keep warm.
5. \_\_\_\_\_ is a good conductor because heat travels through pots and pans easily.
6. Wood and plastic are good \_\_\_\_\_ because heat does not travel through them easily.
7. Warm coats and hats trap air against our bodies and keep us warm.  
Trapped air is a good \_\_\_\_\_.
8. \_\_\_\_\_ is the flow of thermal energy.
9. Metal is a good \_\_\_\_\_. Heat travels well through metals.
10. In order for conduction to occur, two objects must be \_\_\_\_\_.
11. When you hold a cup of hot chocolate, how does heat travel to your hands?  
a. conduction    b. convection    c. radiation
12. How does a sweatshirt keep you warm on a cold day? Sweatshirts are good \_\_\_\_\_ of heat.  
a. conductors    b. insulators



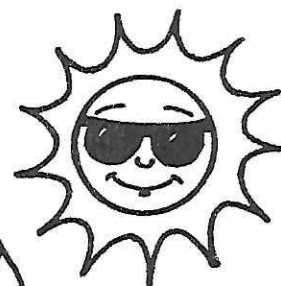
# Finding Out About Heat

Use this index to write the correct page numbers on the blanks below.

## Index

Celsius, Anders, 53	Natural gas, 25–26
Coal, how it is formed, 20–21	Petroleum, where it is found, 22; petroleum products, 24–26
Fahrenheit, Gabriel, 52–53	Sun, facts about, 8–11; protection from, 43–44
Fire, 12–19	Thermometers, kinds of, 52–53; uses of, 54–55
Fuels, 20–26	Wood, 35–38
Heat, sources of, 8–20; how it travels, 38–40; experiments, 60–61	

- Heat experiments are discussed on pages \_\_\_\_\_.
- Information on natural gas is on pages \_\_\_\_\_.
- Pages \_\_\_\_\_ tell how heat travels.
- Hints about protecting yourself from sunburn are on pages \_\_\_\_\_.
- Information about Gabriel Fahrenheit is on pages \_\_\_\_\_.
- The last page on which you will find something about fire is page \_\_\_\_\_.
- Facts about kinds of thermometers are on pages \_\_\_\_\_.
- To find out the sun's temperature, look at pages \_\_\_\_\_.
- You will find out about Anders Celsius on page \_\_\_\_\_.
- Facts about wood are found on pages \_\_\_\_\_.



**Try This!** Design a cover for a book in which this index might be found.

# Heat Energy WS #4

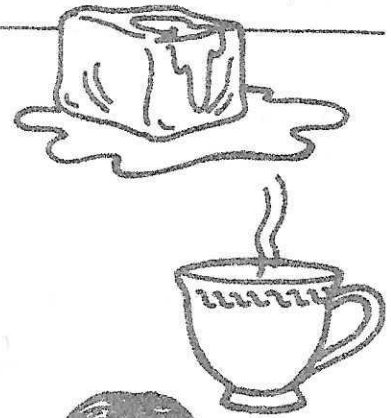
Name \_\_\_\_\_

Comprehension

## Heat Travels

Heat travels from a warmer object to a cooler one. If you touch an ice cube, the heat moves from your finger to the ice. If you leave your finger on the ice, the ice cube will begin to melt. Suppose you touch a hot cup of tea. The heat from the cup will go to your fingers. OUCH! The heat from a hot pan will go to your hands and burn them if you don't use potholders to pick it up.

The movement of heat through solid materials is called conduction. Some materials are better conductors than others. That means they allow heat to pass through more quickly and easily. Aluminum and copper are good conductors. Wood and plastic are poor conductors.



Write the answers.

1. Does heat travel from a cold object to a hot one or from a hot object to a cold one? \_\_\_\_\_

2. What happens to an ice cube when you touch it with your finger? \_\_\_\_\_

3. Why should you use potholders to pick up a hot pan? \_\_\_\_\_

4. What is the movement of heat through solid materials called? \_\_\_\_\_

5. Name two good conductors. \_\_\_\_\_

6. Name two poor conductors. \_\_\_\_\_



# Heat Energy WS #5

Heat –Cause & Effect

Name \_\_\_\_\_

**Thermal energy** is the energy of the moving particles of matter.

The faster the movement of particles, the greater the amount of thermal energy.

**Heat** is the movement of thermal energy from one object to another.

Heat always moves from warmer objects to cooler objects.

Identify Cause and Effect

*Directions:* Read the pairs of statements below. On the line next to each statement, write C if the statement is a cause and E if the statements is an effect.

<u>C</u>	1. Wood is burned in a fireplace.
<u>E</u>	Thermal energy is released.
_____	2. Carbon dioxide is formed.
_____	Carbon combines with oxygen.
_____	3. Solar panels can collect solar energy.
_____	Solar energy is given off by the sun.
_____	4. Thermal energy is released when coal is burned.
_____	People near the burning coal feel heat.
_____	5. A pan of water on the stove heats up.
_____	The burner on a stove is turned on.
_____	6. Thermal energy is given off as waste heat.
_____	A light bulb heats up when it is turned on.
_____	7. The person's body temperature rises.
_____	A person exercises for a half-hour.
_____	8. Ice cream in a dish absorbs thermal energy.
_____	The ice cream melts.

# Heat Energy WS #6

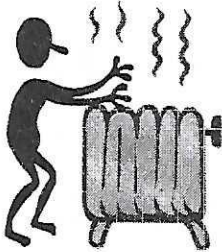
Name \_\_\_\_\_

Target: Classify heat transfer as conduction, convection or radiation. (knowledge)

## Energy Worksheet 2: Conduction, Convection and Radiation

In each of the following examples, identify whether heat is being transferred through conduction, convection or radiation. Some may have two possible answers. Choose the answer that best fits the situation.

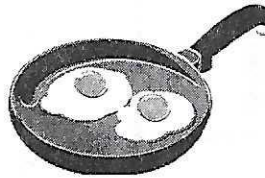
1)



Warming hand over  
a radiator.

\_\_\_\_\_

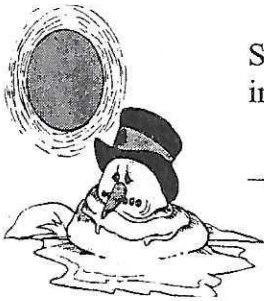
2)



Eggs cooking in  
a frying pan.

\_\_\_\_\_

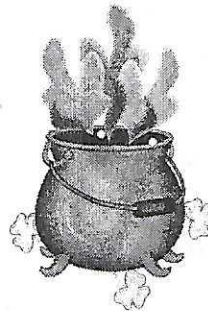
3)



Snowman melting  
in the sun.

\_\_\_\_\_

4)



Water boiling in  
in a kettle.

\_\_\_\_\_

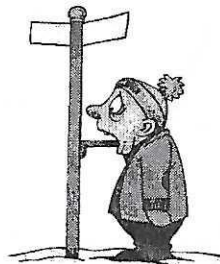
5)



Warmth from the  
fireplace circulating  
through the house.

\_\_\_\_\_

6)



Tongue freezing to  
to a metal pole.

\_\_\_\_\_

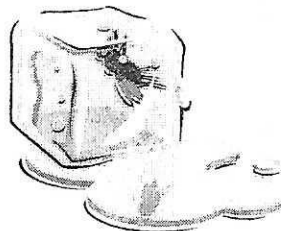
7)



Newt boiling in  
a hot cauldron.

\_\_\_\_\_

8)



Ice melting  
on a hotplate.

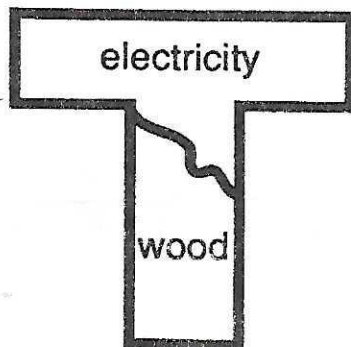
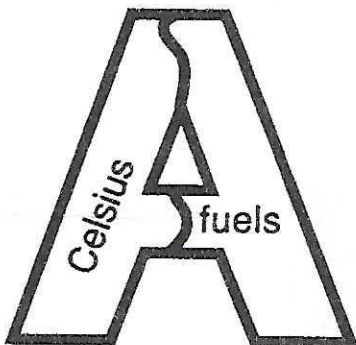
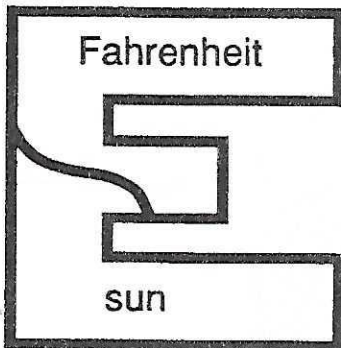
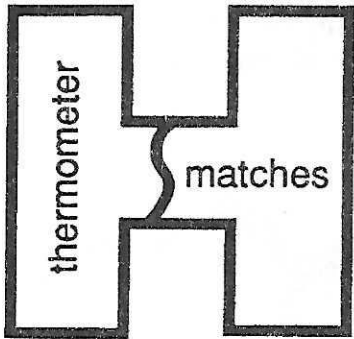
\_\_\_\_\_

Where is the heat coming from? Where is it going?



## Can You Take the Heat?

Use the words in the puzzle to answer the questions. Then color each space in the puzzle with the color given beside the question.



1. What star heats the earth? (yellow)

\_\_\_\_\_

2. What are coal and oil called? (green)

\_\_\_\_\_

3. What device measures temperature? (red)

\_\_\_\_\_

4. People long ago cut and burned this for heat and light. (orange)

\_\_\_\_\_

5. On this scale, the boiling point of water is 100 degrees. (green)

\_\_\_\_\_

6. Children should never play with these. (red)

\_\_\_\_\_

7. On this scale, the freezing point of water is 32 degrees. (yellow)

\_\_\_\_\_

8. This makes a toaster hot. (orange)

\_\_\_\_\_

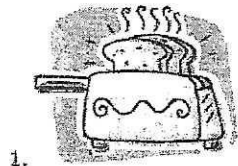
**Try This!** Make a poster showing five ways to cool off on a hot day.

## Heat Transfer Worksheet

Fill in the blanks using the correct form of heat transfer

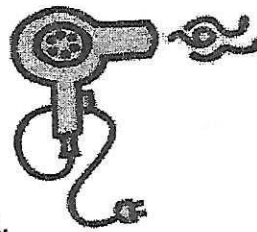
1. The transfer of heat through material by *direct* contact is CONDUCTION.
2. CONVECTION is the transfer of heat in a fluid (gas or liquid) as a result of the movement of the fluid itself.
3. What kind of heat transfer does the sun use? (hint: it transfers heat via electromagnetic waves through space). RADIATION

Identify the method of heat transfer that takes place in each illustration. Some illustrations may show more than one form of heat transfer.



1.

\_\_\_\_\_



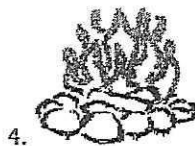
2.

\_\_\_\_\_



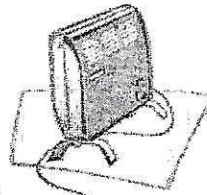
3.

\_\_\_\_\_



4.

\_\_\_\_\_



5.

\_\_\_\_\_



6.

\_\_\_\_\_



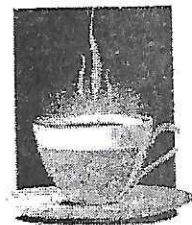
7.

\_\_\_\_\_



8.

\_\_\_\_\_



9.

\_\_\_\_\_



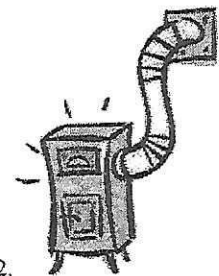
10.

\_\_\_\_\_



11.

\_\_\_\_\_



12.

\_\_\_\_\_



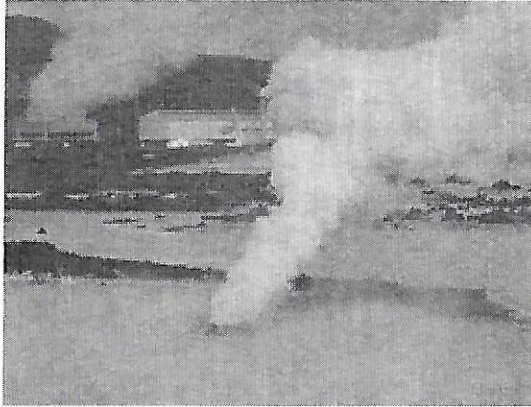


Name \_\_\_\_\_

## How Does Geothermal Energy Work?

By Cindy Grigg

Geothermal energy comes from the heat inside the Earth. People can use geothermal energy to heat and cool their homes and to make electricity. The Earth's heat is a clean energy source. It does not cause any pollution. It is also renewable energy. We can't use it up. But how does geothermal energy work?



Much of the Earth's heat comes from its core. It is still hot from when the Earth formed over four billion years ago. Heat from the core spreads outward through the earth's mantle, or middle layer. Inside the mantle, rocks are mostly in liquid form, called magma, melted by the Earth's internal heat. Magma heats the water under the ground. In some places, the hot water shoots to the surface in hot springs and geysers. This hot water can power geothermal energy systems.

Iceland is one place where geothermal energy is used to heat buildings and to grow food. That country has about 25 active volcanoes. Hot springs and geysers are common there, too. Water from hot springs is piped into buildings. The buildings are heated by the water passing through pipes and radiators instead of furnaces that burn coal, oil, or gas.

Greenhouses use geothermal energy where it is too cold to grow food outdoors. Inside the greenhouses, there are pipes full of hot water. Hot water is pumped up from underground and used to heat the greenhouses. The hot water warms both the soil and the air inside the structure. Greenhouses like this are used to grow food in Iceland, Hungary, Italy, and New Mexico.

Many homes in the U.S. are heated with geothermal heat pumps.

These use the stable temperatures found in the soil to even outside temperatures. Pipes are placed in the ground about ten feet below the surface near a building. At this depth, the soil temperature stays between 50 and 60 degrees, summer and winter. This means it stays warmer in the winter than the outside air. It stays cooler in the summer, too.

Heat pumps use this warmer or cooler temperature to heat homes in winter and cool them in summer. A liquid is pumped into the buried pipes. In winter, warmth from the ground warms the liquid in the pipes. An electric fan blows over the pipes to heat the rooms of the house. In the summer, the opposite happens. Hot air from inside the house is cooled under the ground. Then it is sent back into the house. The heat removed from the hotter, summer air can be used to heat water for bathing and washing dishes.

Geothermal heat pumps can keep buildings warm even when it is very cold outside. Many heat pumps are small enough to fit inside a home's basement.

Geothermal energy use is becoming more common in heating homes and buildings.

How Does Geothermal Energy Work?

### Questions

1. Where does geothermal energy come from?

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2. What are some good reasons to use geothermal energy?

- A. It is a clean energy source.
- B. It does not cause pollution.
- C. It is renewable energy. We can't use it up.
- D. all of the above





# Heat Energy WS #11



Name \_\_\_\_\_

Date \_\_\_\_\_

(Key # 2 - 298654)

## Energy

Find each of the following words.

WASTEHEAT  
KINETIC  
MOTION  
TEMPERATURE  
FORCE  
RADIATION

ELECTRICITY  
INSULATOR  
THERMAL ENERGY  
FUEL  
GASES  
HEAT

SUNSHINE  
PARTICLES  
CONDUCTION  
ENERGY  
INFRARED  
LIGHT

A Y C T E M P E R A T U R E P  
R E T O O E H O U T A A U E T  
W R L I N H N R E O F S E O T  
A T P U C D O E D G L E E H T  
S F U E L I U E G H I S N C R  
T N C U T O R C I Y G A I I A  
E L N O E A L T T T H G H T R  
H M M N R F O R C I T L S E M  
E O E F Y G R E N E O S N N E  
A T N I N R A R E D L N U I A  
T I R A D I A T I O N E S K I  
N O T H E R M A L E N E R G Y  
I N S U L A T O R E C R O F N  
T E O S A G S E L C I T R A P  
H E E U P R A O K I N G E E A