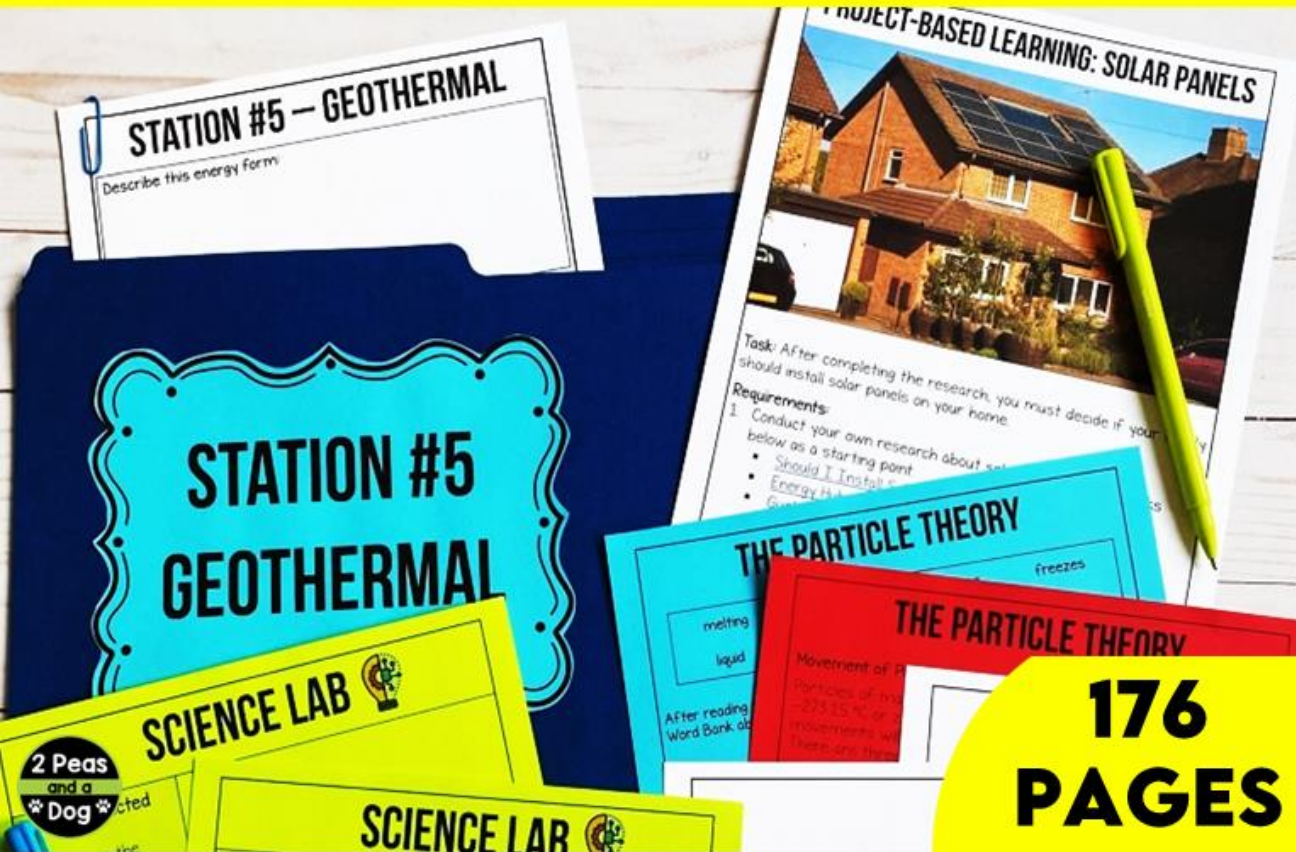


# HEAT IN THE ENVIRONMENT

**PDF & DIGITAL FORMATS**



  
**2 Peas and a Dog**

Middle School Teaching Resources

## RESOURCE INCLUDES

- ✓ Ontario Curriculum Aligned
- ✓ Detailed Lesson Plans
- ✓ Readings, Videos, Graphic Organizers, Group Work, Projects, Rubrics
- ✓ Hands-On Science Labs
- ✓ MP3 Audio Files
- ✓ Answer Keys
- ✓ Quizzes & Unit Test
- ✓ Print & Digital Formats

# INCLUDED LESSONS



- Introduction: Safety Rules & Unit Vocabulary
- Introduction to Heat
- Heat Production
- Heat and Temperature
- The Particle Theory
- Heat and Volume
- Conduction, Convection, and Radiation
- Bill Nye Video – Heat
- Boiling Water in a Paper Cup – Teacher Demonstration

- Lab – Melting Ice Cubes
- Heating and Cooling of the Earth
- Greenhouse Gases
- Investigation – Benefits of Technologies With Heat
- Conventional and Alternate Forms of Energy – Energy Types & Solar Panels
- Heat Unit Test

# UNIT ORGANIZATION

## GRADE 7 HEAT ONTARIO CURRICULUM ALIGNMENT

Lesson	2007 Curriculum	2022 Curriculum
Introduction: Safety Rules & Vocabulary	2.1, 2.5	A1.4, A1.5
1. Introduction to Heat	Review	Review
2. Heat Production	3.2	E2.2
3. Heat and Temperature	Review	Review
4. The Particle Theory	3.1	E2.1
5. Heat and Volume	3.3	E2.3
6A. Conduction, Convection, and Radiation	3.4, 3.5, 3.6	E2.4, E2.5, E2.6
6B. Bill Nye Video	Review	Review
7. Boiling Water in a Paper Cup	2.1, 2.2, 2.4, 3.4, 3.5, 3.6	A1.2, A1.4, E2.4, E2.5, E2.6
8. Melting Ice Cubes	2.1, 2.2, 2.4, 3.4, 3.5, 3.6	A1.2, A1.4, E2.4, E2.5, E2.6
9. Heating and Cooling of the Earth	3.7	E2.7
10. Greenhouse Gases	2.6, 3.8	A1.5, E2.8

## CURRICULUM ALIGNMENT

## LESSON OVERVIEW



Lesson	Activity Type	Name	Suggested Time
Intro	Class Discussion	Safety Lesson	1 – 2 classes
	QR Code Scavenger Hunt	Unit Vocabulary	
#1	Whole Class Brainstorm	Introduction To Heat	0.5 - 1 class
#2	Whole Class Reading	Heat Production	1 class
#3	Whole Class Readings & Matching Activity	Heat and Temperature	1 class
#4	Whole Class Readings & Fill in the Blanks Activity	The Particle Theory	1 – 2 classes
#5	Whole Class Readings & Graphic Organizer	Heat and Volume	1 – 2 classes
#6A	Whole Class Readings, Questions & Labelling	Conduction, Convection and Radiation	1 – 2 classes

## UNIT PLAN

## INTRODUCTION



### Unit Vocabulary

**Lesson Overview:**  
Students will work on reviewing vocabulary for this unit.

- Materials Needed:**
- Photocopy a class set or use the provided Google Slides version:
    - Vocabulary sheets (QR Code or Non-QR Code option)
    - Vocabulary graphic organizer
    - Definitions (For IEP and ESL students)
    - Definitions Google Slides
    - Devices for scanning QR codes (phones or tablets)

- Teacher Instructions:**
- Post the vocabulary words up around the classroom or the hallway using the QR code or the non-QR code format.
  - Divide the class up into groups of 4.
  - Have students walk around the classroom or out in the hallway and find the vocabulary sheets. Students need to scan the QR code with their devices to uncover the mystery word. Once they have uncovered the mystery word, have them write it on the vocabulary graphic organizer.
  - This activity can be used as a review of the Google Slides definitions.
  - Once the definitions are found, have students write the definitions on the vocabulary graphic organizer.

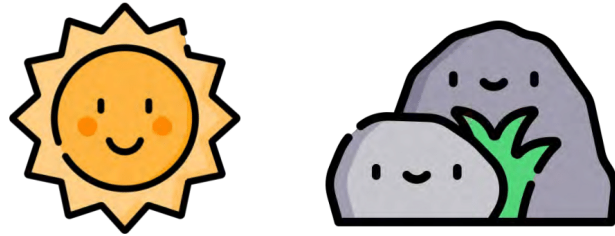
## LESSON PLANS



# WHAT'S INSIDE?



## CONDUCTION, CONVECTION, AND RADIATION



### Conductors and Insulators

The conduction of heat will depend on many factors, including the physical properties of the materials. Some objects conduct heat faster while others are slower. Materials that are good in transferring heat energy are called thermal conductors. Metals are good conductors. Most cookware, like pots are made from metals such as copper, iron, and aluminum which are good conductors of heat.

Insulators are materials that are poor conductors of heat. People have been using insulators for a long time to keep the heat. For example, wool is a good insulator. This traps the heat and protects the body from the cold.

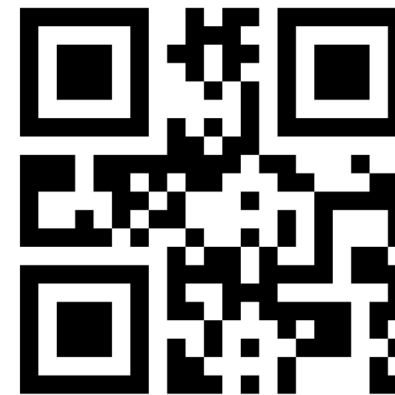
Insulators protect objects or people from the heat. For example, since insulators absorb heat poorly, they are often used for handles of cooking pots and ovens to protect your hand from extreme heat. These handles are made of plastic, rubber, or wood that are good insulators.

### Heat Conduction in Nature

The sun is one of the major sources of heat on the planet. Sunlight heats the ground during the daylight period and then interacts with objects around it. When you walk barefoot in your driveway you will feel the heat from the ground. The earth's core is estimated to be around 7000°C. Heat from the core is conducted through matter in the upper layers. The rocks inside the earth are continuously being heated. When rock is heated between 625°C and 1200 °C it can turn into liquid magma and when it is cooled it turns into igneous rocks.

## SCIENCE VOCABULARY WORD #1

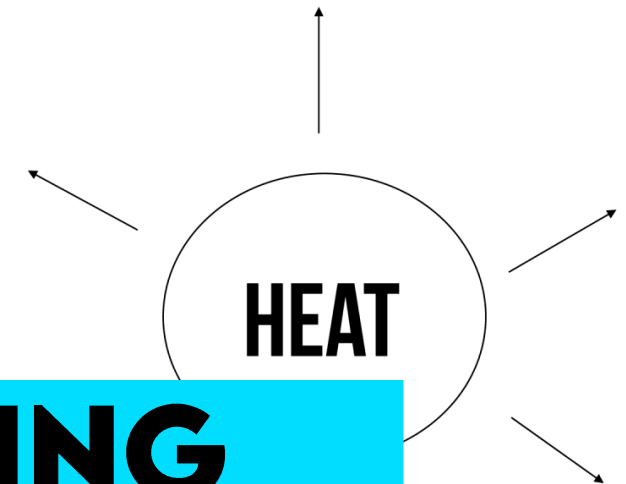
Using a phone or a tablet, scan the QR code below to find the hidden word.



## ENGAGING ACTIVITIES

## HEAT BRAINSTORM ACTIVITY

What do you think of when the word "Heat" is said?  
Brainstorm your ideas below.






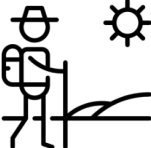





# WHAT'S INSIDE?

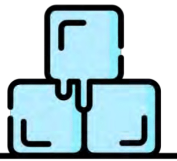


## BILL NYE: SAMPLE ANSWERS

List the three types of heat transfers.	<ul style="list-style-type: none"><li>• conduction</li><li>• convection</li><li>• radiation</li></ul>
How does the molecules in cold substances differ from the molecules in hot substances?	<ul style="list-style-type: none"><li>• molecules move more slowly than in hot substances</li></ul>
Describe natural convection.	
Give one example of heat conduction, convection, and radiation that you saw in the video.	<ul style="list-style-type: none"><li>• Conduction: A metal spoon in a hot liquid.</li><li>• Convection: A hot air balloon rising.</li><li>• Radiation: The sun warming the Earth.</li></ul>

ANSWER KEY		
Microwave Oven  RADIATION	Rubbing hands together  CONDUCTION	Ocean currents  CONVECTION
 CONDUCTION	 CONDUCTION	Hot summer day  RADIATION
Hot cup of coffee  CONVECTION	Fire  RADIATION	Boiling water in a kettle  CONVECTION

## HOW TO MELT AN ICE CUBE THE FASTEST



### PROJECT-BASED LEARNING: SOLAR PANELS



**Task:** After completing the research, you must decide if your family should install solar panels on your home.

**Requirements:**

1. Conduct research on the pros and cons of solar panels.
2. Write down key information on the solar panel notes sheet.
3. Use the information from your research to inform your decision.
4. In your written response, use specific details from the websites to help inform you with your decision and thinking.

method to melt an ice cube (with no hands).

of your plan for the lab using the organizer provided by your teacher. teacher, you may begin bringing in for your experiment. Note: If you do any please do not forget to provide a list of

periment, make sure you record the data a chart/table listing the initial time and took to melt your ice cube.

Initial Time	Final Time

conclusion section of the graphic provided questions.

a final copy of your lab, make sure you list the materials, (10).

## LABS & INVESTIGATIONS

# TEACHER FEEDBACK

“This is a terrific, hands-on, research driven unit that is completely aligned with our Ontario Curriculum. It’s so easy to use...students are engaged and happy not to use a 10 year old text! Thanks for creating and sharing.”

– Nancy D.

# INTRODUCTION



## SCIENCE SAFETY RULES



### SAFETY RULES QUIZ

Complete the following true/false questions on safety:

1. LISTEN		
✓ To ALL the teacher's	1. When you clean-up, wash your hands with water.	T F
✓ Know the location of		
2. ATTIRE		
✓ Wear safety goggles	2. Before you begin, you must listen to ALL the	T F
✓ Tie-up any loose ite	teacher's instructions.	
✓ Wear closed toe, co	3. Remember to tie-up any loose items (e.g. hair,	T F
	clothing, jewellery, etc.).	
3. READ CAREFULLY		
✓ Any labels of c	4. Remember to clean up your work area and lab space room.	T F
symbols)	5. Know where the fire extinguisher and first aid kit are located	T F
✓ The procedure		
4. TOOLS		
✓ Handle all tools with c	6. Do not use tools unless you are properly trained to make it	T F
✓ Inform the teacher	7. Handle all tools with care, especially sharp objects.	T F
there is a spill		
✓ Do not taste test any	8. Wear open toe shoes and use gloves/goggles as	T F
	needed.	
5. CLEAN-UP		
✓ Thoroughly wash all u	9. Read labels on chemicals used carefully (e.g., WHMIS	T F
✓ Wash hands with soa	symbols).	
	10. Do not tell the teacher if there is a spill or if an item	T F
	is broken/faulty.	

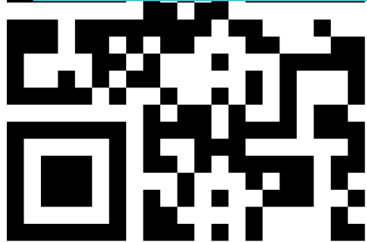
SCIENCE  
SAFETY

## SCIENCE VOCABULARY

### SCIENCE VOCABULARY WORD #1

Using a phone or a tablet, scan the QR code below to find the hidden word.

UNIT  
VOCABULARY





# LESSON 1 & 2



## LESSON #1

Intro

### HEAT BRAINSTORM ACTIVITY

What do you think of when the word "Heat" is said?  
Brainstorm your ideas below.

## INTRODUCTION TO HEAT

Lesson Overview:  
Students will brainstorm ideas

Materials Needed:

- Photocopy a class set of the Heat Brainstorm

Teacher Instructions:

1. Divide the class up into pairs for the activity individually.
2. Explain the importance of the activity.
3. At the end of the activity, share the ideas. Students will vote on the ideas that are most effective.

## HEAT PRODUCTION



### HEAT PRODUCTION EXAMPLES

HEAT PRODUCTION ACTIVITY	EXAMPLES OF HEAT BEING PRODUCED
SUNLIGHT	
FRICTION	
ELECTRICITY	
BURNING OF FOSSIL FUELS	
PHYSICAL ACTIVITY	

electrons, atoms) collide and produce heat and electrical energy. For example, a light bulb. When you turn it on for a few minutes, you will notice it gets hot. In the same manner, when you rub your hands together, you will generate heat that will toast your hands.

Heat is the burning of fossil fuels. The heat produced from the burning of fossil fuels comes from the burning of the components of fossil fuels. For example, when you burn wood, the heat produced is used to cook food. During this process, the heat is transferred to the food.

Heat is the temperature of an object. When the temperature of an object increases, the molecules move faster. For example, when you exercise, your muscles work, and the heat produced is distributed to all parts of your body. You will have the same temperature throughout your body.

Heat is the temperature of an object. When the temperature of an object increases, the molecules move faster. For example, when you exercise, your muscles work, and the heat produced is distributed to all parts of your body. You will have the same temperature throughout your body.



# LESSON 3 & 4

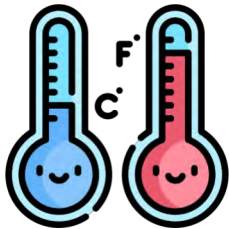


## HEAT VS. TEMPERATURE



### TEMPERATURE MATCHING ACTIVITY

Match the temperatures to the answers on the left.



Temperature of water when taking a shower

A. 0°C

B. 37°C to 38°C

C. 100°C

Freshly made hot chocolate

D. 40°C to 45°C

Body temperature

E. 18°C to 22°C

Ice

F. -5°C to 0°C

Boiling water

G. 70°C to 90°C

## HEAT AND TEMPERATURE

**Heat**  
Heat is thermal energy transferred from one object to another.  
Heat is measured in Joules.

**Temperature**  
Temperature measures the average kinetic energy of the particles in a substance.  
This is measured in degrees Celsius (°C) or degrees Fahrenheit (°F).

**Did you know?**  
• When you add heat, the temperature of a substance increases.  
• When you lose heat, the temperature of a substance decreases.

**Important Temperature Points**

- Room Temperature: 20°C to 25°C
- Water Freezing Point: 0°C
- Water Boiling Point: 100°C
- Average Body Temperature: 37°C

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## THE PARTICLE THEORY



### THE PARTICLE THEORY

melting	solid	condenses	freezes
liquid	matter	boiling	gas

After reading the article, fill in the blanks with the correct word from the Word Bank above:

- All \_\_\_\_\_ is made up of particles.
- When heat is removed from a gas it \_\_\_\_\_ into a liquid.
- When heat is added to a liquid, it \_\_\_\_\_ into a gas.
- Particles that form a rigid shape are in the form of a \_\_\_\_\_.
- When heat is added to a solid, it \_\_\_\_\_ into a liquid.
- When heat is removed from a liquid it \_\_\_\_\_ into a solid.
- Particles that form a rigid shape are in the form of a \_\_\_\_\_.

## THE PARTICLE THEORY

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The Particle Theory of Matter or small particles. These tiny particles

When two or more atoms combine to form a molecule. The most common elements are oxygen and hydrogen, they will form water.

atoms. For example, the element oxygen, on the other hand, has a different kind of arrangement. It is made up of two oxygen atoms.

moving. Particles of a solid constantly vibrate, but they are not free to move. Particles of a liquid have more freedom of movement. In comparison, particles of a gas are farthest apart and move most freely.

Particles of a solid are tightly packed together. Particles of a liquid have some space between them. Particles of a gas are farthest apart and move most freely.

Attractive degree of force called intermolecular attraction is the force of attraction between particles. In a solid, the particles are very close to each other. In a liquid, the particles are slightly farther apart. In a gas, the particles are very far apart.

and behave differently. As these particles move faster and bump into each other, they transfer energy.

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# LESSON 6A & 6B



## CONDUCTION, CONVECTION, AND RADIATION



### CONDUCTION, CONVECTION, AND RADIATION QUIZ

For each example, write the corresponding letter (e.g., a, b, c, etc.) into the correct spot in the table (Conduction, Convection, Radiation).

## CONDUCTION, CONVECTION, AND RADIATION

Conductors are materials that allow heat to pass through them easily. The conduction properties of materials are slow, and they are made of materials that are good conductors. Insulators are materials that do not allow heat to pass through them easily. They have been used for many years, for example, in the form of wool. This traps the heat and protects the body from the cold. Insulators are used in many places, for example, in pots and ovens to protect your hands from the heat. They are made of plastic, rubber, or wood.

**Heat Conduction in Nature**  
The sun is one of the major sources of heat on the ground during the daylight hours. When you walk barefoot in the sun, you feel the heat. The earth's core is extremely hot. The heat from the core is conducted through the mantle and crust. The earth's core is continuously being heated by the sun and 1200 °C it can turn into liquid. Igneous rocks are formed from the molten material.

J. Heat from a light bulb.

CONDUCTION	CONVECTION	RADIATION

## LESSON #6B



### BILL NYE: HEAT QUESTIONS

List the three types of heat transfers.	
How do the molecules in a cold substance differ from the molecules in a hot substance?	
Describe what natural convection is.	
Give one example of heat conduction, convection, and radiation that you saw in the video.	

## BILL NYE HEAT VIDEO

Watch a Bill Nye video. [Bill Nye the Science Guy - S02E10 Heat](#)  
Use the provided digital version of the worksheet to take notes. [Bill Nye the Science Guy - S02E10 Heat](#)  
Watch the video and take notes. [Bill Nye the Science Guy - S02E10 Heat](#)  
Share their answers in a class discussion to ensure they understood the concepts.

# LESSON 7 & 8



## LESSON #7



Teacher Lab: Boiling Water in a Paper Cup

**Lesson Overview:**  
Students will learn how heat gets transferred by conduction, convection, and radiation through a demonstration.

**Materials Needed:**

- Paper cups (not white)
- Heat Source (candle)

## LESSON #7



Teacher Lab: Boiling Water in a Paper Cup

**Teacher Instructions:**

7. If you are not comfortable using fire in your classroom, show these two videos instead.

# BOILING WATER IN A PAPER CUP TEACHER DEMONSTRATION

- Tea
1. What do you think will happen?
  2. Start your heat source, and observe what happens.
  3. Does not allow the paper cup to burn.
  4. Measure the temperature of the water.
  5. Measure the temperature of the water source. Try to get the water to boil.
  6. Measure the temperature of the water source. Try to get the water to boil.

or at home. Ensure all school safety protocol is followed if completing this lab.

## HOW TO MELT AN ICE CUBE THE FASTEST

### SCIENCE LAB

#### Hypothesis

What do you think will happen in your lab?

#### Materials

List all materials used to complete this lab.

\*Needs to be approved by your teacher\*

#### Procedure

List the steps you will follow to complete this lab.

\*Needs to be approved by your teacher\*

# LAB - MELTING ICE CUBES

Put an ice cube (with no hands)

using the teacher. bringing in If you do any provide a list of

sure you record the data testing the initial time and your ice cube.

Final Time

tion of the graphic tions. of your lab, make sure you esis, list of materials, on/results).



# HEATING AND COOLING OF THE EARTH



# HEATING AND COOLING OF THE EARTH

The temperature of the earth's surface is mainly dependent on heat coming from the sun. During the day, the sun heats the surface and at night

When it reaches the earth's surface, it is absorbed. The earth's surface absorbs the sun's radiation. Some of this energy is lost to clouds, ice, snow, ocean

Earth's atmosphere and does not stay permanently up, they will emit to space. The release of the temperature more too hot for living

the atmosphere due to  
are methane, carbon  
and warm the earth's

A high concentration of these greenhouse gases such as methane and carbon dioxide increases the temperature in the atmosphere. They restrict the outward passage of heat energy resulting in global warming. Excess heat cannot go out into space because some of the infrared radiation is being blocked by greenhouse gases resulting in global climate change. The increasing greenhouse gases and rising sea levels will have a negative impact on the planet and all living things.

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Greenhouse gases in the atmosphere like carbon dioxide, methane, and water vapor trap infrared radiation emitted by the earth's surface,

Task:

Research one possible solution to help combat global warming and present the information to the class.

Process:

- # GREENHOUSE GAS

presentation, infographic). Your teacher must approve your method of presentation once you have decided.

5. Create your presentation. Reference the rubric to ensure all requirements have been met.
6. Present your presentation on the assigned due date.

Due Date: \_\_\_\_\_

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help regulate the earth's greenhouse effect, the planet will freeze and will be covered by ice. But in the next century, these greenhouse gases are now causing global warming. These gases include Carbon Dioxide,

he atmosphere and forms  
oxide caused by human  
p global warming and accounts

Projected to increase due to the majority of the fuel used by pipeline and diesel. Electricity carbon dioxide emissions from residential and commercial buildings, from heating, cooking,

absorbed by plants,  
the balance has been  
for human activities.

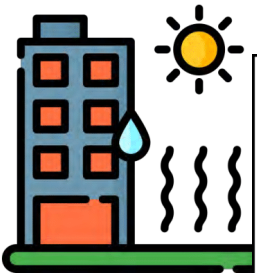
al greenhouse emissions but  
ed gases come from  
ial processes. Unlike other  
es. Fluorinated gas like  
in the atmosphere, but some  
ears.

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# LESSON 11 & 12



## TECHNOLOGIES THAT REDUCE HEAT LOSS



### ENERGY-EFFICIENT BUILDINGS

What is this topic? Explain.

Why are technologies that r  
For both the society and the  
keep heat in. This is because  
sustain  
sure o  
techno  
Techn  
For ex  
keep t  
insulat  
to kee  
keep h  
comfo  
tempe  
less in  
also visually appealing. Finally  
for the environment and mo  
pass through the buildings. T  
stay more comfortable and  
of greenhouse emission on

© http

## STATION #5 – GEOTHERMAL

Describe this energy form:

### PROJECT-BASED LEARNING: SOLAR PANELS



DISADVANTAGES

Task: After  
should ins

Requireme

1. Conduct  
below
  - [Sh](#)
  - [En](#)
  - [Gu](#)
  - [Is it worth it installing solar panels in Ontario?](#)
2. Write down key information on the solar panel notes sheet.
3. Use the information from your research to inform your decision.
4. In your written response, use specific details from the websites to help inform you with your decision and thinking.

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## INVESTIGATION – BENEFITS OF TECHNOLOGIES WITH HEAT

## ENERGY TYPES & SOLAR PANELS INVESTIGATION

# LESSON 13



UNIT TEST

/20

Name: \_\_\_\_\_ Class: \_\_\_\_\_

Multiple Choice: Select the correct answer.

1. Which type of heat is transferred by radiation and light for living organisms?  
a) Friction  
b) Sunlight  
c) Electricity  
d) Fossil Fuels

2. Which unit is used to measure temperature?  
a) Celsius  
b) Fahrenheit  
c) Joules  
d) Watts

3. Temperature is a measure of  
a) The amount of heat energy  
b) The amount of heat that is transferred  
c) The amount of thermal energy  
d) The amount of matter

4. Which of the following temperatures is closest to the freezing point of water?  
a) 18°C  
b) 0°C  
c) 37.5°C  
d) 100°C

UNIT TEST

Name: \_\_\_\_\_ Class: \_\_\_\_\_

True or False: Read the following statements. Then circle if the statement is true or false.

5. Heat is a form of energy. T F

6. Temperature is a measure of the average kinetic energy of the particles in a substance. T F

7. Heat always flows from a warmer object to a cooler object. T F

8. The greenhouse effect is caused by the trapping of heat by the atmosphere. T F

9. The greenhouse effect is caused by the trapping of heat by the Earth's surface. T F

10. The greenhouse effect is caused by the trapping of heat by the greenhouse gases. T F

11. The greenhouse effect is caused by the trapping of heat by the water vapor. T F

12. The greenhouse effect is caused by the trapping of heat by the carbon dioxide. T F

13. The greenhouse effect is caused by the trapping of heat by the methane. T F

14. The greenhouse effect is caused by the trapping of heat by the nitrous oxide. T F

15. The greenhouse effect is caused by the trapping of heat by the ozone. T F

16. The greenhouse effect is caused by the trapping of heat by the water. T F

17. The greenhouse effect is caused by the trapping of heat by the soil. T F

18. When a liquid becomes a gas, it vaporizes. T F

19. The greenhouse effect refers to the cooling of the atmosphere. T F

20. Molecules in cold substances move faster than those in hot substances. T F

HEAT IN THE ENVIRONMENT

UNIT TEST

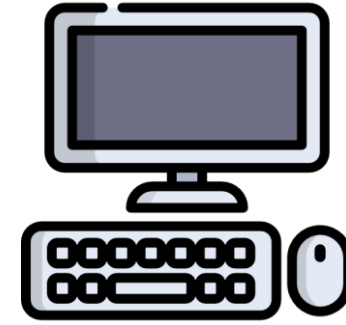
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# LESSON FORMATS



**PDF**

✓ Individual & Whole Unit



**DIGITAL**

✓ Google Slides

**RESOURCE CAN BE USED IN-PERSON OR ONLINE**