

# THERMAL ENERGY

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## Introduction

If you are new to the idea of using a Science Interactive Notebook in your classroom, stop by my Nitty Gritty Science shop and download my Intro to Science Interactive Notebooks tutorial for FREE! In there you will find tips on how to begin with your students, what materials to have on hand and, most importantly, how it will enhance your students learning through reflection and creativity.

## Focused Lessons with Differentiated Instruction

The lessons shared on the following pages cover National Science Standards and meet students' needs. I have given you the notes that I would give my students (Right Side - Input Side of Notebook) so you can understand what I'm having the students focus on when working on their creative assignments (Left Side - Output Side of Notebook). Each lesson focuses on a Question of the Day (QOD) represented in red in the top margin of each "Input" page with the student giving an answer in red on "Output" page.

## Left Side - Output

Instructions for each Output Side are included. This includes cut-outs, foldables or master copies where applicable. You may find that students work slow at first, but once groups are organized and students know what is expected from them, not only will you see more energy focused on the final product, but also you will be shocked at the level of creativity certain students have in certain areas.

## Mini-Assessments

Mini quizzes will be given for each section so you may monitor student's level of understanding. For reproduction purposes, there are two quizzes to a page so you can cut them in half and save on some paper 😊

# Section 1: Temperature and Heat

## Kinetic Energy

Directions: Complete the following data table and description. Paste into Science Interactive Notebook.

Time	Data Table: Kinetic Energy of Water Beaker A	Beaker B	Observations
Immediately after drop of Food coloring (0 minutes)			Food coloring moved very fast in Beaker B
1 minute			Beaker B - molecules of color moved throughout entire container
2 minutes			Both Beakers are fully colored - A has lighter color with drop at bottom

Conclusion: Describe the results of your experiment making sure to use the following vocabulary words in your description of each beaker: water molecules, kinetic energy, temperature.

Beaker B - with higher temp have faster moving molecules, therefore it has higher kinetic energy. Since water molecules are moving faster, they will collide more often with food coloring molecules making them move faster. The thermal energy of the food coloring molecules increased as soon as their kinetic energy increased.

**Question:**

### TEMPERATURE AND HEAT

**Temperature** - a measure of the average value of the kinetic energy of the molecules in random motion. (SI unit for temperature is Kelvin (K)).

**Thermal expansion** - almost all substances expand when they are heated and contract when they are cooled - exception water

**Thermal energy** - sum of the kinetic and potential energy of all the particles in an object; thermal energy of an object increases as temperature increases

Temperature Conversion Equations

$$^{\circ}\text{F} \rightarrow ^{\circ}\text{C}$$

$$^{\circ}\text{C} = \left(\frac{5}{9}\right)(^{\circ}\text{F} - 32)$$

$$^{\circ}\text{C} \rightarrow ^{\circ}\text{F}$$

$$^{\circ}\text{F} = \left(\frac{9}{5}\right)(^{\circ}\text{C}) + 32$$

**Heat** - thermal energy that flows from something at a higher temperature to something at a lower temp.

**Specific heat** - amt of heat needed to raise the temp of 1 kg of some material by 1 $^{\circ}\text{C}$

Thermal Energy Equation

(Q) change in thermal energy (J) = mass (kg) x  $\Delta$  temp ( $^{\circ}\text{C}$ ) x (c) Specific heat (J/kg $^{\circ}\text{C}$ )

$$Q = m(T_f - T_i)C$$

Specific Heat of Common Materials	
Substance	Spec. Heat (J/(kg $^{\circ}\text{C}$ ))
Water	4,184
Wood	1,760
Carbon	710
Glass	664
Iron	450

## Instructions:

Students will get a quick and effective visual of thermal energy with this activity in which they compare the movement of food coloring in either hot or cold water. To save equipment and clean-up time, I've included two different variations of this activity so you can give a different version to members of a group.

I have included the direction sheet (Version I - Ice, Ice, Baby and Version 2 - Too Hot to Handle), student data table, teacher preparation for the activity and a mini-quiz.

MULTIPLE LEARNING STYLES ADDRESSED WITH ORIGINAL ACTIVITIES - NO REPEATS!

Name \_\_\_\_\_ Date \_\_\_\_\_

### Quiz: Temperature and Heat

#### Matching

- |                            |   |
|----------------------------|---|
| _____ 1. Temperature       | a. SI unit for temperature  |
| _____ 2. Thermal expansion | b. sum of the kinetic energy and potential energy of all the particles in an object                     |
| _____ 3. Kinetic energy    | c. amount of heat needed to raise the temperature of 1 kg of some material by 1 °C                      |
| _____ 4. Kelvin            | d. occurs in metals when they are heated  |
| _____ 5. Thermal energy    | e. energy an object has due to its motion   |
| _____ 6. Heat              | f. measure of the average value of kinetic energy of molecules in random motion                         |
| _____ 7. Specific heat     | g. thermal energy that flows from something at a higher temperature to something at a lower temperature |

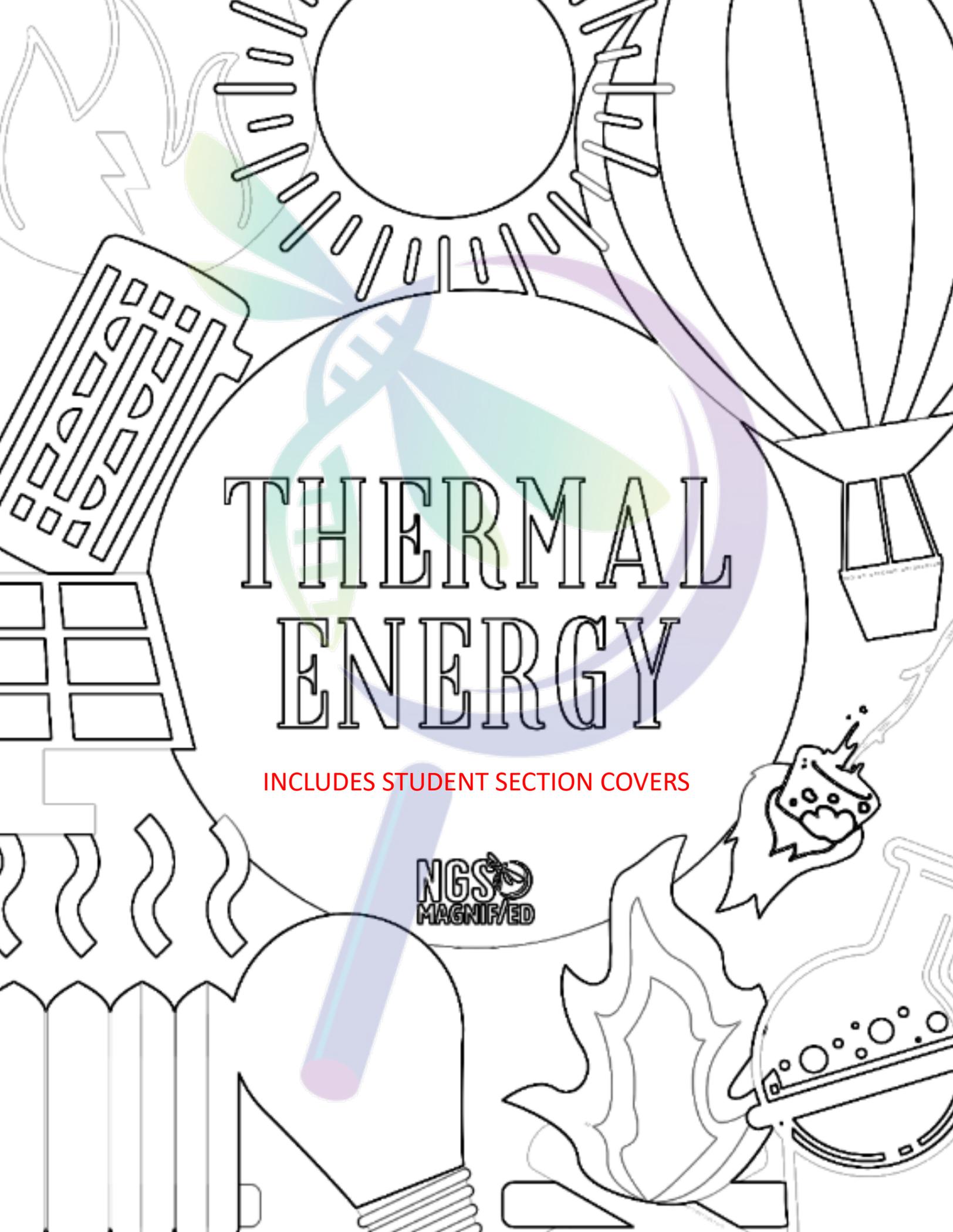
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**MINI QUIZZES INCLUDED FOR EACH SECTION**  
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Name \_\_\_\_\_ Date \_\_\_\_\_

### Quiz: Temperature and Heat

#### Matching

- |                            |   |
|----------------------------|---|
| _____ 1. Temperature       | a. SI unit for temperature  |
| _____ 2. Thermal expansion | b. sum of the kinetic energy and potential energy of all the particles in an object                     |
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| _____ 6. Heat              | f. measure of the average value of kinetic energy of molecules in random motion                         |
| _____ 7. Specific heat     | g. thermal energy that flows from something at a higher temperature to something at a lower temperature |

The cover art features a central sun with rays, a hot air balloon on the right, a lightbulb at the bottom, and a flame on the right. On the left, there are stylized buildings and a grid pattern. The background is white with faint, overlapping circular patterns in shades of green and purple. The title 'THERMAL ENERGY' is centered in a large, outlined, serif font.

# THERMAL ENERGY

INCLUDES STUDENT SECTION COVERS

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Question: What happens to particles when heated?

## TEMPERATURE AND HEAT

**Temperature** - a measure of the average value of the kinetic energy of the molecules in random motion. (SI Unit for temperature is Kelvin {K})

**Thermal expansion** - almost all substances expand when they are heated and contract when they are cooled; water is an exception

**Thermal energy** - sum of the kinetic and potential energy of all the particles in an object; thermal energy of an object increases as temperature increases

### Temperature Conversion Equations

$^{\circ}\text{F} \rightarrow ^{\circ}\text{C}$	$^{\circ}\text{C} \rightarrow ^{\circ}\text{F}$
$^{\circ}\text{C} = (5/9)(^{\circ}\text{F} - 32)$	$^{\circ}\text{F} = (9/5)(^{\circ}\text{C}) + 32$

**Heat** - thermal energy that flows from something at a higher temperature to something at a lower temperature

**Specific heat** - amt of heat needed to raise the temp of 1 kg of some material by 1°C

### Specific Heat of Common Materials

	Substance	Spec. Heat (J/(kg°C))
<p><b>Thermal Energy Equation</b></p> <p>(Q) Change in thermal energy (J) =                      Mass (kg) x <math>\Delta</math>temp (°C) x                      (c) Specific heat (J/kg °C)</p> <p><math>Q = m (T_f - T_i) C</math></p>	Water	4,184
	Wood	1,760
	Carbon	710
	Glass	664
	Iron	450



Thank you for sharing NGS Magnified with your students!

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