

S8P2: Students will be familiar with the forms and transformations of energy.

- d. **Describe how heat can be transferred through matter by the collisions of atoms (conduction) or through space (radiation). In a liquid or gas, currents will facilitate the transfer of heat (convection).**

Use the terms to make a crossword puzzle due by

Terms to learn: temperature, Fahrenheit scale, Celsius scale, Kelvin scale, absolute zero, heat, specific heat, conduction, convection, convection current, radiation, conductor, insulator

Notes: **Part I - Temperature and Thermal Energy**

Essential Question: How is heat transferred through matter by collisions of atoms or through space?

Agree or Disagree: Write A if you agree and D if you disagree by the following statements.

- 1. Temperature depends on the kinetic energy of the molecules in a material. ____
- 2. Heat engines can convert energy from one form to another. ____
- 3. Objects cannot have a temperature below zero on the Celsius scale. ____
- 4. In a refrigerator, the coolant gas gets cooler as it is compressed. ____
- 5. A conductor is any material that easily transfers thermal energy. ____
- 6. Energy is created by an engine. ____
- 7. Thermal energy from the Sun reaches Earth by conduction through space. ____
- 8. A car's engine converts thermal energy to mechanical energy. ____
- 9. Thermal energy always moves from colder objects to warmer objects. ____

I. Temperature

- _____ is a measure of the average kinetic energy of the particles in an object.
- Temperature depends on the kinetic energy of particles:
- All matter is made up of particles- atoms or molecules – that are in constant motion. The _____ the particles are moving, the more kinetic energy they have.
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- **Question:** What does temperature have to do with kinetic energy?
- **Answer: The more kinetic energy the particles of an object have, the higher the temperature of the object.**

Facts about temperature:

- Low temperature particles have a low average kinetic energy
- High temperature particles have a high average kinetic energy.
- As the temperature of liquid decreases, its volume decreases.
- As the temperature of the liquid increases, its volumes increases.
- **Question:** What happens to the liquid particles inside a thermometer when it is heated?
- **Answer:** _____

II. **Measuring Temperature**

- Thermometers can measure temperature because of thermal expansion.
- _____ is the increase in the volume of a substance due to an increase in temperature. As a substance gets hotter, its particles move faster. The particles themselves do not expand; they just spread out so that the entire substance expands.
- You measure the temperature of a substance by measuring the expansion of the liquid in the thermometer.

Temperature Scales :

• Fahrenheit	• Celsius	• Kelvin
Water boils - 212°	•	<u>Water boils - 373</u>
	• Water boils – 100 °	•
Body temperature – 98.6°	Body temperature - 37 °	<u>Body temperature – 310</u>
Room temperature - 68 °	Room temperature - 20 °	<u>Room temperature – 293</u>
•		

Water freezes - 32 °	Water freezes - 0	• <u>Water freezes - 273</u>

Temperature Scales:

- When you hear a weather report that gives the current temperature as 65 °, chances are that you are given the temperature in degrees Fahrenheit (°F). In science, the Celsius scale is used more often than the Fahrenheit scale. The Celsius scale is divided into 100 equal parts, called degrees Celsius (°C), between the freezing point and boiling point of water. A third scale called the Kelvin (or absolute) scale is the official SI temperature scale. The kelvin scale is divided into units called kelvins (K). The lowest temperature on the kelvin scale is 0 K, which is called _____ .

III. **Temperature Conversion**

- You can convert from one scale to another using the simple equations below.

To convert	Use this equation	Example

Math Break

- **Directions:** Using the equations given in your notes, answer the following questions:

1. What temperature on the Celsius scale is equivalent to 373 K?
2. Absolute zero is 0 K. What is the equivalent temperature on the Celsius scale?
3. Which temperature is colder, 0 °F or 200 K?

Quiz Review:

- 1. Most substances _____ when they are cooled.
- 2. The common temperature scale used by most Americans is the _____ scale.
- 3. Scientists use either the _____ scale or the _____ scale.
- 4. Temperature _____ as average kinetic energy decreases.

IV. **Heat**

- The total energy of all of the particles in an object is called _____. The thermal energy depends on the _____.

number of particles in the object, and the arrangement of the object's particles.

- _____ is thermal energy that is transferred from matter at a higher temperature to matter at a lower temperature.
- Only when thermal energy is transferred is called heat.
- **Heat is thermal energy moving from a warmer object to a cooler object.**
- **Question:** Why does an ice cube melt in your hand?
- Answer: **An ice cube melts in your hand because thermal energy is transferred from your hand to the ice cube.**

Specific Heat

- The amount of heat required to raise the temperature of an object depends on the object's chemical makeup. To change the temperature of different objects by the same amount, different amounts of heat are required.
- Specific heat is used by scientists. _____ is the amount of energy required to raise the temperature of 1 kilogram of a material by 1 kelvin.
- A material with a high specific heat can absorb a great deal of thermal energy without a great change in temperature.
- **Formula:**
- Change in energy =
- Mass X Specific Heat X Change in temperature
- **Question:** How much heat is required to raise the temperature of 5 kilograms of water by 10 kelvins?

Example:

Material	Specific Heat (J/(kg·K))
Aluminum	903
Copper	385
Glass	837
Ice	2,060
Iron	450
Sand	800
Silver	235
Water	4,180

On a separate sheet of paper complete the following assignment and turned it in at the end of the period:
Use the Prentice Hall Textbook.

Page 475 – Math Skills (Converting Units) Complete the practice problem

Page 476 – Math Analyzing Data – Complete Questions 1 – 3.

Page 477 – Section 1 Assessment (Questions 1 – 5)

Please write down your homework assignment for tonight:

Homework:

Part II: **What is Heat?**

A. Heat is what causes objects to feel hot or cold or to get hot or cold under the right conditions.

- _____ is the transfer of energy between objects that are at different temperatures.
- Question: Why do some things feel hot, while others feel cold?
- Answer: **When two objects at different temperatures come in contact, energy is always transferred from the object with the higher temperature to the object with the lower temperature.**

B. **Heat and Thermal Energy**

- If heat is a transfer of energy, what form of energy is being transferred? _____

_____ is the total kinetic energy of the particles that make up a substance. Thermal energy which is expressed in _____, depends partly on the temperature.

An object at a high temperature has more thermal energy than it would at a lower temperature.

- **Reaching the same temperature:** When object's at different temperatures come in contact, energy will always be transferred from the higher-temperature object to the lower-temperature object until both objects reach the same temperature. This point is called _____.

Reading Checkpoint (True or false?)

- 1. Thermal energy depends partly on the temperature of a substance. _____
- 2. At thermal equilibrium, two substances in contact may have the same temperature but not the same thermal energy. _____
- 3. A cup of water at 283 K and a pot of water at 283 K have the same thermal energy. _____

C. **Conduction, Convection, and Radiation**

- The three types of energy transfer are _____ and _____.
- 1. _____ is the transfer of thermal energy from one substance to another through direct contact.
- **Example:** Suppose you place a cold metal spoon in a bowl of hot soup. Eventually the spoon will get warm.

How does conduction work?

- As substances come in contact, particles collide and thermal energy is transferred from the higher-temperature substance to the lower-temperature substance.

Conductors and Insulators

- _____ – substances that conduct thermal energy very well.
- _____ – substances that do not conduct thermal energy very well.

Examples of conductors and insulators

Conductors	Insulators

2. **Convection**

- _____ is the transfer of thermal energy by the movement of a liquid or a gas.
- Example: When you boil a pot of water, the water moves in roughly circular patterns because of convection.
- Convection currents are circular motions of liquids or gases due to density differences that result from temperature differences.

3. **Radiation**

- _____ is the transfer of energy through matter or

space as electromagnetic waves such as visible light and infrared waves.

Radiation and the Greenhouse Effect

- 1. Visible light passes through the atmosphere and heats the Earth.
- 2. The Earth radiates infrared waves, some of which escape into space.
- 3. Greenhouse gases trap some of the reradiated energy near the Earth's surface.

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