Thermal, Under Where?

What is thermal energy?

- **Thermal energy** is the total kinetic energy of all particles in a substance.
- Thermal energy is measured in joules (J).

What is the difference between thermal energy and temperature?

- Temperature is related to the average kinetic energy of particles.
- Thermal energy is the total kinetic energy of all the particles.
- For example, a glass of water can have the same temperature as a lake, but the lake has much more thermal energy because the lake contains many more water molecules.

Heat It Up!

What is heat?

- **Heat** is the energy transferred from an object at a higher temperature to an object at a lower temperature.
- For example, energy in the form of heat flows from warm drinks to a bucket of ice.

How is heat measured?

- Heat is measured in two ways.
- Heat is measured in calories (cal).
- One **calorie** is equal to the amount of energy needed to raise the temperature of 1 g of water by 1 °C.

How is heat measured?

- Heat is also measured in joules (J) because heat is a measurement of energy.
- One calorie is equal to 4.18 joules.

How is heat measured?

- In nutrition, 1 calorie is actually 1 kilocalorie, or 1,000 calories.
- To find out how many calories are in food, a sample of food is burned inside an instrument called a calorimeter.
- The change in temperature in the calorimeter is used to calculate how much energy is released from the food sample.

How is heat related to thermal energy?

- When two objects at different temperatures come into contact, energy as heat flows from the warmer object to the cooler object.
- When both objects are at the same temperature, no more energy as heat flows.

How is heat related to thermal energy?

- Even though two materials might have the same temperature, their thermal energies might be different.
- Thermal energy depends on how many particles are present in the object.

How can heat affect the state of an object?

- The state of a substance depends on the speed of its particles.
- Adding energy in the form of heat to a substance can result in a change of state.
- Removing energy in the form of heat from a substance can result in a change of state.

Move It Around!

What is conduction?

- Energy as heat is transferred in three main ways.
- **Conduction** is the transfer of energy as heat from one substance to another through direct contact.
- As long as two objects are in contact, conduction continues until the temperatures of the objects are equal.

What is conduction?

- A **conductor** is a material that transfers energy as heat very well.
- Metals are typically good conductors.
- An **insulator** is a material that is a poor conductor of energy as heat.
- Wood, paper, and plastic foam are examples of good insulators.

What is convection?

- **Convection** is the transfer of energy as heat by the movement of a liquid or gas.
- Convection occurs when a cooler, denser mass of gas or liquid replaces a warmer, less dense mass of gas or liquid by pushing it upward.

What is convection?

- When water is boiled, the water moves in roughly circular patterns because of convection.
- This motion is due to density differences that result from temperature differences.
- The motion is called a *convection current*.

What is radiation?

- **Radiation** is the transfer of energy by electromagnetic waves.
- All objects, including the sun and all living things, emit radiation.
- When radiation is emitted from one object and is absorbed by another, the result is often a transfer of heat.
- Radiation can travel through empty space.

Practical Uses of Radiation

- A solar cooker is a device that cooks food using mirrors that concentrate radiation from the sun.
- In parts of the world that are far from electricity and clean water, solar cookers are a useful way to sterilize water for drinking.
- Many people like to use solar cookers because they do not release harmful emissions.