

Heat Energy and Conduction with Hot Chocolate

Introduction

In this investigation, students will explore the concepts of heat energy and conduction using a hot chocolate day theme. They will gain a better understanding of how heat transfers between objects and materials, and how this knowledge applies to real-world scenarios.

Vocabulary

- **Conduction:** The process by which heat or electricity is directly transmitted through a substance when there is a difference of temperature or electrical potential between adjoining regions, without movement of the material.
- **Conductor:** A material that allows heat or electricity to pass through easily.
- **Insulator:** A material that does not easily allow heat or electricity to pass through it.
- **Heat Energy:** A form of energy that is transferred between systems or objects with different temperatures (also known as thermal energy).

Background Information

Heat energy is a type of kinetic energy that is associated with the movement of atoms and molecules in a substance. Conduction is one of the primary methods by which heat is transferred. Metals are typically good conductors of heat due to their atomic structure, which allows energy to pass through them quickly.

Hypothesis

If a metal spoon is placed in hot chocolate, then the spoon will become hot because metal is a good conductor of heat.

Materials

Hot chocolate mix
Hot water
Ceramic mugs
Metal spoons
Wooden spoons
Thermometers
Stopwatch
Data chart (provided below)

Procedures

1. Prepare hot chocolate by mixing the hot chocolate powder with hot water in a ceramic mug.
2. Measure the initial temperature of the hot chocolate using a thermometer.
3. Place a metal spoon in the mug of hot chocolate. Start the stopwatch.

4. Measure the temperature of the spoon every minute for ten minutes. Record the data.
5. Repeat steps 1-4 using a wooden spoon.
6. Compare the temperatures recorded for metal and wooden spoons.

Data Chart

Time (minutes)	Metal Spoon Temperature (°C)	Wooden Spoon Temperature (°C)
0		
1		
2		
3		
4		
5		
6		

Conclusion

Compare the temperatures of wooden and metal spoons. What can you conclude about conduction? Explain the process of conduction using the temperatures of the metal spoon. Make connections with real life situations such as:

- Cooking Utensils: Metal pots and pans are used because they conduct heat well, allowing for even cooking.
- Home Insulation: Insulators are used in building materials to prevent heat loss or gain, making homes more energy efficient.

Career Connections

- Materials Scientist: Studies and develops materials with specific properties, including thermal conductivity.
- Mechanical Engineer: Designs systems that involve heat transfer and energy conversion.
- Chef: Utilizes knowledge of heat conduction to cook and prepare food efficiently.

Next Generation Science Standards (NGSS)

MS-PS3-3: Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

MS-PS3-4: Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.