

Thermal Energy Notes

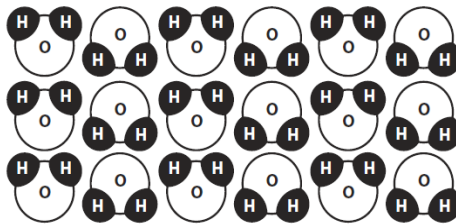
What is Heat?

- Kinetic energy is the energy of motion.
- Heat is the **TOTAL** motion of the molecules in a substance. The transfer of thermal energy from hotter objects to cooler ones.

What Happens When Matter is Heated?

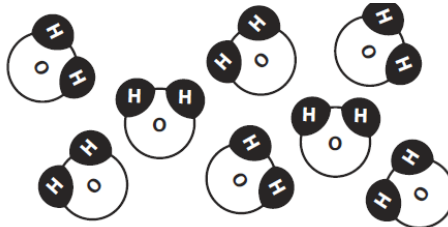
- The molecules in **solids** are held in one position and cannot flow through the substance. They do move back and forth in their positions. They vibrate. The more heat they have, the faster they vibrate.
- **Liquids** and **gases** are called fluids. The molecules in fluids move more freely than in solids. The more heat fluids have, the faster their molecules move.
- What happens when you heat an ice cube? In the space below, summarize in text or use diagrams and captions to answer the question.

Solid:



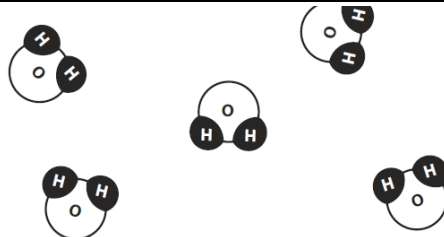
Molecules vibrate in one place.

Liquid:



Molecules spin and move close together.

Gas:

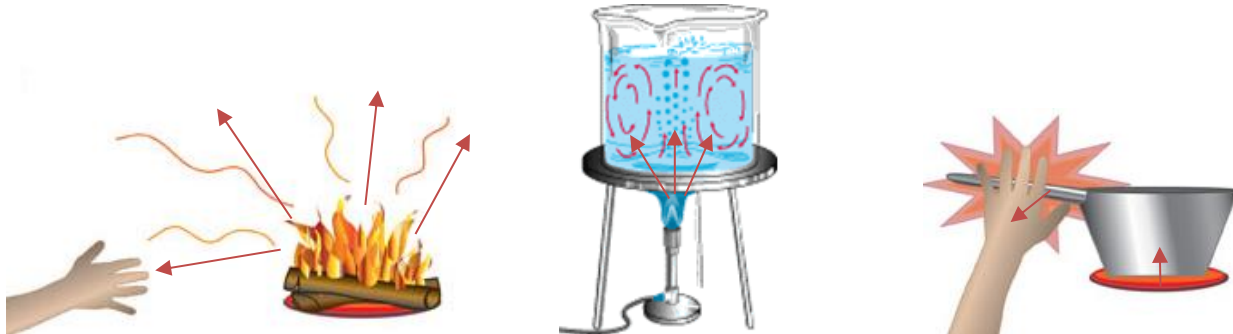


Molecules spin faster and move far away from each other.

Heat Transfer

- What does the statement “Heat seeks balance” mean”? Heat flows from hotter substances to colder substances to reach equilibrium. The molecules of hot substance have more energy. They are fast moving. They give the cold substance some of their energy. The molecules of hot substance slow down. The molecules of cold move more quickly. Soon both substances are the same temperature.
 - 3 types of Heat Transfer: Give the definitions and examples of each
 - **Conduction:** The way heat transfers in solids. Through direct touch.
 - Examples: Heating a pan on a stove. A spoon hot in a cup of coffee.
 - **Convection:** Heat energy in liquids and gases (fluids) moves in currents
 - Examples: Boiling water on a stove. Heating a room with a heater.
 - **Radiation:** Heat energy in rays or waves. Does not require matter to travel on.
 - Examples: Sun heating the earth. Heat lamps over food.

In the diagrams below label on the line under them which form of heat transfer they are an example of and then indicate which direction(s) the heat is traveling in each by drawing an arrows over the picture



Radiation

Convection

Conduction

Conductors and Insulators

- **Conductors:** Materials the move heat energy well.
 - Examples: Metal pan, a glass pot.
- **Insulators:** Materials that do not move heat well.
 - Examples: Wood, Clothing (wool), Rubber.

- Label the parts of the image on page 6 of the article “Conductors and Insulators” to indicate which are conductors and which are insulators.
- Compare and contrast using examples from the text
 - 1 way they are the same: They are both used in cooking. They both relate to heat transfer.
 - 1 way they are different: Conductors transfer heat well and insulators do not.

Heat vs. Temperature

- Temperature is the measure of the average kinetic energy in a substance.
- Explain how heat and temperature are different using an example from the text. Heat is the total amount of kinetic energy in a substance. Temperature is the average kinetic energy. Temperature describes how hot or cold something is heat does not.
- On the Fahrenheit scale the boiling point of water is 212°F. The freezing point of water is 32°F.
- On the Celsius scale the boiling point of water is 100°C. The freezing point of water is 0°C.
- How does the thermometer on the left in the picture on page 9 work? The thermometer wants to reach equilibrium with the substance it is measuring. Thermal expansion/contraction occurs. As the liquid inside gets hotter it expands and rises up the tube to tell the temperature.
 - Rank each state of matter below 1-3, one being the least and three being the most in terms of the effect of heat on expansion. 2 Liquid 3 Gas 1 Solid
 - Using your understanding on thermal expansion, explain why telephone/electrical wires are hung with slack in between them. So in the winter when they get cold and contract they do not snap.

