

**Section 1 Temperature and Heat**

- A. Temperature—related to the average kinetic energy of an object's atoms or molecules
- B. Thermal energy—the sum of the kinetic and potential energy of all the atoms in an object
1. Thermal energy increases as temperature increases.
  2. At constant temperature, thermal energy increases if mass increases.
- C. Thermal energy that flows from something at a higher temperature to something at a lower temperature is called heat.
- D. Specific heat—amount of heat needed to raise the temperature of 1 kg of a material by 1 degree C or K
- E. Changes in thermal energy can be calculated as *change in thermal energy equals mass times change in temperature times specific heat*.
1. When heat flows into an object and its temperature rises, the change in temperature is positive.
  2. When heat flows out of an object and its temperature decreases, the change in temperature is negative.
  3. A calorimeter is used to measure specific heat.

**Discussion Question**

How do temperature and heat differ? Heat is thermal energy that flows from something warmer to something cooler; temperature is related to kinetic energy of atoms in a substance.

CHAPTER  
6

Content Outline  
for Teaching

# Thermal Energy

Underlined words and phrases are to be filled in by students on the Note-taking Worksheet.

## Section 2 Transferring Thermal Energy

- A. **Conduction**—transfer of thermal energy through matter by direct contact of particles
1. Kinetic energy is transferred as particles collide.
  2. Solids, particularly metals, are good heat conductors.
- B. The transfer of energy by the motion of heated particles in a fluid is called **convection**.
1. Convection currents transfer heat from warmer to cooler parts of a fluid.
  2. Convection currents create rain forests and deserts over different regions of Earth.
- C. **Radiation**—energy transfer by electromagnetic waves
1. Some radiation is absorbed and some is reflected when it strikes a material.
  2. Heat transfer by radiation is faster in a gas than in a liquid or solid.
- D. Most living things control the flow of heat by using special features such as fur, blubber, or scales.
- E. **Insulator**—material that does not let heat flow through it easily
1. Gases such as air usually make better insulators than liquids or solids.
  2. A vacuum layer in a thermos is a good insulator because it contains almost no matter to allow conduction or convection to occur.

### Discussion Question

What state of matter generally makes a good heat conductor? Heat insulator? Solids generally conduct heat better than liquids or gases; gases usually make better insulators than liquids or solids.

END

CHAPTER  
6

Content Outline  
for Teaching

# Thermal Energy

Underlined words and phrases are to be filled in by students on the Note-taking Worksheet.

## Section 3 Using Heat

### A. Heating systems—warm homes and buildings

1. Forced-air system—fuel heats air, which is blown through ducts and vents; cool air is returned to the furnace to be reheated.
2. Radiator system—hot water or steam in a radiator transfers thermal energy to the air
3. Electric heating system—electrically heated coils in ceilings or floors heat air by conduction

### B. Solar energy—energy from the Sun

1. Passive solar heating does not use mechanical devices to move heat.
2. Active solar heating systems use solar collectors to absorb radiant energy, which is circulated through the building.

### C. Heat engine—an engine that converts thermal energy into mechanical energy

1. An internal combustion engine burns fuel inside the engine in chambers or cylinders.
2. Internal combustion engines convert only about 26% of the fuel's chemical energy to mechanical energy.

### D. Heat mover—device that removes thermal energy from one location and transfers it to another location at a different temperature

1. A refrigerator contains a coolant that absorbs heat from the inside of the refrigerator and releases it on the outside as heat.
2. Air conditioners cool warm air.
3. Heat pumps can both cool and warm air.
4. The human body stays cool by evaporation of sweat.

### Discussion Question

What are three types of heating systems? Forced-air systems, radiator systems, and electric systems

END