

**Intermediate Science 7**  
**Unit 1: Temperature and Heat**  
**Topic 8: Types of Heat Transfer**

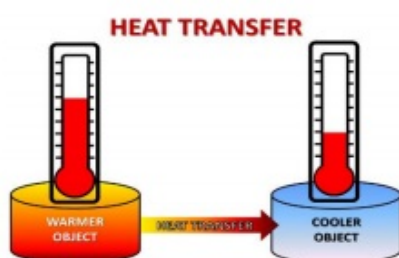


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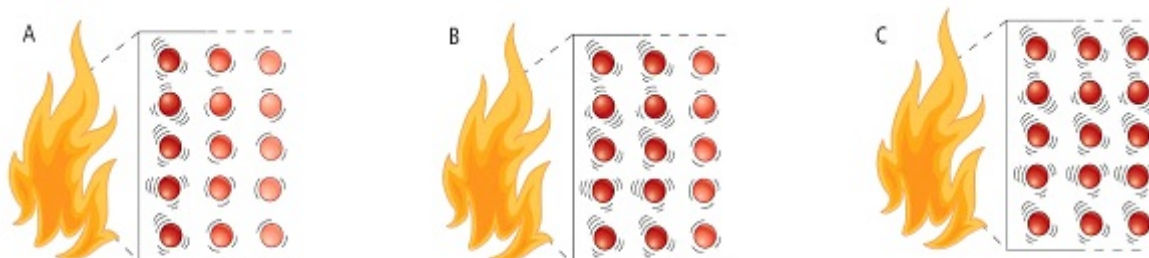
We have learned that heat is the energy that makes molecules move. Molecules with more heat energy move faster, and molecules with less heat energy move slower. We also learned that as molecules heat up and move faster, they spread apart and objects expand (get bigger). This is called thermal expansion.

**Methods of Heat Transfer**

1) **Conduction** The transfer of thermal energy that occurs when warmer particles come in contact with cooler particles and transfer energy to the cooler particles.

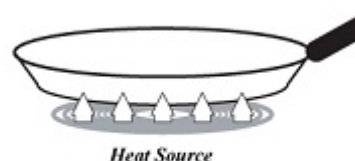


- Occurs when the particles in an object vibrate in place but collide with neighbouring particles passing kinetic energy to them.
- Conduction occurs in most solids.
- The particles do not leave their original position.



**Figure 6.3** (A) Particles near a heat source absorb energy from the source and begin to move faster and, therefore, have more kinetic energy. (B) When the hot molecules on the surface collide with the neighbouring particles, they give some of their own kinetic energy to the nearby particles. (C) The collisions continue and heat is transferred throughout the object.

Examples: cook ware, ice pack



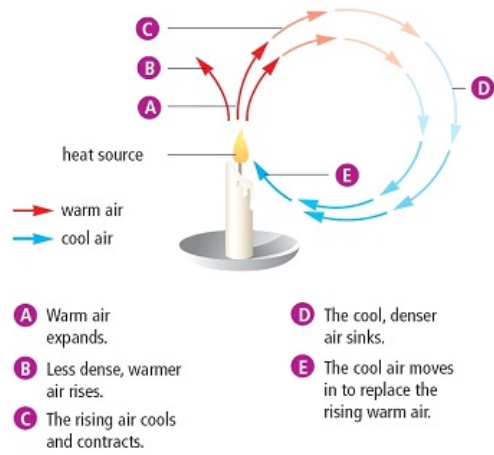
**COOKING BY CONDUCTION**

Conductors are materials that allow heat to move easily through them.

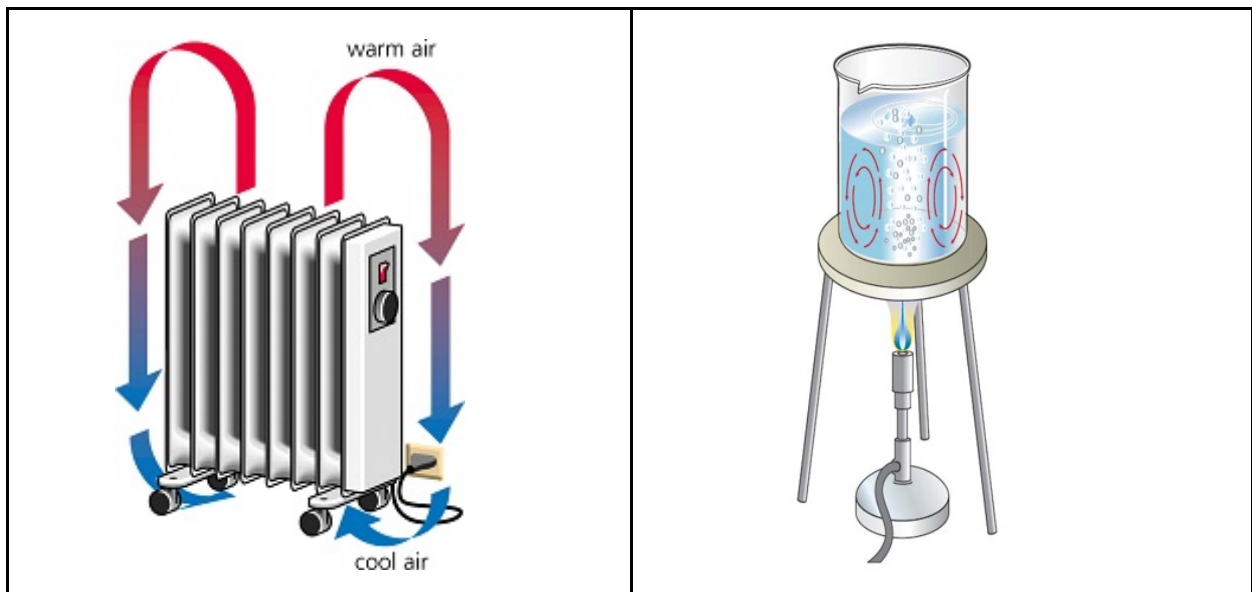
Insulators are materials that do not allow heat to move easily through them.

3) **Convection:** is the transfer of energy vertically by movement of particles in a fluid (water or atmosphere).

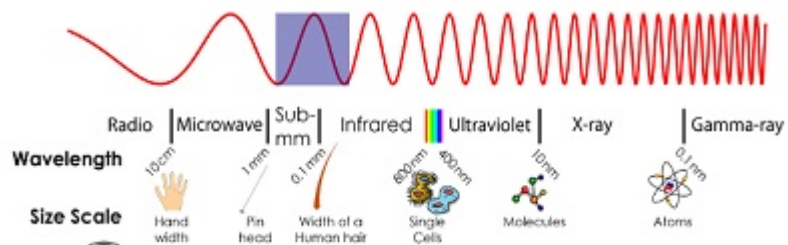
- Occurs in liquids and gases



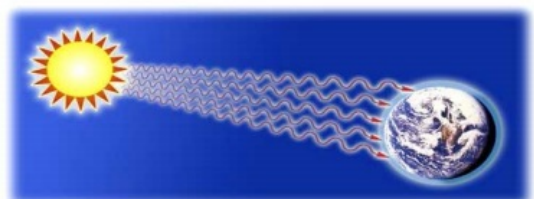
- Examples: air currents, heating a liquid



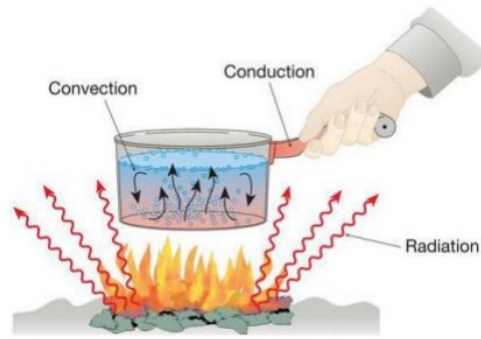
3. **Radiation** is the transfer of energy by means of electromagnetic waves that can travel through a vacuum.



- Visible light is one form of radiation that reaches us from the sun via empty space.
- Visible light is only one member of the electromagnetic spectrum. Some other waves from this spectrum are: microwaves, X-rays, infrared waves, etc
- There are no particles involved.
- The waves can travel in a vacuum.
- Examples fireplace, sunlight



**Summary of the different types of heat transfer:**



<b>Conduction</b>	<b>Convection</b>	<b>Radiation</b>
<ul style="list-style-type: none"> <li>•Energy transferred by direct contact</li> <li>•Energy flows directly from warmer to cooler objects</li> <li>•Continues until object temperatures are equal</li> </ul>	<ul style="list-style-type: none"> <li>•Occurs in gases and liquids</li> <li>•Movement of large number of particles in same direction</li> <li>•Cycle occurs while temperature differences exist</li> </ul>	<ul style="list-style-type: none"> <li>•Energy transferred by electromagnetic waves (visible light, microwaves, infrared)</li> <li>•All objects radiate energy</li> <li>•Can transfer energy through empty space</li> </ul>

**PART A: MULTIPLE CHOICE**

Instructions: Shade the letter of the correct answer on the computer scorable answer sheet provided

1. Which of the following is not a method of heat transfer?
  - (A) Conduction
  - (B) Convection
  - (C) Induction
  - (D) Radiation
  
2. Which one of the following do all methods of heat transfer require?
  - (A) The movement of particles
  - (B) Direct physical contact
  - (C) A difference in thermal energy
  - (D) A liquid or gaseous state
  
3. The transfer of energy that occurs when molecules bump into one another is called \_\_\_\_\_.
  - (A) Condensation
  - (B) Conduction
  - (C) Convection
  - (D) Radiation

4. The transfer of heat by molecule-to-molecule contact is:
- (A) Condensation
  - (B) Conduction
  - (C) Convection
  - (D) Radiation
5. If one end of metal rod is heated whole rod becomes hot due to
- (A) Conduction
  - (B) Contraction
  - (C) Convection
  - (D) Radiation
6. Materials that allow an easy transfer of heat are called ...
- (A) Conductors
  - (B) Energizers
  - (C) Insulators
  - (D) Thermals
7. Plastic, cork and wood are materials that do not allow an easy transfer of heat. They reduce the amount of heat that can transfer from a hot object to a colder object. They are called ...
- (A) Conductors
  - (B) Energizers
  - (C) Insulators
  - (D) Thermals
8. A heat transfer process in the atmosphere that depends upon the movement of air is:
- (A) Conduction
  - (B) Contraction
  - (C) Convection
  - (D) Radiation
9. Heat transferred outward from the surface of the moon can take place by:
- (A) Conduction
  - (B) Contraction
  - (C) Convection
  - (D) Radiation
10. One of the key characteristics of conduction is that heat transfers in only one direction – from areas of ...
- (A) Greater kinetic energy to areas of less kinetic energy
  - (B) Less kinetic energy to areas of greater kinetic energy
  - (C) Greater potential energy to areas of less potential energy
  - (D) Less potential energy to areas of greater potential energy
11. In a liquid the particles are moving quickly. When heat is added they have more energy, but this energy is transferred from particle to particle in a different way than in a solid. The reason for this is because of the ...
- (A) Speed of the particles
  - (B) Space between the particles
  - (C) Types of particles
  - (D) Temperature of the particles

12. During which process of energy exchange does cold air displace warmer air?
- (A) Conduction
  - (B) Contraction
  - (C) Convection
  - (D) Radiation
13. During which process does heat transfer occur because of density differences?
- (A) Conduction
  - (B) Contraction
  - (C) Convection
  - (D) Radiation
14. Which of the following statements about convection is true?
- (A) Convection can only occur during the process of boiling
  - (B) Convection always involves the circulation of a liquid or gas
  - (C) All types of currents are convection currents
  - (D) Convection occurs between solids only at high temperatures
15. What method of energy transfer requires no particles for the transfer of heat?
- (A) Conduction
  - (B) Contraction
  - (C) Convection
  - (D) Radiation
16. A gardener carefully places her outdoor thermometer in a shady location out of direct sunlight, so that it doesn't give incorrectly high readings. What method of heat transfer is she trying to avoid?
- (A) Conduction
  - (B) Contraction
  - (C) Convection
  - (D) Radiation
17. Which type of heat transfer (if any) would be possible in the vacuum of space?
- (A) No heat transfer is possible in the vacuum of space
  - (B) Convection
  - (C) Conduction
  - (D) Radiation
18. Which of the following statements about radiation heat transfer is true?
- (A) Radiant heat transfer explains why a spoon in a cup of hot tea soon feels warm
  - (B) Only glowing objects can be a radiant heat source
  - (C) Radiation heat transfer does not involve particles
  - (D) A radiant heat source transfers heat by energizing the molecules of air around it

**PART B: MATCHING**

Fill in the blanks on the left with the terms on the right. Please, place your answers on the scantron

19. ____ Conduction	A. A material that lets heat move through them easily (ex metals)
20. ____ Insulator	B. heat transfer and circulation to force molecules in the air to move from warmer areas to cooler ones.
21. ____ Convection	C. Process of heat being transferred between objects through direct contact.
22. ____ Conductor	D. is the transfer of heat by means of electromagnetic waves.
23. ____ Radiation	E. A material that does not let heat move through them easily (ex wood, plastics)

**PART C: WRITTEN RESPONSE**

1. What is necessary in order for conduction of heat to occur between two objects?

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2. Does conduction occur in objects that are solids, liquids, or gases? Explain why.

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3. How is heat transferred from one side of a solid object, such as the bottom of a skillet, to the other side of the object, such as the inside of the skillet?

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4. In convection, what carries heat from one place to another?

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5. Why can convection not occur in a solid?

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6. Give an example of a common form of convection current.

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7. How can you transfer energy from your hand to an object without touching the object?

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8. What can carry energy through empty space?

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9. When radiant energy reaches an object, what must happen in order for the object to become warmer?

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10. Identify the method of heat transfer that takes place in each illustration. Some illustrations may show more than one form of heat transfer.

<p>(A) _____</p> 	<p>(B) _____</p> 
<p>(C) _____</p> 	<p>(D) _____</p> 
<p>(E) _____</p> 	<p>(F) _____</p> 

11. In each of the following situations, identify the method of heat transfer taking place (conduction, convection, radiation). More than one process may be occurring
1. Hot coffee is stirred with a spoon, the spoon gets hot due to \_\_\_\_\_.
  2. A chair is placed several feet from a fire in a fireplace. The fireplace has a glass screen. The side of the chair facing the fireplace gets warm because of \_\_\_\_\_.
  3. A certain type of decorative lamp contains colored liquids. These liquids form globs that break off and rise to the top of the liquid. The globs rise due to \_\_\_\_\_.
  4. Near the ceiling of a room the air is warmer. The warm air rises because of \_\_\_\_\_.
  5. A college student holds the back of his hand near an iron to see if it is hot. Heat is transferred to his hand by \_\_\_\_\_.
  6. A heater is placed under one corner of a water bed mattress. Warm water moves throughout the mattress because of \_\_\_\_\_.
  7. A certain type of stainless steel cookware has a layer of copper applied to the bottom to help it heat evenly. The copper transfers heat to the pan by \_\_\_\_\_.
  8. In a swimming pool, the water near the surface is slightly warmer. The warm water rises because of \_\_\_\_\_.
  9. One end of a copper rod is placed in a flame of a Bunsen burner. Small pieces of wax placed along the rod melt at progressively larger distance from the flame. Heat is transferred through the rod by \_\_\_\_\_.
  10. A house burns down. On the house across the street, all of the vinyl siding is twisted and warped by the heat. The heat was transferred across the street by \_\_\_\_\_.
  11. Warm air over the beach rises while cooler dense air from the ocean rushes in due to \_\_\_\_\_.
  12. The metal skewer gets so hot that you drop your marshmallow in the campfire because of \_\_\_\_\_.
  13. A huge rock at the state park gets so hot during the day that you can't sit on it from \_\_\_\_\_.
  14. You lay on that same rock at night so that you can keep warm by \_\_\_\_\_.
  15. A fireman feels a door and it is hot from the fire on the other side due to \_\_\_\_\_.
  16. The cause of weather systems on earth is \_\_\_\_\_.
  17. You are in the top bunk of a bunk bed and you want to turn the air conditioner on while your friend on the bottom bunk is fine is caused by \_\_\_\_\_.



