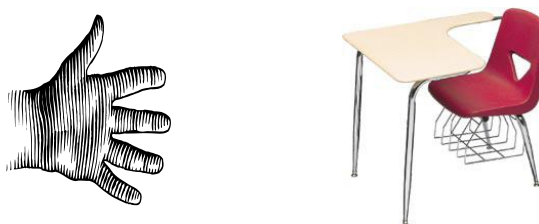


HOW DOES HEAT ENERGY MOVE (TRANSFER)?

Heat is the energy an object has because of the *movement of its atoms and molecules*. These particles are constantly in motion, moving around – sliding past and running into one another. This motion of atoms and molecules creates a form of energy called **heat or thermal energy** which is present in all matter. We sometimes use the term *heat* to describe how much thermal energy has moved between different objects.

Thermal energy has the ability to transfer from one object to another. Thermal energy is always transferred from the substance with the higher temperature (warmer) to the substance with the lower temperature (colder). If you were to take your hand and place it on some metal part of your chair, you might sense that it feels cold. You experience this cold sensation because your hand actually transfers some of its heat to the chair. It's not that your hand "gained" coldness, it's that your hand lost some of its thermal energy to the chair. Heat is always transferred from the substance with the higher temperature to the substance with the lower temperature. Heat would continue to move from the warmer substance to colder one until the temperature of each reached equilibrium (they are the same temperature).

WARM → COLD

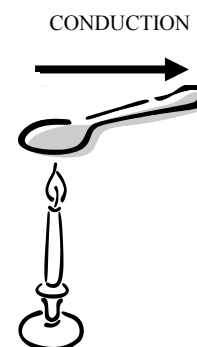


There are three methods of heat transfer.

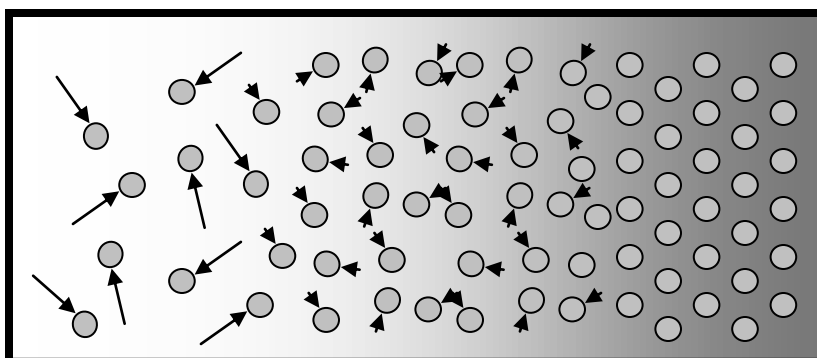
1. conduction
2. convection
3. radiation

CONDUCTION

Conduction happens when particles (atoms and molecules) transfer some of their kinetic energy (energy of motion) by colliding directly with one another. The particles that collide cause kinetic energy from the faster moving particles (warmer) to be transferred to the slower moving particles (colder). The candle at right heats the spoon and the heat is conducted along the entire length of the spoon. The illustration below shows how the molecules behave. As they are heated, the molecules move faster and cause neighboring molecules to increase their kinetic energy. Eventually, the end of the spoon would become hot. Conduction can happen between the molecules in a single object (spoon), or when two substances come in contact with one another. Place some hot chocolate in a cold mug and the heat will conduct between the particles in the hot chocolate to the particles in the mug, causing the mug to warm.



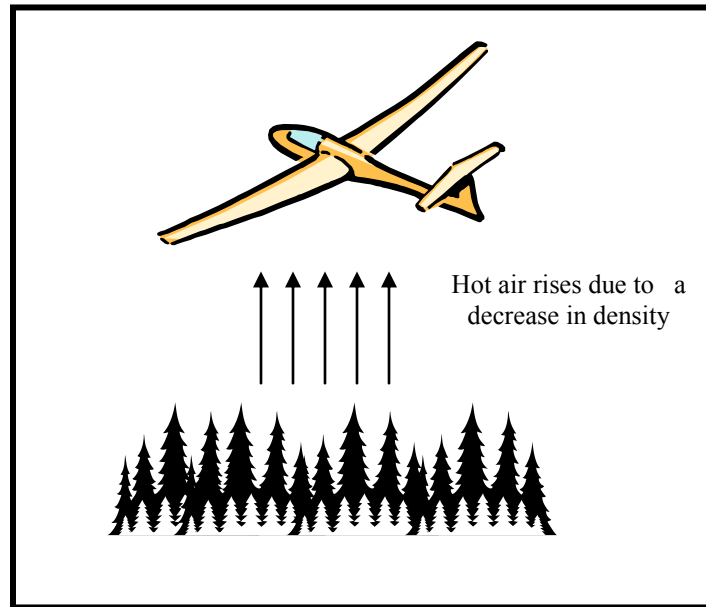
CONDUCTION
BETWEEN TWO
SUBSTANCES
(hot chocolate and mug)



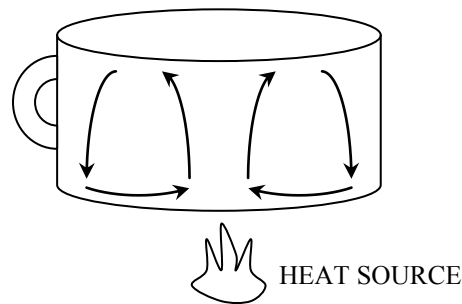
CONVECTION

In convection, the particles in a fluid (liquid or gas) transfer heat by actually moving to a new location. This movement is sometimes called a convection current. Heating particles in substances like water or air causes their density to decrease. This difference in density causes the fluid to move and transfer heat to a new location.

Birds and gliders use convective currents of rising hot air to stay aloft without engines or flapping their wings.



Heating a liquid can also cause the same convective currents as just explained in air. Again, heating or cooling a liquid causes a change in density and results in the movement of the liquid.



RADIATION

Radiation is the transfer of energy by electromagnetic waves. **In radiation, heat transfer happens through empty space.** This is different from convection and conduction where heat energy is transferred by colliding particles or the actual movement of particles of matter. The important thing to remember here is that heat transfers through empty space.

