

Heat Transfer

Key Concepts:

- How is temperature measured?
- How is heat transferred into the troposphere?

All substances are made up of small particles, which can be atoms or molecules, that are constantly moving. The faster the molecules are moving, the more energy they have. The total energy of motion in the particles of a substance is called **thermal energy**. **Temperature** is the average amount of energy of motion in each particle of a substance. It is a measure of how hot or cold a substance is. Temperature is one of the most important elements of weather.

Air temperature is usually measured with a thermometer. A **thermometer** is a thin glass tube with a bulb on one end that contains a liquid, usually mercury or colored alcohol. Thermometers work because liquids expand when they are heated and contract when they are cooled.

Temperature is measured in units called degrees. On the Celsius scale, the freezing point of pure water is 0 degrees Celsius and the boiling point of water is 100 degrees Celsius. On the Fahrenheit scale, the freezing point of water is 32 degrees Fahrenheit and the boiling point is 212 degrees Fahrenheit.

Heat refers to the energy transferred from a hotter object to a cooler one. **Heat is transferred in three ways: radiation, conduction, and convection.**

Radiation is the transfer of energy by electromagnetic waves. The direct transfer of heat from one substance to another substance that is touching is called **conduction**. Conduction works well in some solids, but not as well in fluids (liquids and gases). In **convection**, heat is transferred by the movement of currents within a fluid.

In fluids, molecules can move from place to place and take their heat with them.

Radiation, conduction, and convection work together to heat the troposphere. Air near Earth's surface is warmed by conduction of heat from the surface to the air. Within the troposphere, heat is transferred mostly by convection. When the air near the ground is heated, the molecules have more energy and move faster. The molecules bump into one another and move farther apart, or become less dense. Cooler, denser air sinks, forcing the warmer, less dense air to rise. The upward movement of warm air and the downward movement of cool air from convection currents move heat throughout the troposphere.