

SECTION 1-2

SECTION SUMMARY

Convection Currents and the Mantle

Guide for Reading

- ◆ How is heat transferred?
- ◆ What causes convection currents?

The movement of energy from a warmer object to a cooler object is called **heat transfer**. Heat is always transferred from a warmer substance to a cooler substance. **There are three types of heat transfer: radiation, conduction, and convection.**

The transfer of energy through empty space is called **radiation**. Heat transfer by radiation takes place with no direct contact between a heat source and an object. For example, radiation enables sunlight to warm Earth's surface.

Heat transfer by direct contact of particles of matter is called **conduction**. In conduction, the heated particles of a substance transfer heat to other particles through direct contact. An example is when a spoon heats up in a hot pot of soup.

The transfer of heat by the movement of a heated fluid is called **convection**. Fluids include liquids and gases. During convection, heated particles of a fluid begin to flow, transferring heat energy from one part of the fluid to another.

Heat transfer by convection is caused by differences in temperature and density within a fluid. **Density** is a measure of how much mass there is in a volume of a substance. When a liquid or gas is heated, the particles move faster. As they move faster, they spread apart. Because the particles of the heated fluid are farther apart, they occupy more space. The fluid's density decreases. But when a fluid cools, the particles move closer together and density increases.

An example of convection occurs in heating a pot of soup on a stove. As soup at the bottom of the pot gets hot, it expands and becomes less dense. The warm, less dense soup moves upward, floating over cooler, denser soup. At the surface, the warm soup spreads out and cools, becoming denser. Then gravity pulls this cooler, denser soup down to the bottom, where it is heated again and begins to rise. This flow that transfers heat within a fluid is called a **convection current**. **The heating and cooling of the fluid, changes in the fluid's density, and the force of gravity combine to set convection currents in motion.** Convection currents continue as long as heat is added to the fluid.

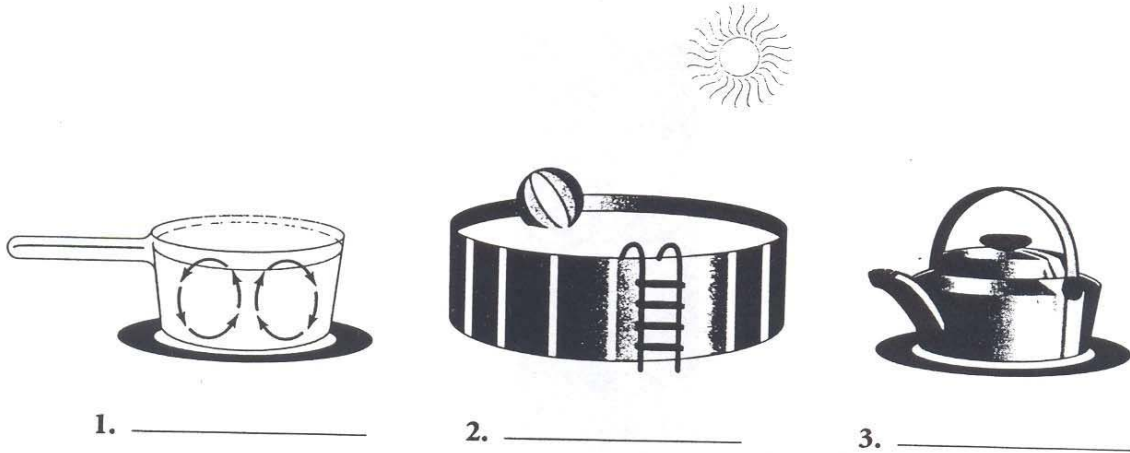
Convection currents flow in the asthenosphere. The heat source for these currents is heat from Earth's core and from the mantle itself. Hot columns of mantle material rise slowly. At the top of the asthenosphere, the hot material spreads out and pushes the cooler material out of the way. This cooler material sinks back into the asthenosphere. Convection currents like these have been moving inside Earth for more than four billion years!

SECTION 1-2 REVIEW AND REINFORCE

Convection Currents and the Mantle

◆ Understanding Main Ideas

Label each figure by writing the type of heat transfer it shows.



Answer the following questions in the spaces provided.

4. What are convection currents and what causes them?

5. What causes convection currents in Earth's mantle?

◆ Building Vocabulary

If the statement is true, write true. If it is false, change the underlined word or words to make the statement true.

_____ 6. The transfer of energy through empty space is called convection.

_____ 7. The movement of energy from a warmer object to a cooler object is called heat transfer.

_____ 8. Conduction is heat transfer by direct contact of particles of matter.

_____ 9. Radiation is the transfer of heat by the movement of a heated fluid.

_____ 10. Density is a measure of how much heat there is in a volume of a substance.