

# Inside Earth: Chapter 1- Plate Tectonics



## Section 2: Convection Currents and the Mantle

# Guide For Reading

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

# Heat Transfer

- Heat Transfer: The movement of heat from a warmer object to a cooler object
- Heat is always transferred from a warmer substance to a cooler substance

# Explain how an ice cube would melt in your hand.

- Since heat is transferred from a warmer substance to a cooler substance, your hand (the heat source) melts the ice cube

# Guide For Reading: How is heat transferred?

- There are three types of heat transfer:
  - radiation
  - conduction
  - convection

# Radiation

# Radiation

- Radiation: The transfer of heat through empty space
- Heat transfer takes place with no direct contact between a heat source and an object

Give three examples of radiation.

- Sunlight
- Campfire
- Microwave oven

# Conduction

# Conduction



- Conduction: The transfer of heat by direct contact of particles of matter
- Example:
  - Spoon in a bowl of hot soup

# Explain what happens when a spoon heats up in a pot of soup?

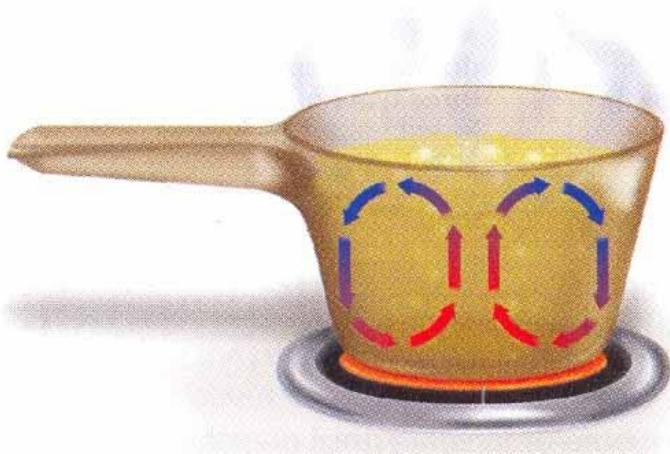
- Heat is transferred from the hot soup and the pot to the particles that make up the spoon
- The particles near the bottom of the spoon vibrate faster when they are heated, so they bump into other particles and heat them too.
- Gradually the entire spoon heats up

Give another example of conduction. Explain how the heat is transferred.

- Stepping on sand at the beach
- The heat from the sand is transferred to your foot

# Convection

# Convection



- Convection: Heat transfer involving the movement of fluids-liquids and gases
- Heated particles of fluid begin to flow, transferring heat energy from one part of the fluid to another.

# Density

- Density: A measure of how much mass there is in a volume of a substance

# How does density play a role in convection?

- The warmer, spread out particles of a fluid rises and pushes the cooler, more compact particles of a fluid down
- Since fluids are constantly heated and cooled this cycle is continuous

When a liquid or gas is heated, the particles move \_\_\_\_\_ and \_\_\_\_\_ out. The density of the liquid or gas becomes \_\_\_\_\_ dense.

- faster
- spread
- less

When a fluid cools, its particles move more \_\_\_\_\_ and settle together more closely. As the fluid becomes cooler, its density \_\_\_\_\_.

- slowly
- increases

A \_\_\_\_\_ is a constant flow of a fluid in which the cooler fluid sinks, while the warmer fluid rises.

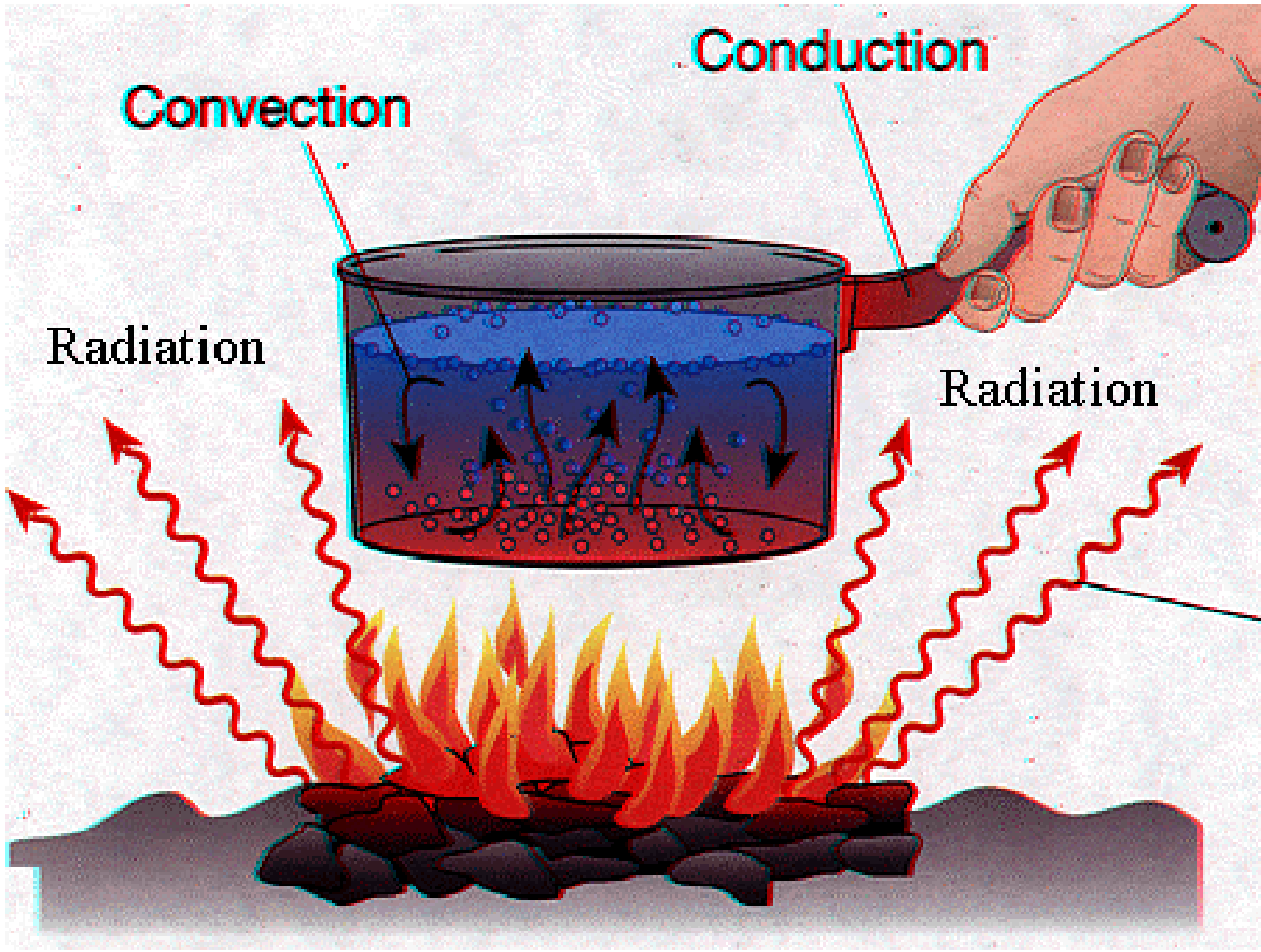
- convection current

# Guide For Reading: What causes convection currents?

- 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.

# Checkpoint: What is convection?

- Convection is heat transfer by the movement of a heated fluid



Conduction

Convection

Radiation

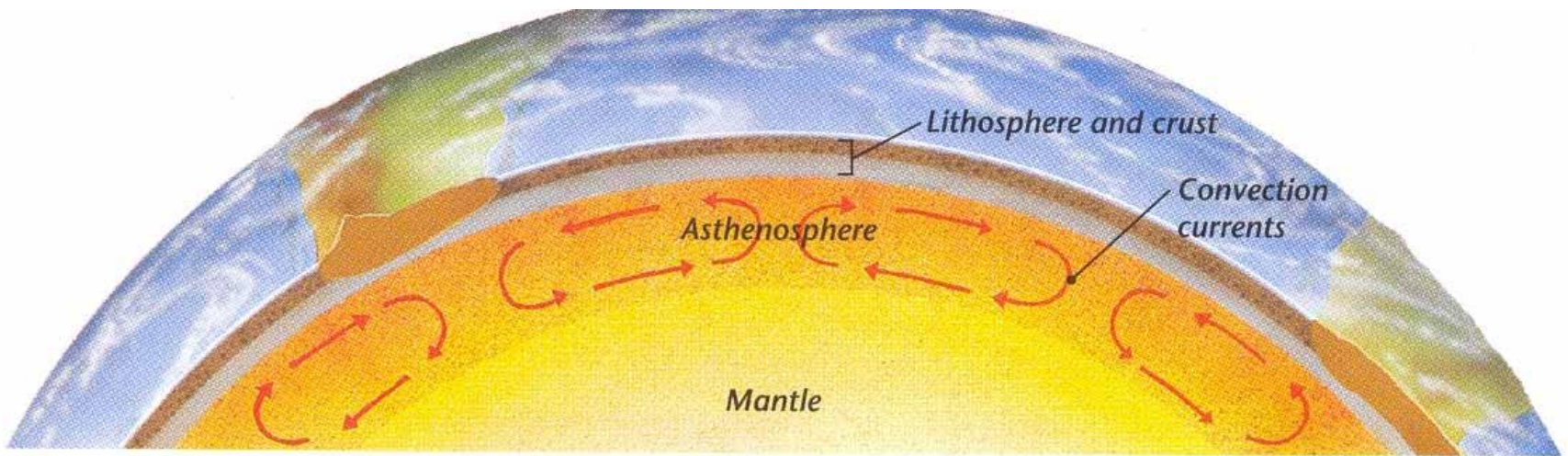
Radiation

# Convection Currents in Earth's Mantle

Convection currents in the earth's mantle occur in the \_\_\_\_\_.

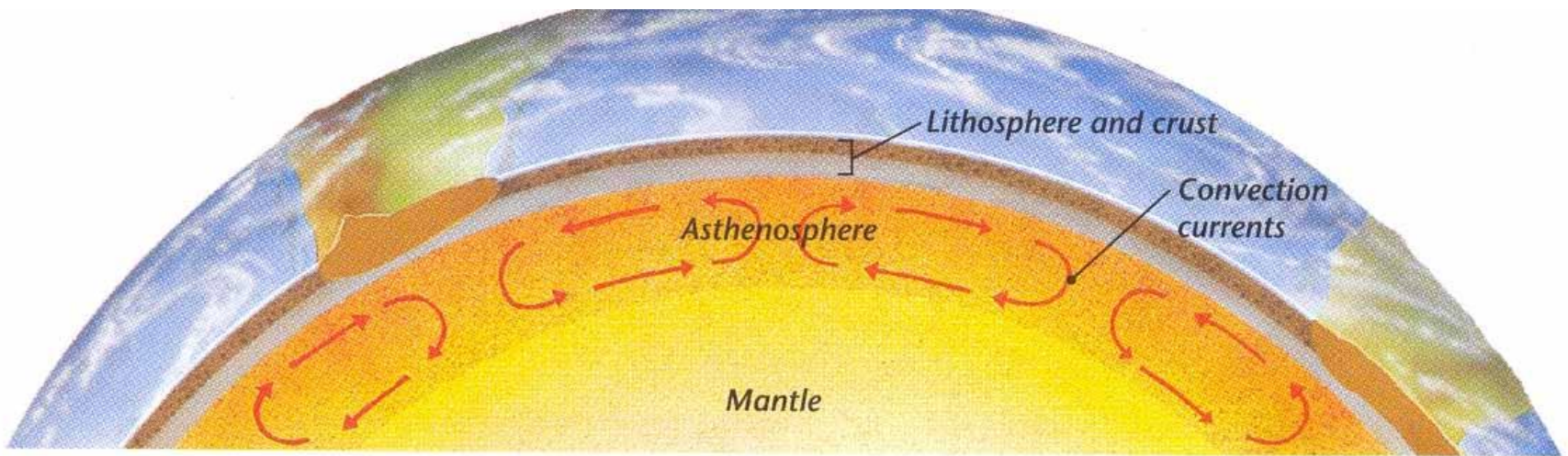
- asthenosphere

Figure 10: **Applying Concepts:** What part of Earth's interior is like the soup in a pot?



- The asthenosphere is like the soup in the pot.

Figure 10: **Applying Concepts:** What part is like the burner on the stove?



- The core and mantle are like the burner on the stove

# Describe how convection currents form in Earth's asthenosphere.

- Heat from Earth's core and mantle cause hot columns of mantle material to rise slowly in the asthenosphere
- At the top of the asthenosphere, hot material spreads and forces the cooler material to sink
- This cycle has continued for more than four billion years