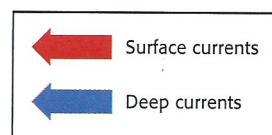


Figure 3 This map shows the directions in which ocean currents flow. Surface currents are shown in red. Deep currents are shown in blue. Together, the currents form the ocean conveyor belt.



MATH PRACTICE

Calculating Change

The surface temperature of ocean water near the equator can be as high as 30°C . But the surface temperature of polar ocean water can be as low as -2°C . If the temperature of a sample of ocean water is 30°C , what will the temperature be if it drops by 70%? Record your work in your **Science Journal**.

Convection

Most energy is moved through Earth's systems by convection. Convection occurs in fluids, such as water and air. But some convection occurs in solids that can flow like putty. The uneven heating of matter drives convection. Most matter becomes less dense when heated. Hotter, less dense matter rises through surrounding matter. As the hot matter rises, it cools and becomes denser. As a result, this matter sinks back toward the heat source where it is warmed again. This movement of matter that results from differences in density is called a *convection current*.

Convection in the Ocean

Convection currents occur in the ocean because of differences in the density of ocean water. The uneven heating of ocean water causes these differences. The differences in density are also caused by differences in the salinity of ocean water. Salinity is the amount of salt in water. In the ocean, convection causes deep currents. Deep currents are streamlike movements of water far below the ocean surface. As **Figure 3** shows, deep currents flow from the North Atlantic Ocean to Antarctica. Then, they flow around Antarctica and into the Pacific Ocean. The cold bottom water then flows northward toward Alaska. This journey takes more than a thousand years.

Convection in the Atmosphere

The process of convection in the atmosphere is shown in **Figure 4**. If Earth's surface is warmer than the air, conduction will heat the air touching the ground. As this air becomes warmer, it becomes less dense and rises. The warm air moves upward, away from Earth's surface. As the air rises, it cools. The air becomes denser and begins to sink back toward Earth's surface. As the cooled air sinks, it forces warm air away from Earth's surface. This cycle causes winds and moves energy through the atmosphere.

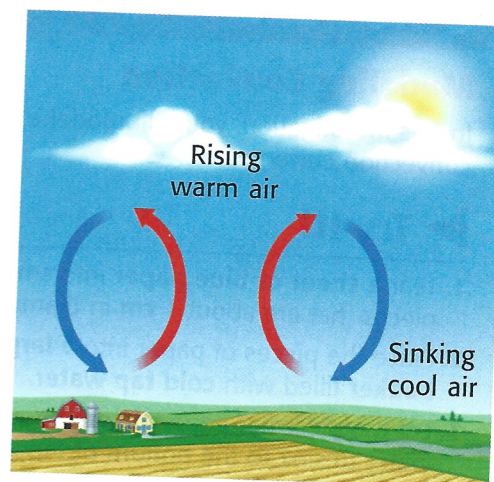


Figure 4 Convection currents in the atmosphere form when cold air sinks and forces warm air away from Earth's surface.

Convection in the Geosphere

Earth may seem solid and rigid to you. But inside Earth, solid rock is slowly moving. Energy produced deep inside Earth heats rock in the mantle. The heated rock is under high pressure. So, the rock becomes plastic without melting, which causes the rock to flow like putty. As it becomes less dense, the heated rock rises toward Earth's surface. The cooler, denser rock surrounding the heated rock sinks, as **Figure 5** shows. In this way, heat inside Earth moves toward the cooler crust. This movement of rock is a convection current. Convection currents in the mantle cause the movement of tectonic plates.

Standards Check How does convection occur in the geosphere?

6.4.c

Figure 5 Convection currents in the geosphere carry heat from Earth's interior toward the surface.

