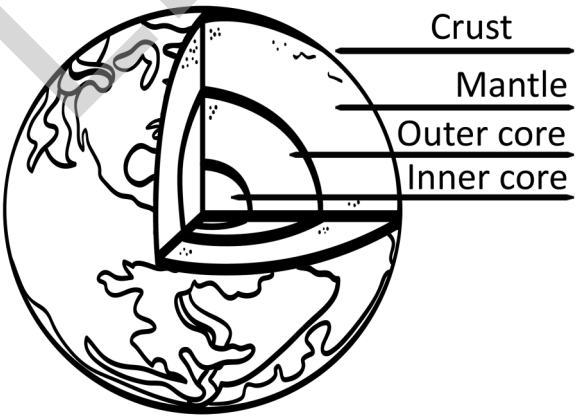
Earth's Cycles and Systems

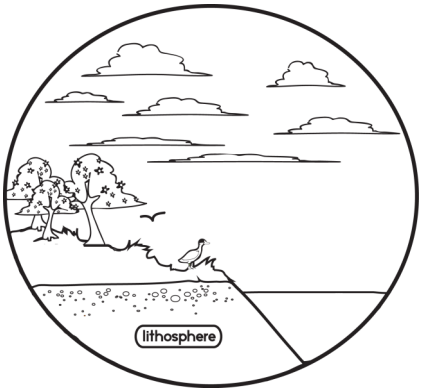
Everywhere around us, there are cycles happening that we can't see. We breathe oxygen in and breathe carbon dioxide out. Plants use the carbon dioxide in photosynthesis. Larger animals feed on smaller animals. Changes deep beneath the surface of the earth produce earthquakes and volcanoes on the surface. So many things are working together in incredible ways that we don't normally notice. We're going to take a look at a few of those important cycles, but in order to better understand them, we need to first look at some of the systems our world is made up of.

A **system** is just a group of things that are working together like a whole unit. The organs of your respiratory system work together in a system, just like the organs of your digestive system work together. Scientists divide the world around us into systems, too. The four main spheres are the lithosphere, biosphere, hydrosphere, and atmosphere. These spheres are systems that work together

To understand what the lithosphere is, we need to quickly review the layers of the earth. The first layer of the earth is the **crust**. It includes the dry land that makes up the continental crust and the ocean floor, the oceanic crust. The crust is thought to be between 5 to 25 miles (8 to 40 kilometers) thick. The deepest place in the ocean ever discovered—the Mariana Trench—is only 35,840 feet (10,924 meters) deep. That's less than 7 miles (11 kilometers).

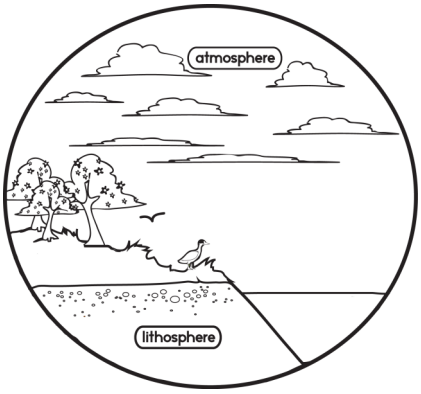


The next layer of the earth is called the **mantle**. The mantle is made of rock, but it's a little bit different. The very top of the mantle is hard rock, but there is so much heat and pressure on the rock in the rest of the mantle that the rock isn't solid or hard, like we usually think of rock. This rock is sort of sticky and gooey, a little like caramel. It's not totally solid, and it's not totally liquid. This part of the mantle is also called the **asthenosphere**.



The **lithosphere** is the crust of the earth and the hard top part of the mantle. The final two layers of the earth are the outer core and inner core. The outer core is liquid iron, and scientists think this layer is about 1,400 miles (2,250 kilometers) thick. The very heart of the earth, the deepest layer, is called the inner core. Scientists think this layer is made of nickel and iron that form an extremely hard ball.

We've studied the ground beneath our feet, so let's study the sphere above us, the **atmosphere**. The atmosphere can be divided into five layers. The higher the altitude, the thinner the air is.



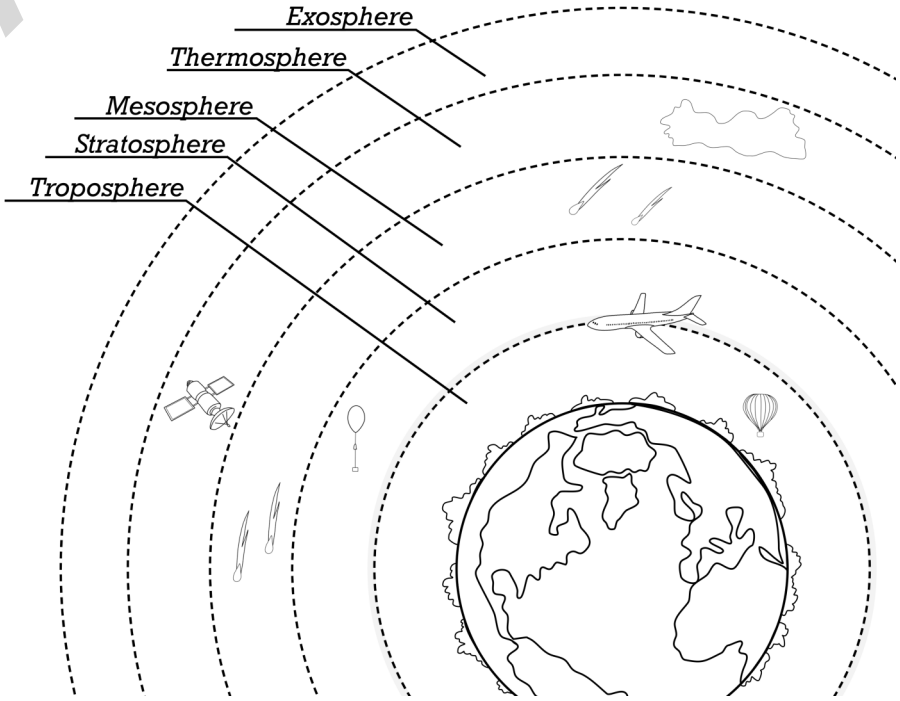
The **troposphere** is the layer closest to the ground. This is where almost all of our weather happens as the air is heated by the sun, rises, cools, and sinks again. The troposphere is also the level where hot air balloons travel.

The next layer is the **stratosphere**. This layer is home to many larger jets as well as weather balloons. Though there is wind, there are not generally large storms, making it a good place for the jets to fly. The **ozone layer**, where ultraviolet light from the sun reacts with oxygen to form ozone, lies in the upper stratosphere. The ozone layer protects Earth from much of the dangerous ultraviolet rays.

The **mesosphere** is the next layer, and it is the coldest layer of the atmosphere. The ozone layer beneath it keeps heat closer to earth, but it isn't close enough to the sun to pick up enough heat to warm it up. The is the layer where meteors generally break up as they pass through the atmosphere.

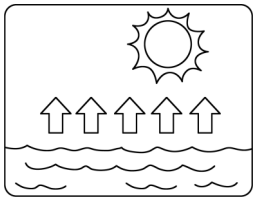
The next layer is sometimes considered the last layer of atmosphere because this is the last layer that has air, though the air is extremely thin. The air in the **thermosphere** warms up as it soaks up radiation from the sun. This is also the layer where space shuttles and satellites orbit. It is home to the **auroras**, incredible displays of light that we see as the magnetic field around the earth interacts with the solar wind from the sun and deflects it.

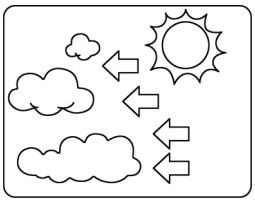
The final layer is the **exosphere**, and this is the layer where what is left in our atmosphere fades into outer space.



Now let's look at some of the interactions that happen between systems. Some involve living things and some involve nonliving things. We'll start by looking at the water cycle, which is also called the **hydrologic cycle**. I'm sure you've studied it before, but let's quickly review the major parts so we can dig deeper into what happens to the water once it hits the ground.

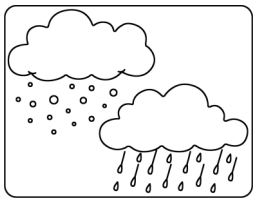
The first step is evaporation. The sun heats the earth, warming the water in the ocean. The water evaporates as water vapor into the air.

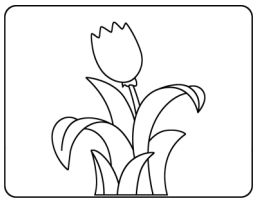




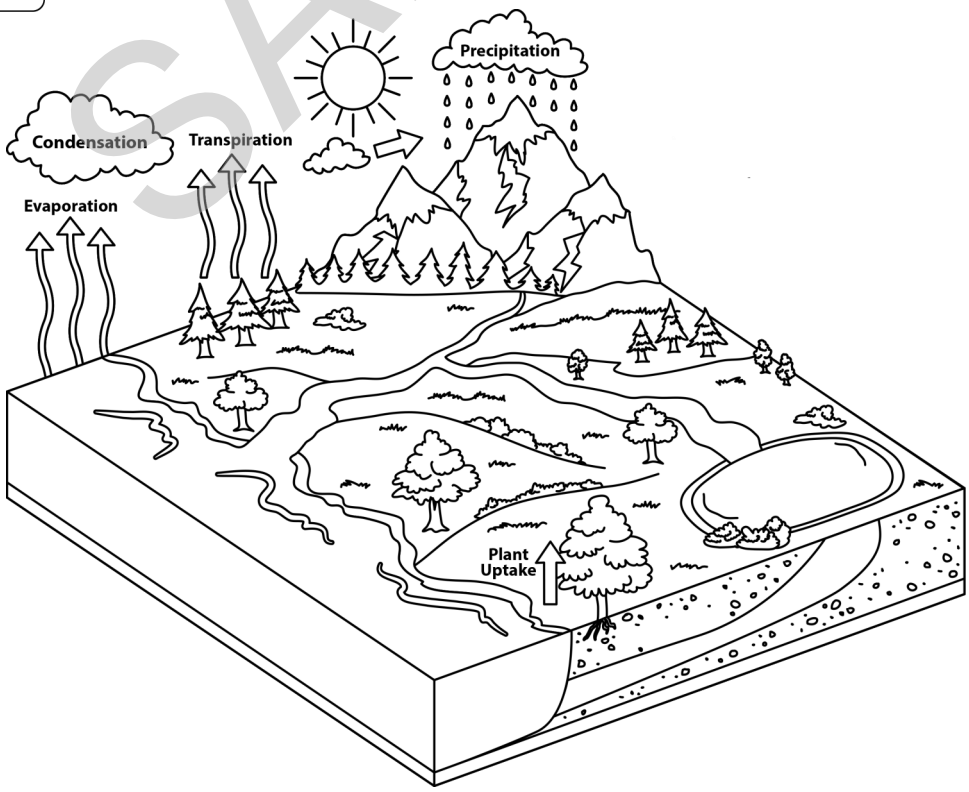
As the water vapor rises into the air, it cools and turns back into drops of water. Those drops of water come together to form clouds. The process of water vapor cooling and turning into drops of water is called **condensation**. You can see it when you set a cold can of soda out of the refrigerator.

Once enough water droplets accumulate in clouds, it comes back down to earth as precipitation. It can come down as rain, sleet (pieces of ice), hail (larger pieces of ice), or snow (ice crystals).

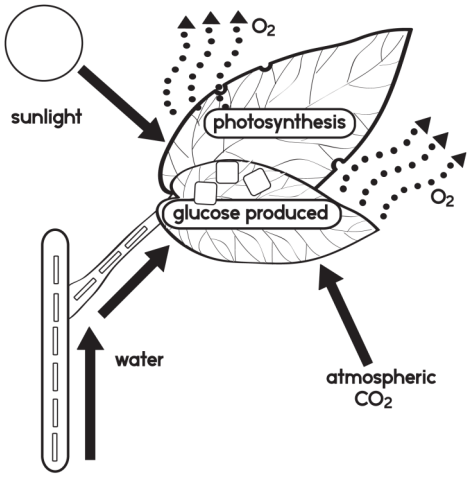




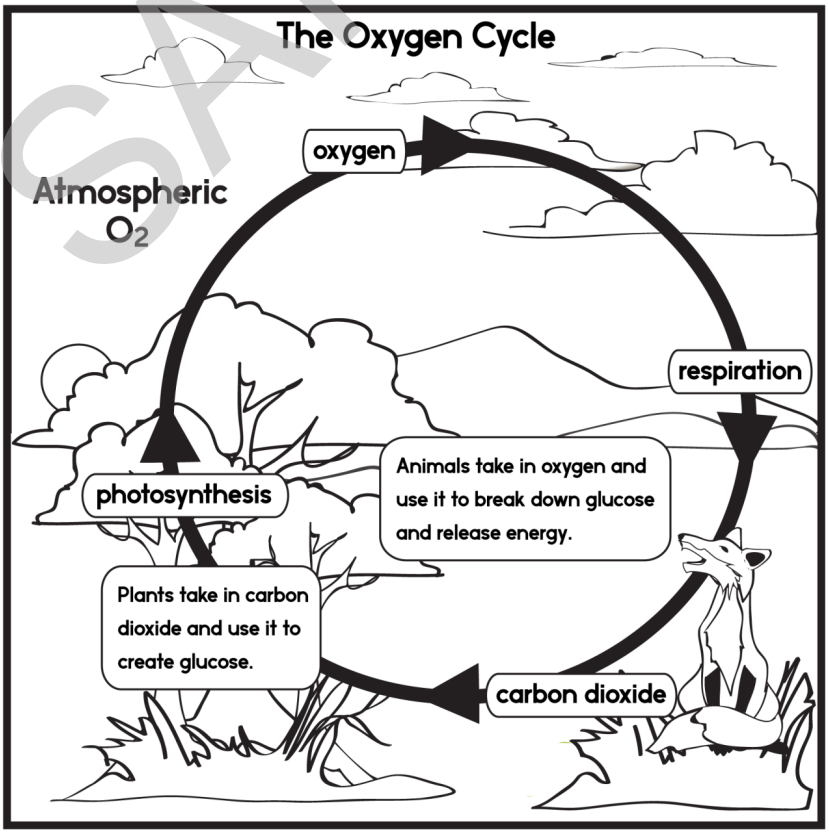
Some of the precipitation that falls will eventually be absorbed by plants. Plants give water vapor back into the air through the process of transpiration. The water vapor then starts collecting in clouds again.



Now that we've explored the water cycle, let's look at the oxygen cycle. Just like water never stays in one place forever, neither does oxygen. People breathe in the air, which contains oxygen. Our lungs and respiratory system process that air, pulling out the oxygen our bodies need to survive. Getting and using oxygen is called **respiration**. Our cells use oxygen to break down the food we eat, which includes glucose that we get from many different plants and animals. We breathe out carbon dioxide. Many animals use similar processes. They breathe air in and use the oxygen to fuel their cells and process the food they've eaten.



Plants take carbon dioxide in out of the air. Through photosynthesis, they use the carbon dioxide, water, and sunlight to produce glucose and give off oxygen into the atmosphere. The oxygen is then available for people or animals to breathe again. The glucose in the plants will give energy to people and animals when we eat them.



Terminology

Using what you learned, define these words in the best way you can. Use the back of the page if you need more room.

System: _____

Crust: _____

_____

Mantle: _____

Asthenosphere: _____

Lithosphere: _____

Atmosphere: _____

Troposphere: _____

_____

Stratosphere: _____

_____

Ozone layer: _____

Mesosphere: _____

_____

Thermosphere: _____

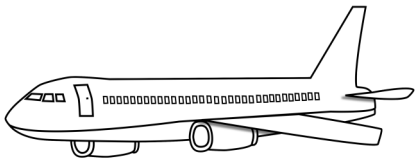
_____

Auroras: _____

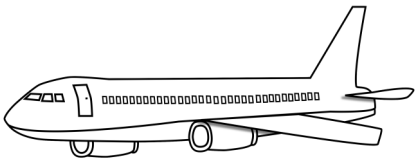
_____

Exosphere: _____

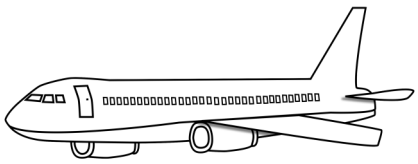
Which layer of the atmosphere is home to many jets? Draw a circle around it.



Stratosphere

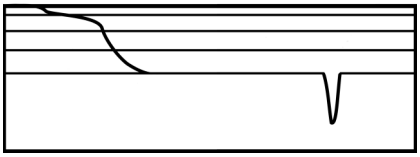


Mesosphere



Exosphere

Which layer of the ocean includes the surface? Draw a circle around it.



Midnight

Abyssal

Sunlight

Name six of the parts of the water cycle:

What two methods of nitrogen fixation did we discuss?

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