READ and REMEMBER: Earth Cycles and Patterns

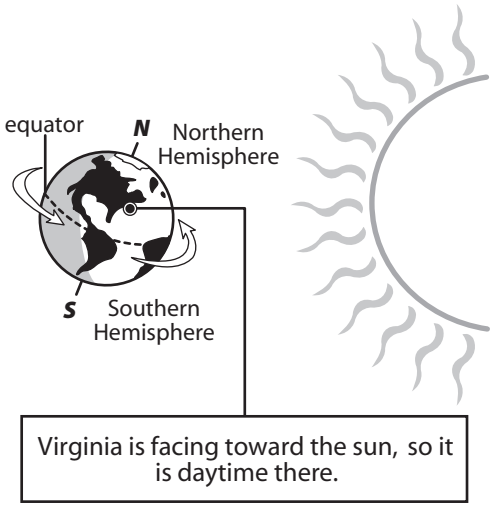
SOL 3.8.a 1.6.b

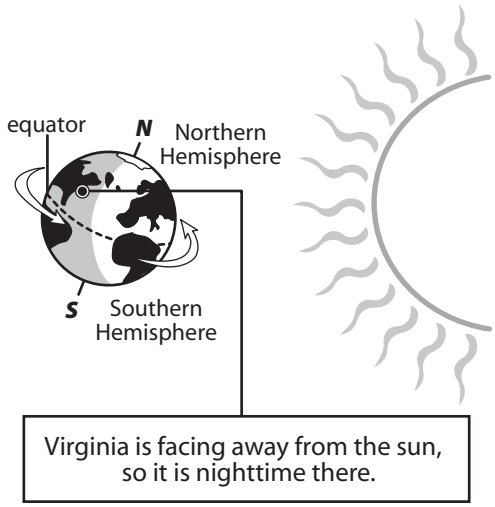
Day and Night

Every 24 hours, or each **day**, there is a pattern of daytime and nighttime. During most of the daytime it is light, and during most of the nighttime it is dark.

This cycle is caused by the planet Earth's **rotation**. The word *rotation* means "spinning" and that is exactly what Earth does. It rotates, or spins around, like a top on its axis. Earth's **axis** is an imaginary line drawn through the North Pole and South Pole. It takes Earth 24 hours to go all the way around. Earth rotates in a **counterclockwise** direction. This means that if you look down at the planet Earth from the North Pole, it will always be spinning to the left.

When Earth rotates, it changes what areas are facing the sun. The part of Earth that faces toward the sun has daylight. The part of Earth that faces away from the sun has night.





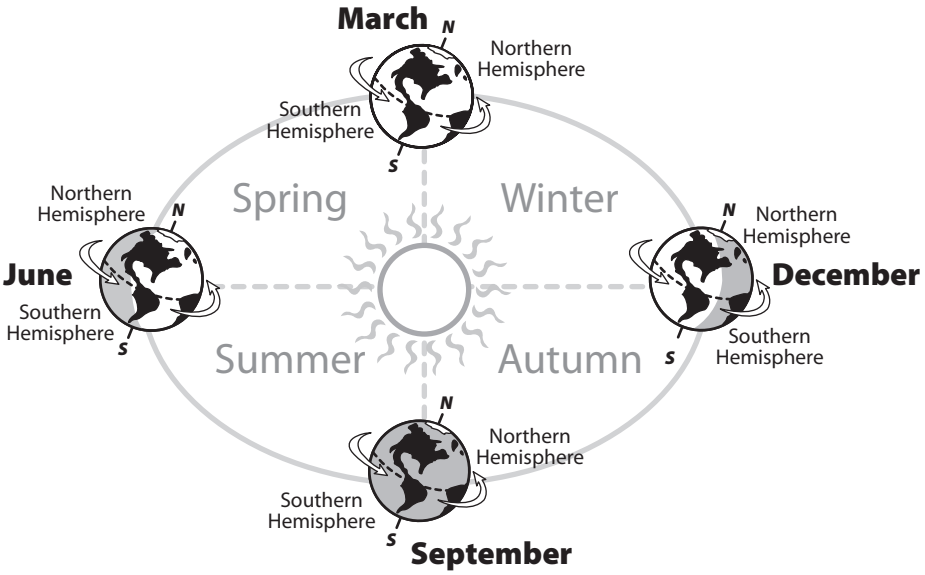
The *N* shows where the North Pole is located, the *S* shows where the South Pole is located. The line around the Earth's middle is the **equator**. The sun's rays hit the areas around the equator most directly. This means it is warmest by the equator. The sun's rays hit the North Pole and South Pole least directly, so it is cold in those places.

The Seasons

About every 3 months, the temperature changes in many areas. This pattern is the changing of the **seasons**. In Virginia, we experience four seasons: summer (when it is warmest), autumn or fall (when it cools down), winter (when it is coldest), and spring (when it warms up again).

This cycle takes place because Earth's axis is tilted toward or away from the sun at different times of year. This is caused by Earth's **revolution** around the sun. When Earth makes a revolution around the sun, it revolves, or moves in a circle, around the sun. Earth always revolves around the sun on the same almost-circular path, called an **orbit**. It takes Earth 365 days, or 1 year, to make a full revolution around the sun.

Earth is divided into two hemispheres. The **Northern Hemisphere** is between the equator and the North Pole. The **Southern Hemisphere** is between the equator and the South Pole. Virginia is in the Northern Hemisphere. At certain points in Earth's orbit, the Northern Hemisphere is tilted toward the sun. This causes summer in Virginia. When the Northern Hemisphere is tilted away from the sun, it is winter in Virginia.



When a hemisphere is titled towards the sun, the sun's rays strike it more directly. This warms it up more efficiently.

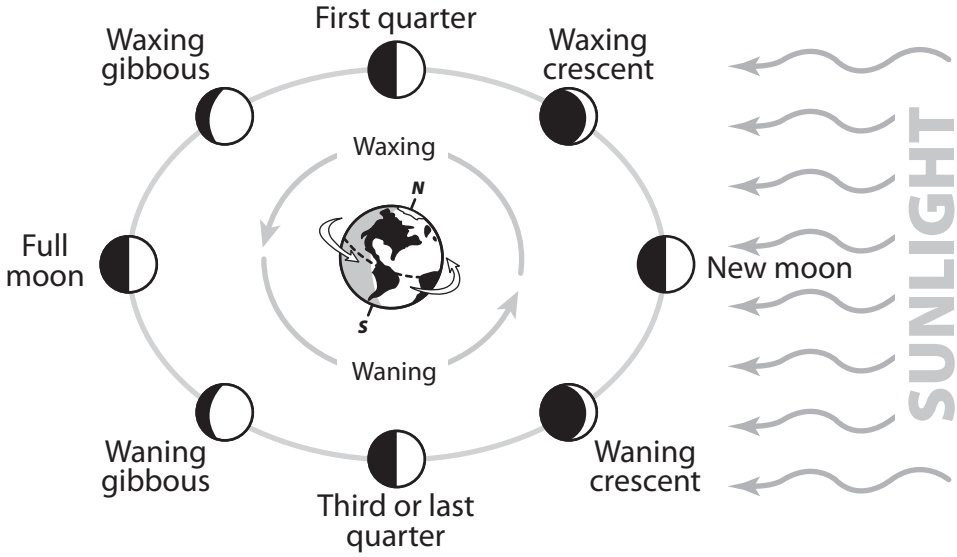
The model shows that in June, July, and August, it is summer. In September, October, and November, it is autumn or fall. In December, January, and February, it is winter. And in March, April, and May, it is spring. When it is summer in the Northern Hemisphere, it is winter in the Southern Hemisphere. When it is winter in the Northern Hemisphere, it is summer in the Southern Hemisphere.

The Phases of the Moon

Just as Earth revolves around the sun, the moon revolves around Earth. As the moon revolves around Earth, it appears to change shape. These shapes are called **phases of the moon**. Each month, all of the moon's phases appear.

This cycle is caused by the sun's light and the moon's orbit. The parts of the moon that the sun's light reaches glow with reflected light, making the moon appear bright white. The part of the moon in shadow looks black, like much of the night sky. Depending on where the moon is in its orbit, we see either the light side or the dark side, or some mix or combination of them.

A **full moon** has no shadow on it: the sun's rays light up the whole surface facing Earth. A **new moon** is completely hidden by shadow: to us, it appears black and cannot be seen. When the shadow on the moon grows larger (and the bright part grows smaller), the phases are described as **waning**. When the shadow gets smaller (the bright part gets larger), the phases are described as **waxing**.



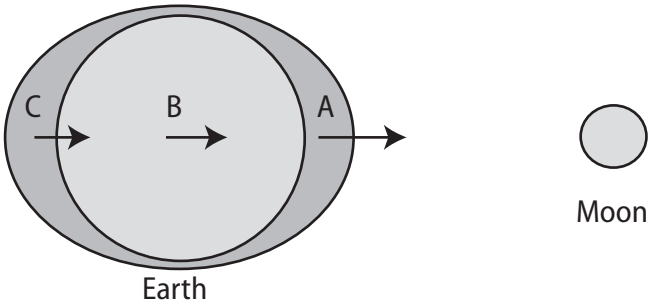
Be careful with the names of the different phases. A *crescent* moon is $\frac{1}{4}$ lit up. A *gibbous* moon is $\frac{3}{4}$ lit up. And the quarter moons are actually $\frac{1}{2}$ lit up!

The Tides

Every 24 hours, the waters of Earth's oceans will get higher in each place twice and lower in that same place twice. This pattern is called the **tides**.

This cycle is caused by **gravity**, which is an unseen force that pulls things toward it. When the moon orbits Earth, the moon's gravity pulls at the Earth's oceans. This makes the water higher in some places (high tide) and lower in others (low tide).

As some water is pulled slightly towards the moon by its gravity, there is that much less water in other places. In fact, there are *two* high spots, or high tides: one right under the moon (A), and the other on the opposite side of the world (C). This second high tide occurs because the moon's gravity pulls Earth (B) slightly towards it, and "out from under" the water on the other side, deepening that water. As the moon revolves around Earth, it brings the high tides with it, causing low tides elsewhere.



The sun's gravity and the motions of Earth can also affect the tides. (Even though the sun is many millions of times larger than the moon, the moon is so much closer that its gravity has a greater affect.) Though there are usually two high tides and two low tides on a beach or coast within 24 hours, sometimes the pattern will change, depending on the positions of the sun, moon, and Earth.

The tides are displayed in something called a **tide table**. This is a chart that shows people what time the tides are expected to come. This information is important to people who live or work near an ocean coast.

Tide Table for Virginia Beach
11/06–1/07

Tides	November	December	January
High Tide 1	5:41 a.m.	5:40 a.m.	5:44 a.m.
Low Tide 1	11:59 a.m.	12:09 p.m.	12:10 p.m.
High Tide 2	5:51 p.m.	5:51 p.m.	6:05 p.m.
Low Tide 2	NO TIDE	11:56 p.m.	11:57 p.m.