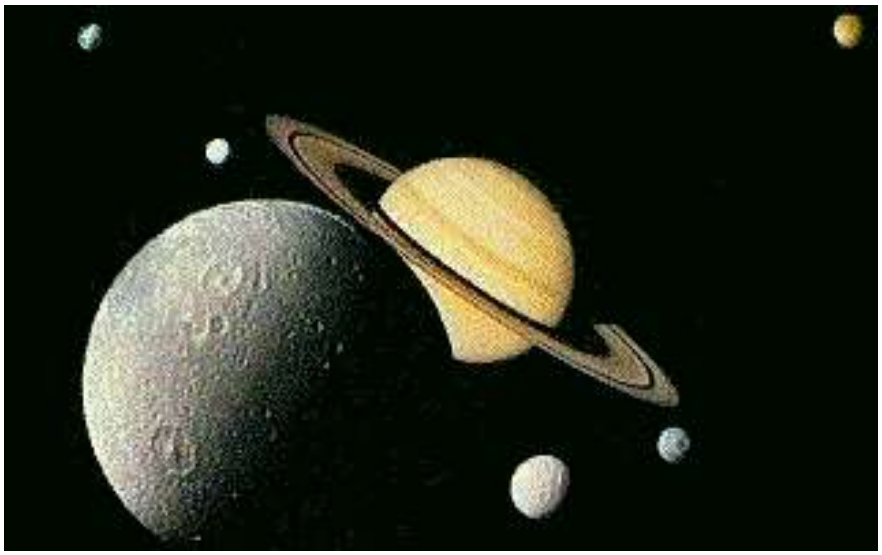
Sky Science
Note Pack



Sky Science

S-1 Where Are We?

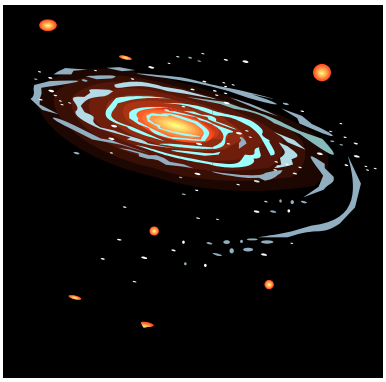
The planet Earth is part of a group of planets surrounding a star which we call the sun. The nine planets, the sun as well as comets and asteroids all make up the Solar System. The nine planets from closest to the sun to furthest away are as follows;

Create a mnemonic to remember the (old) nine planets order and names.

_____ Mercury
_____ Venus
_____ Earth
_____ Mars
_____ Jupiter
_____ Saturn
_____ Uranus
_____ Neptune
_____ Pluto
_____

Note: As of August 2006, Pluto is now considered a minor planet. Another body known as Eris has also been discovered in our solar system and is also classified as a minor planet. Who knows what will be discovered this year!

Our solar system is only one of thousands if not millions of other solar systems in the galaxy known as the Milky Way Galaxy. A Galaxy is a grouping of millions of stars all slowly orbiting a central core of stars. The Milky Way galaxy has a spiral shape like the one pictured below.



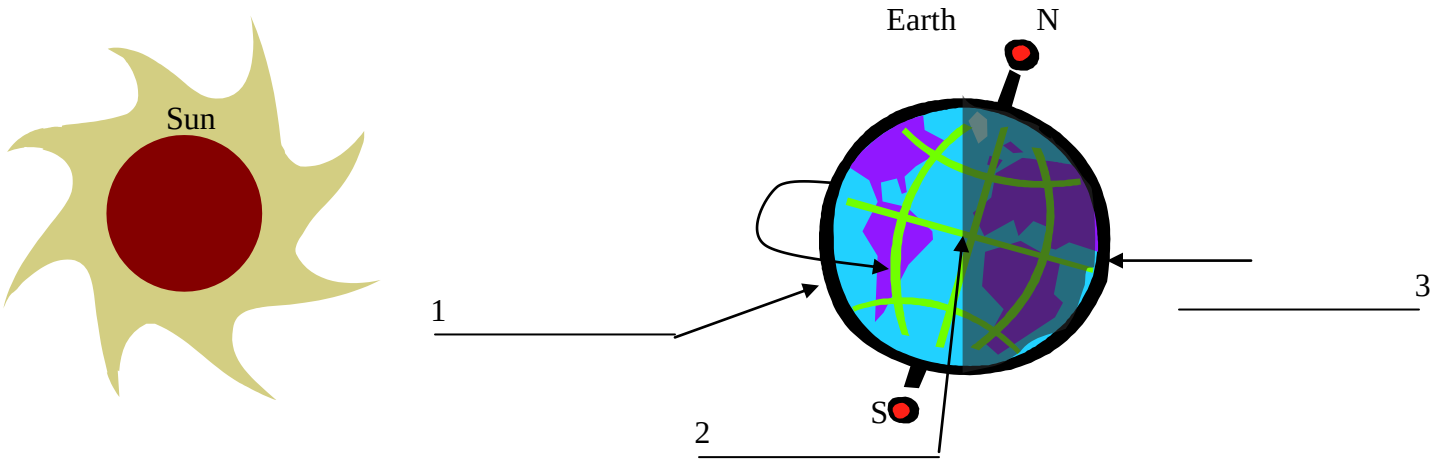
Our galaxy is not the only one out there; scientists have discovered thousands of other galaxies in the night sky and the deeper telescopes look the more are being discovered.
Find the name of at least two other galaxies and in which constellation are they found?

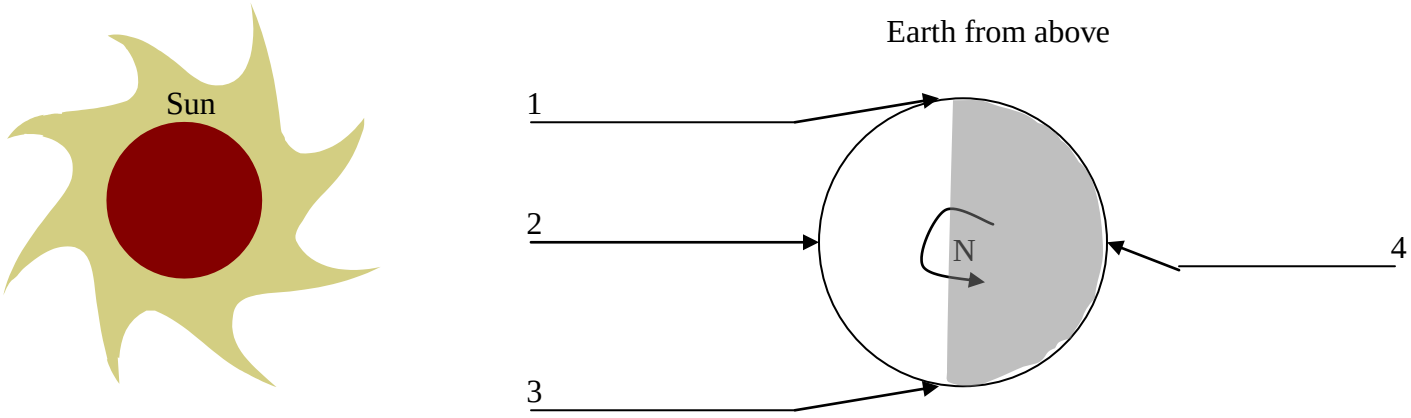
1. _____

2. _____

S-2 The Spinning Earth #1 Night and Day

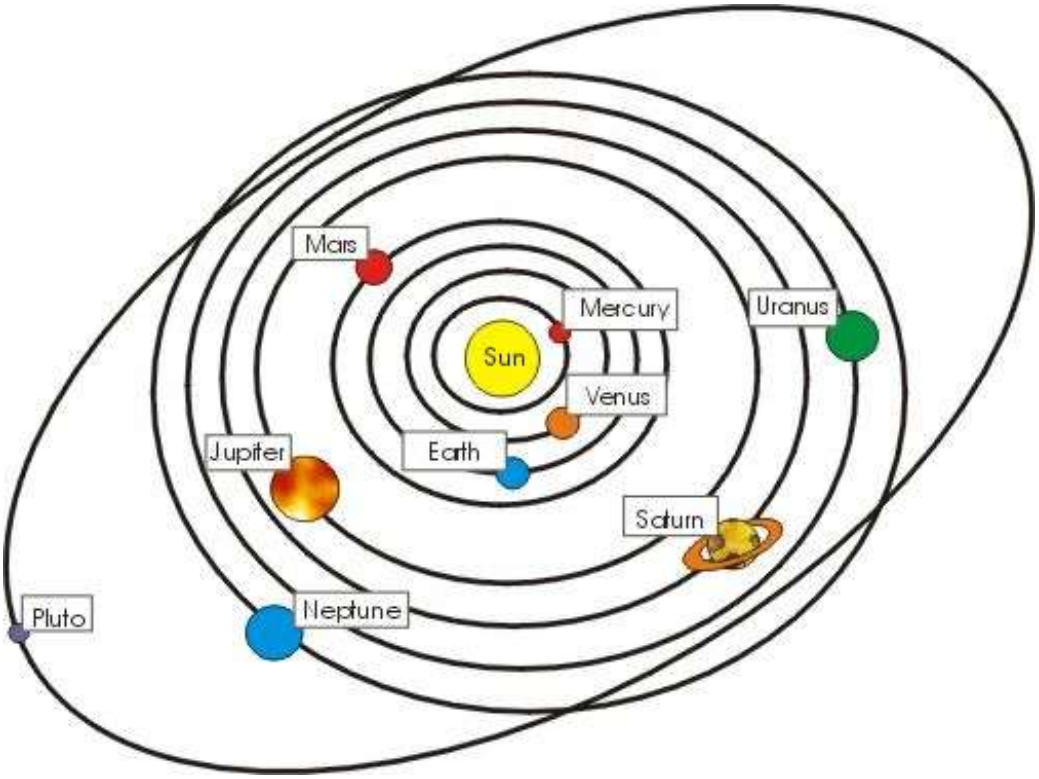
Our days and nights are caused by the spinning of the Earth on it's axis. This is called the Earth's **rotation.** The **axis** is an imaginary line that goes through the centre of the Earth, so that one end comes out the North Pole and the other end comes out the South Pole. This axis is at a slight tilt, and the Earth spins around it from West to East once every 24 hours. This rotation can also be described if you are looking down on the Earth from above, the rotation is counter-clockwise. This makes it look as if the sun were rising in the East and setting in the West, but really it is just the earth rotating on it's axis. When the part of the Earth that you are on is facing toward the Sun, it is day. When it is facing away from the Sun, it is night.





S-3 The Revolving Earth, Seasons

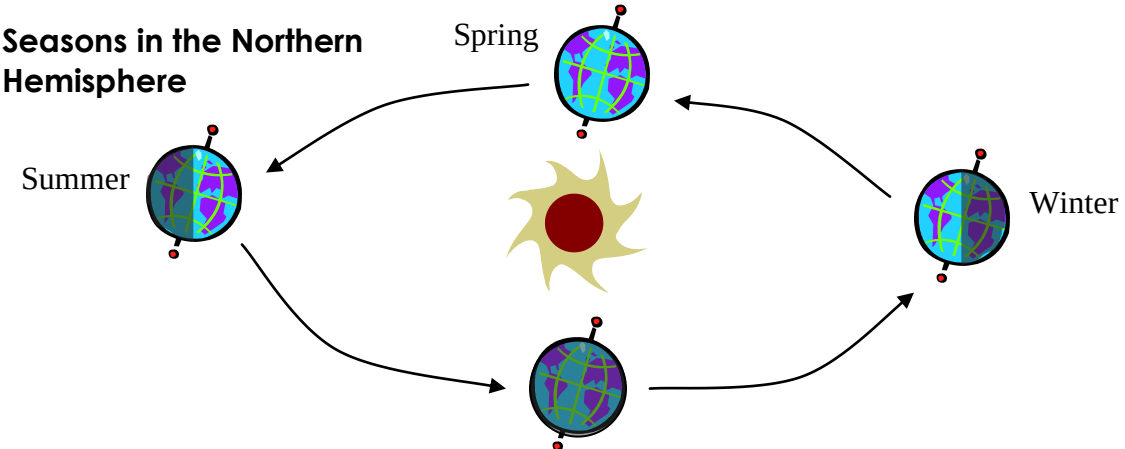
The planets all move around the sun in a path known as an **orbit**. The Orbits of the planets are mostly circular, but not quite, the actual path is known as an **ellipse**. An **ellipse** is also known as an oval. Pluto has the most **elliptical** orbit with the inner planets having almost circular orbits.



When a planet travels around the sun it is said to have completed one **revolution**, this is also known as one year. On Earth it takes 365.25 days to travel once around the sun. This is why every four years we have a leap year! (0.25+0.25+0.25+0.25 = one extra day in February)

The Earth's North Pole is tilted towards a single distant star (Polaris or North Star). As the Earth revolves around the sun the pole continues to point at Polaris. This gives the Earth it's seasons.

Seasons in the Northern Hemisphere



When the Earth's North Pole is tilted directly towards the sun, we call this summer. June 21st is called the summer solstice, this is considered the longest day of the year, when the sun is up in the sky for the longest. When the Earth's North Pole is tilted directly away from the sun, we call this winter. December 21st is called the winter solstice, this is considered the shortest day of the year, when the sun is up in the sky for the least amount of time. September 21st and March 21st are considered the **equinox**, equal night and daylight hours.

Summer Solstice June 21st		
Autumnal Equinox September 21st		
Winter Solstice December 21st		
Vernal Equinox March 21st		

Where and in which season on Earth would you have 24 hours of darkness?

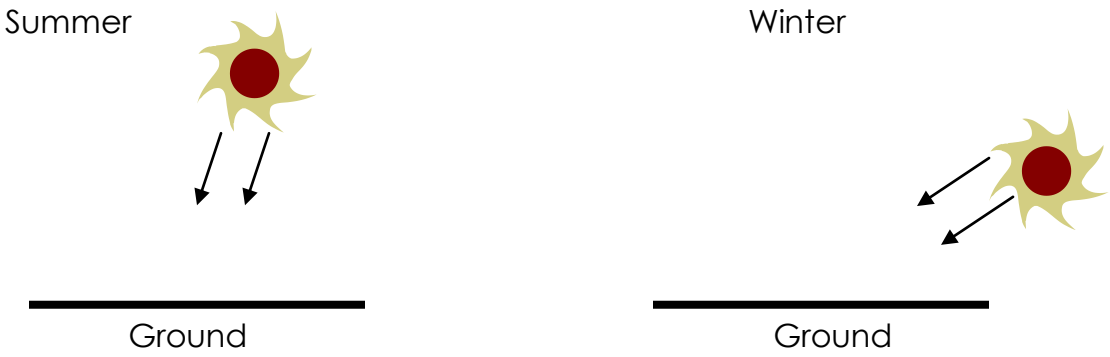
How are the seasons different in the Southern Hemisphere?

When would the Summer Solstice take place for the Southern Hemisphere?

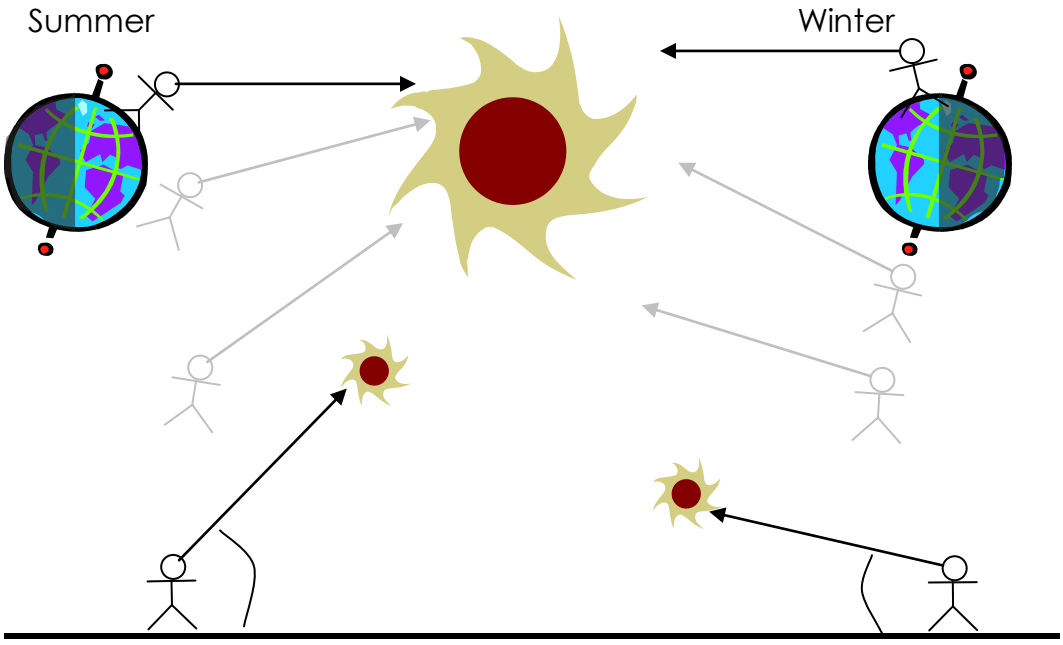
S-4 Seasons Continued…

The reason that we have the seasons has to do with the directness of the sun's rays on the surface of the Earth.

Using the following diagram show the difference in the size of the ground surface that is covered by a ray of sunshine in the different seasons.



Of course the sun does not move up and down in the sky, the tilt of the Earth makes it look that way over a year.

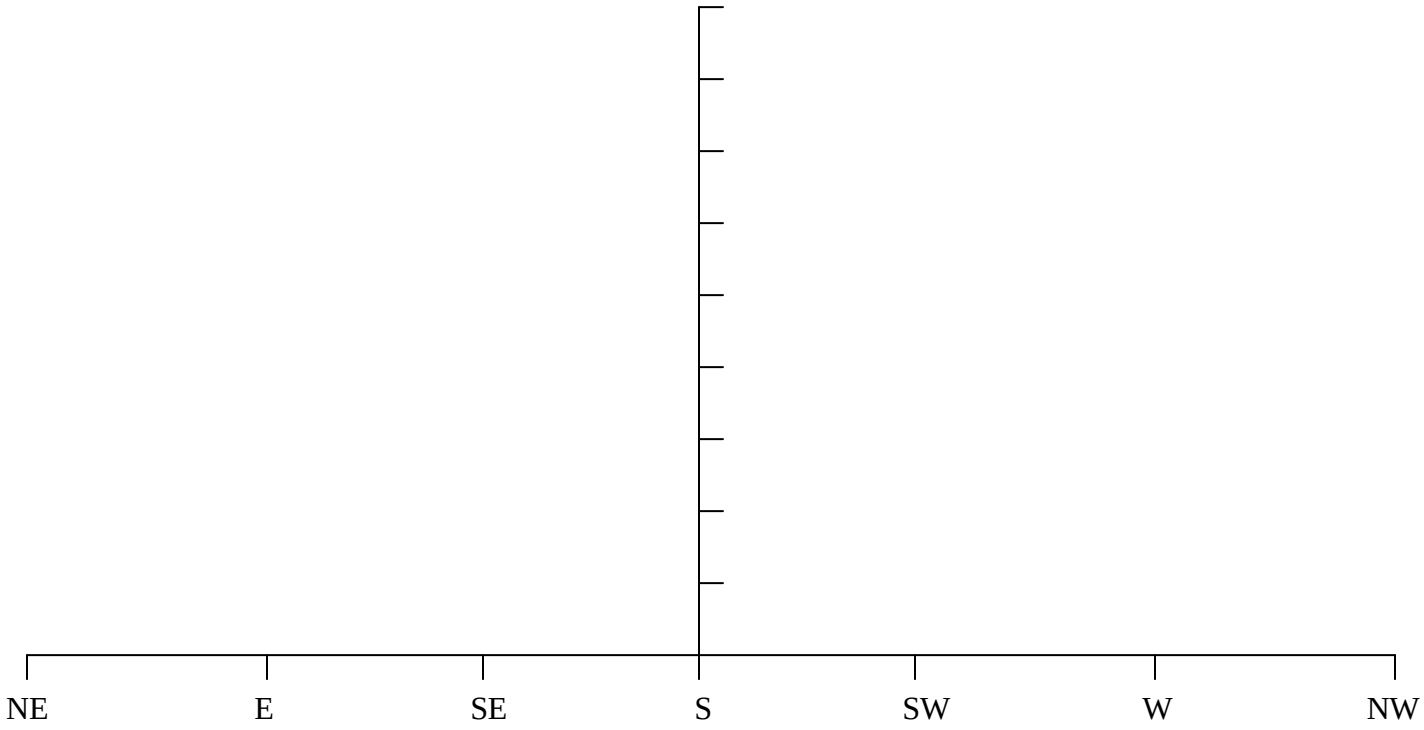


To a person standing on the same point on Earth during the summer and the winter months, the tilt of the Earth's axis makes the sun seem to appear at different angles above the horizon. During the summer the rays are more direct and allow the Earth to heat up, and during the winter the rays are spread out and less heating occurs.

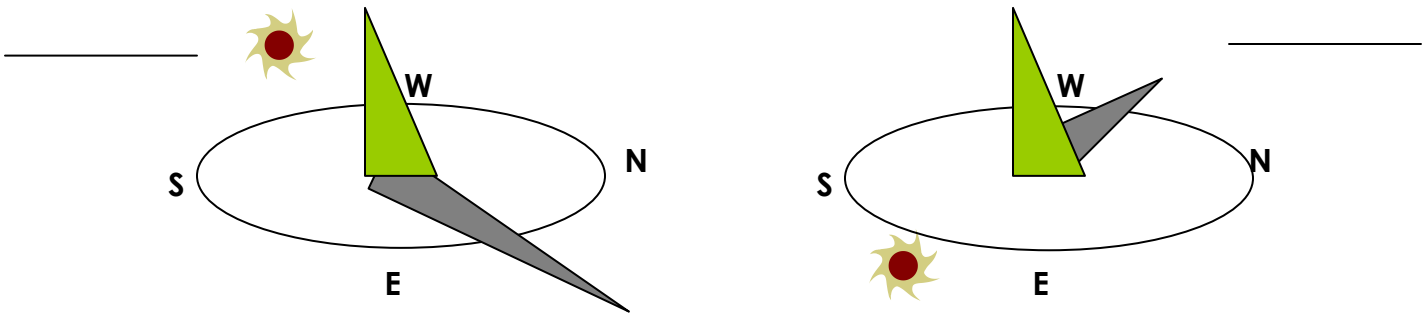
S-5 Sun's Path Across the Sky (Sun Dials)

Generally objects in the sky (including the sun) rise in the east and set in the west. However due to the tilt of the Earth, the sun's path seems to shift through the seasons. The sun's path across the sky varies and seems to rise and set further north in the summer and further south in the winter.

Use the following chart to map out the apparent path of the sun across the sky for each of the four seasons.



A Sundial is a device that consists of a shadow maker and an area to cast the shadow onto. The casting area has to be aligned with north in order to work. Due to the placement of the shadow, the observer can tell the position of the sun in the sky. **The sun is on the opposite side of the shadow.**

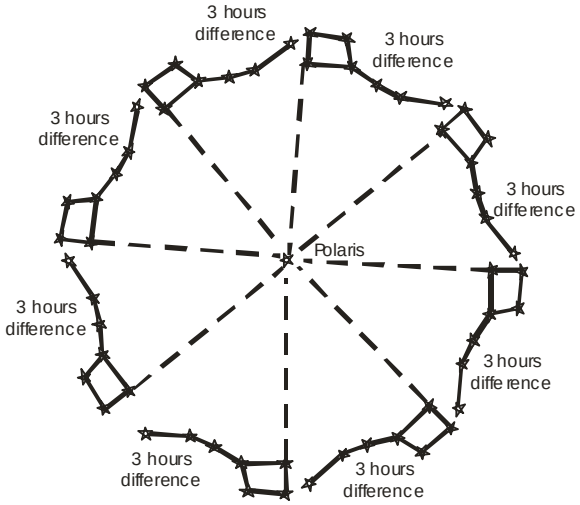


If this is winter, what time of day do you think is shown in the above sundials? Write your answers on the blanks above.

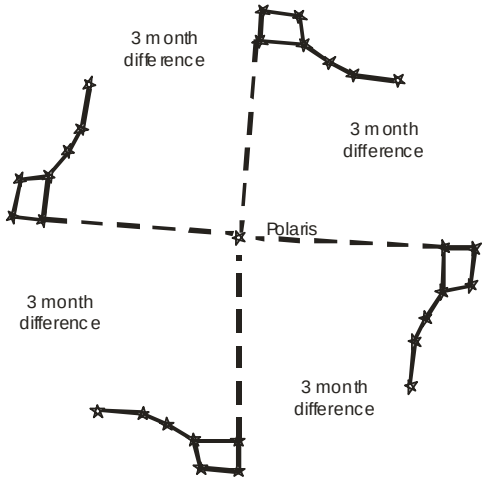
S-6 The Spinning Earth #2 Constellations and Stars

Constellations are imaginary pictures that are suggested by star locations. As the Earth rotates on its axis, that star and constellations appear to move around in a large circle at night. In the northern hemisphere where we are, the constellations seem to pivot around **Polaris**, with is also called the **North Star.** This is because the north axis of the Earth points almost directly at Polaris. The picture below shows how this happens. In one 24 hour period, the Big Dipper constellation will appear to completely circle around Polaris. Of course we can only see its apparent journey when it is dark, but you can predict its location by imagining 24 points on a circle surrounding Polaris. Each Hour, it will move one twenty-fourth of the total distance.

Due to our revolution around the Sun, the constellations will also appear to rotate around Polaris. Therefore, we see different constellations depending on the season of the year. If you were to look at the same time every night for a year, you would notice the positions of the stars to circle Polaris completely in 12 months.



Rotation through a single day (24 hours). The Big Dipper (Ursa Major) moves because the Earth spins on its axis.



Rotation through a year, if you were looking at the same time of day. The Big Dipper moves because the Earth is travelling around the sun.

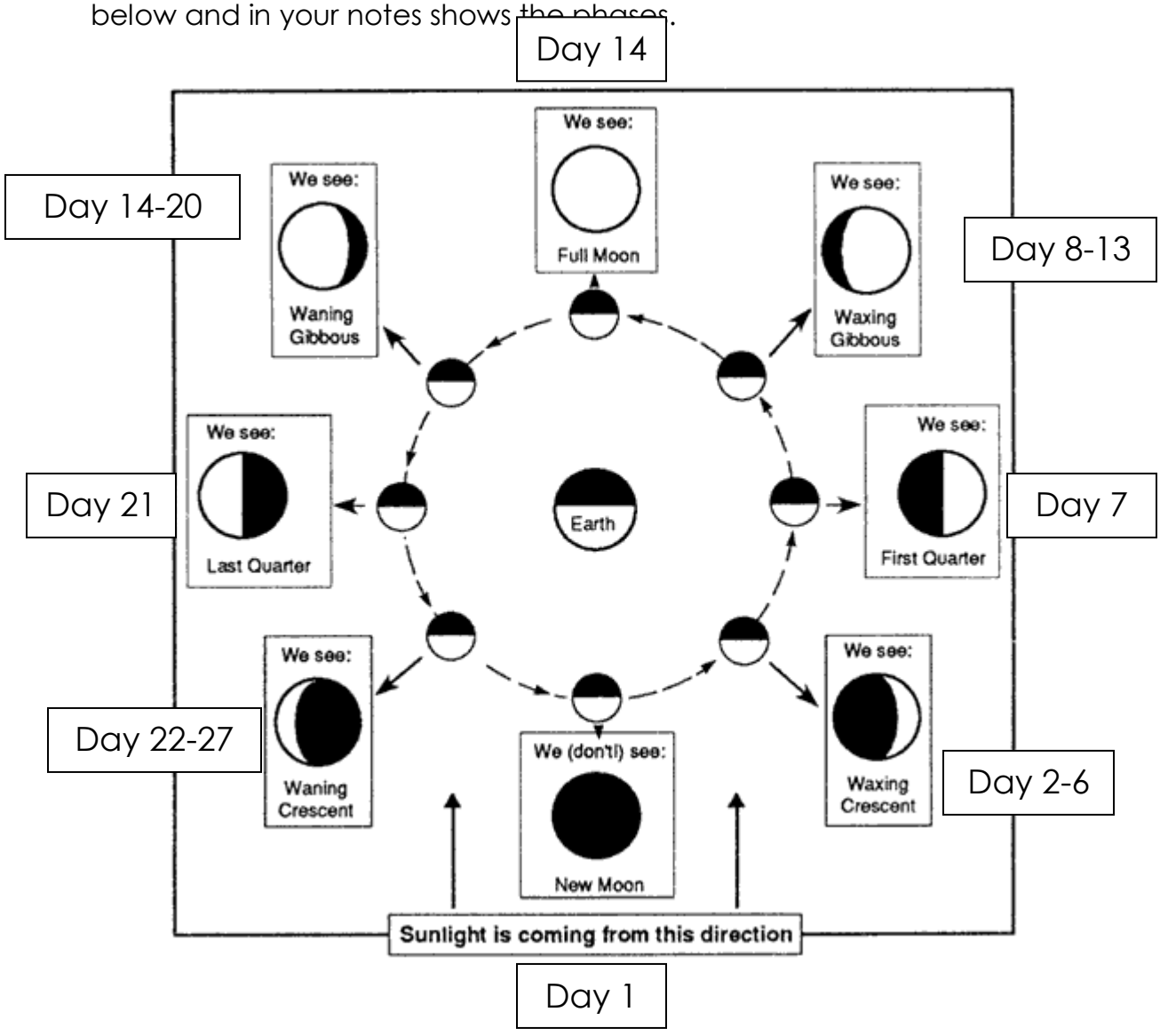
Use your star finder to view these changes in the star positions.

S-7 The Moon

The Earth has only one NATURAL SATELITE which is called the moon.

We only see the moon because the sun illuminates it and makes it shine brightly in the sky. Without the reflected light, the moon is a black chunk of rock orbiting our planet.

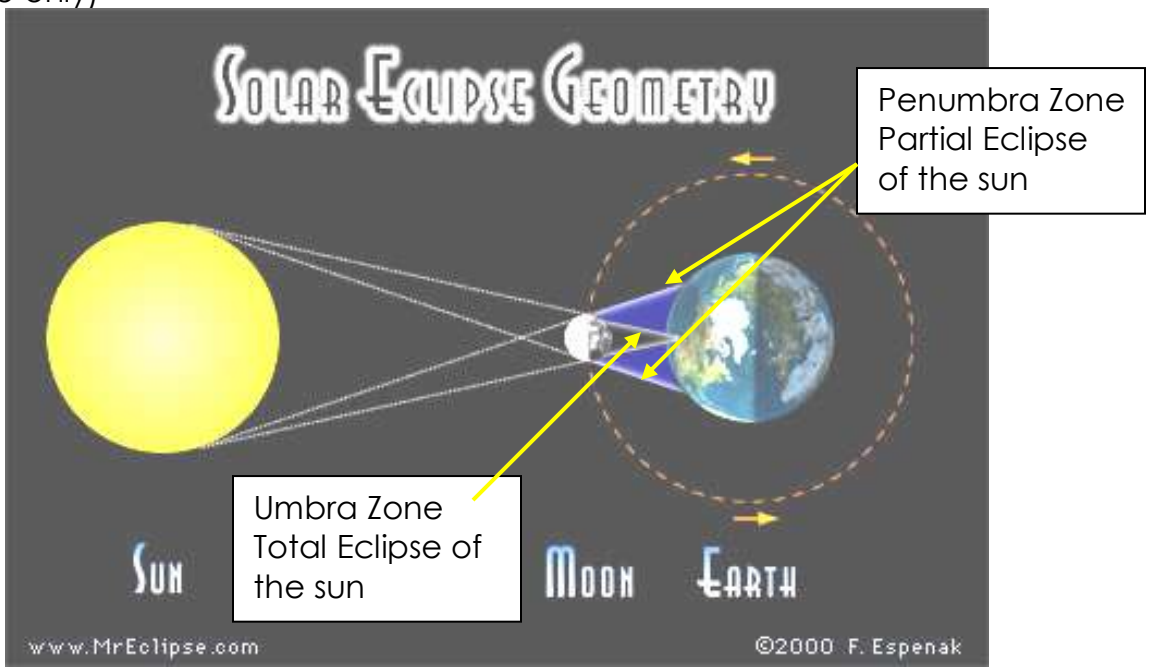
The moon takes approximately 28 days to complete a counterclockwise **revolution** of our planet. As the moon orbits around Earth, the same side is always turned towards but appears to change shape. This doesn't actually happen, and we now understand what is really going on. When the face we see is facing directly toward the sun, it is fully illuminated and we see a **Full Moon**. When the face that we see is facing directly away from the sun, it is completely in shadow and invisible, looking like a "black hole" in the sky. This is the **New Moon**. In between these two extremes, the moon **WAXES** (get bigger) and **WANES** (gets smaller). The picture below and in your notes shows the phases.



S-8 Eclipses

The moons orbit only crosses the orbit of the Earth at two locations, only when the alignment of the sun, moon and Earth are just right do we get a solar or lunar eclipse.

A **Solar Eclipse** occurs when the moon passes directly between the Sun and the Earth, blocking the sunlight from our view. You can only see a Solar Eclipse when you are inside the shadow on the Earth. **(New Moon** Phase only)



A **Lunar Eclipse** occurs when the moon passes into the shadow of the Earth as it orbits our planet. The Earth is blocking the sunlight that would normally be illuminating a **Full Moon**.