NAME\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Mrs. Weimer /Grade 8 /Unit Astronomy

The atmosphere

* The atmosphere is a mixture of gases that surround the earth
	+ Does a couple of things:
		- Provides us with \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in which to breathe
		- Protects us from the sun’s harmful rays
* Composition
* The atmosphere is composed of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, with a small amount of liquids and solids
	+ Solids are: dust, volcanic ash, sea salt, dirt, and smoke
	+ Liquids: most common is water droplet in the clouds (in the visible form) and water vapor (invisible form)
	+ Gases: the two gases making up most of the air we breathe are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Air Pressure
* The measure of the force with which air molecules push on a surface
	+ Your ears pop due to an equilibrium balance in your \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Air pressure is like a pyramid:
		- On the bottom, all the pressure and weight are felt and at the top there is less pressure and weight
* Gravity
* The atmosphere is held around the earth by gravity
	+ This pulls the gas molecules in the atmosphere towards the earth's surface giving them weight
	+ Weight cause the air to push against the earth’s surface
		- As you move farther from the earth’s surface, air pressure \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because fewer gas molecules are pushing on you
	+ ALTITUDE-the height of an object above the earth’s surface
* Air Temperature
* Air temp also decreases as you increase altitude
	+ As you pass through the atmosphere, air temp changes between warmer and cooler conditions
		- This change is due to the way solar energy is absorbed as it moves downward in the atmosphere
		- Some parts of the atmosphere are warmer b/c they contain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Layers of the Atmosphere
* T. SMITH
	+ The acronym for the layers
		- T= troposphere
		- S= stratosphere
		- M=mesosphere
		- I= ionosphere
		- TH=thermosphere
* Troposphere
	+ Lies next to the earth’s surface and is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_layer of the atmosphere
		- Densest layer and contains 90% of the total atmospheric mass
		- Almost all of the CO2, H2O vapor, clouds, air pollution, weather and life forms are found in this layer
		- Stratosphere
	+ Layer above the troposphere
	+ Very thin air and contains little moisture
	+ Lower portion is extremely cold (-60 degree C)
		- Temp rises with increasing altitude b/c of ozone
		- OZONE-a molecule made up of \_\_\_\_\_\_ oxygen atoms
			* Absorbs solar radiation in the form of UV radiation, which warms the air
			* Also protects the earth’s surface
* Mesosphere
	+ Layer above stratosphere
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the atmosphere
	+ Temps can be as low as -93 C
	+ Also contains large wind storms with wind gusts up to 320 km/h
* Thermosphere
	+ Upper atmospheric layer
	+ Temp increases with altitude b/c of the gases absorbing the radiation
		- Temps in this layer can reach \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
		- The thermosphere has high temp, but is not hot (?)
			* Temperature is a measure of the amount of energy in a particle, so this just means that particles are moving very quickly
* Ionosphere
	+ Between the upper mesosphere and the lower thermosphere
		- High temps b/c of the absorption of X rays and gamma rays from our solar energy source
		- This high temp leads to electrically charged particles \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
			* Sometimes the ions radiate different colors of light
		- Ionosphere reflects radio waves
			* Thus, if you have listened to an AM radio station, the clearness of the signal was dependent on the ionosphere
* Introduction to Astronomy
	+ Is the original science and is the study of all physical objects beyond earth
		- Used to understand the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Used to keep time:
		- Ancient cultures based their calendars on the sky
		- Roman calendar was thought out to have 365 days in a year and 7 days in a week and worked well until the seasons began to “shift” and things went out of whack.
* Calendar
	+ The Julian calendar took the place of the Roman calendar and Julius Caesar corrected by adding 90 days to the year 45 BC, which brought seasons back into position—this is because there are actually 365.25 days in a year (or 1 day every four years to account for leap year)
	+ Julian Calendar incorrect
	+ In the 1500’s the Julian calendar was also proven incorrect and Pope Gregory figured out that there are actually \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_days in the year---so he created the Gregorian calendar
		- Dropping 10 days from the year 1582 restricting leap year to every \_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Gregorian calendar will be accurate for another \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ years
* The beginning or astronomy
	+ Ptolemy- Ptolemaic theory – thought the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ was the center of the universe and the sun and other planets revolved around it-**GEOCENTRIC**
		- People believed this for more than \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ years
	+ Copernicus- Nicolaus Copernicus- \_\_\_\_\_\_\_\_\_\_\_ at the center of the universe and the planets orbit the sun, but his theory was not widely accepted-**HELIOCENTRIC**
	+ Tycho Brahe- favored the earth centered universe of Ptolemy, but thought that the other planets revolved around the sun and the sun and moon revolved around the earth
	+ Kepler- Tycho’s assistant; announced new laws of planetary motion all planets revolve around the sun in elliptical orbits and the sun is not in the exact center of those orbits
	+ Galileo- first person to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a telescope to observe celestial bodies; discovered the moons of Jupiter, sunspots on the sun and phases of Venus
	+ Newton- 1687- explained why planets orbit the sun and why moons orbit planets--\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* **The Moon**
	+ Moon
	+ Our planet's large \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, the Moon, is the easiest astronomical object to observe.
	+ The only "scientific instrument" you'll need at first is a pair of eyes.
* **The Moon's Orbit**
	+ Rotation
		- Moon is spinning on its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Revolution
		- The moon orbits around the Earth
		- It takes the moon approximately \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to go around the Earth.
	+ **Why do we never see the DARK SIDE? Answer (IN YOUR OWN WORDS) when you watch the video:**
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the reason we never see the dark side of the moon.
* Over the millennia, the Moon has become "locked" into a special kind of motion around the Earth.
* It rotates on its axis at the same pace as it revolves around the Earth
* As a result, the Moon keeps the same face toward us throughout its orbit.
* Phases
	+ The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the moon always faces the sun.
* New Moon
	+ New moon occurs when the moon is between the sun & the Earth.
	+ The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_side of the moon is facing the Earth
* Full Moon
	+ The full moon occurs when the Moon & the Sun are on opposite sides of the Earth.
	+ The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_side of the moon is facing Earth.
* Blue Moon
	+ When there is more than one \_\_\_\_\_\_\_\_\_\_\_\_\_ moon in a month, the second moon is called a blue moon.
	+ A blue moon happens every \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on average.
	+ The phrase, “Once in a blue moon” means very rarely or very seldom or almost never.
* First Quarter Moon
	+ The First quarter moon occurs when the moon is halfway between new and full.
	+ As seen from the Earth, half the moon’s disk is illuminated.
* Third Quarter Moon
	+ The Third or last quarter moon occurs halfway between the full moon & the new moon.
	+ As seen from the Earth, half the moon’s disk is illuminated.
* **Waxing**
	+ When the moon is between new & full, the visible part of the moon is **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
	+ This is called waxing
* **Waning**
	+ When the moon is between full & new, the visible part of the moon is **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
	+ This is called waning.
* Crescent Moon
	+ When the moon is between New & 1st Quarter it is called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Gibbous Moon
	+ When the moon is between 1st Quarter & Full it is called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.



* **TIDES**
	+ What are tides?
		- The periodic rise and fall of the sea level under the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the moon
	+ Tides are one of the most reliable phenomena in the world. As the sun rises in the east and the stars come out at night, we are confident that the ocean waters will regularly rise and fall along our shores.
* Moon Tide
* The Moon’s gravity exerts a strong pull on Earth.
* The water bulges outward as Earth and the Moon revolve around a common \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* The moon’s gravity pulls on the earth, and pulls the water towards it. The water moves up into a slight bulge on the side of the earth that faces the moon.
* Brain Check
	+ Think to yourself, what causes tides?
	+ On your notes, write down what causes tides.
* Moon Tides
	+ The gravitational and centrifugal forces are constant, always pulling water towards the moon and directly away from the moon. The forces in either direction are equal to each other.
	+ The bodies of water that feel these forces change constantly as the earth rotates within these forces, but the force directions are always toward and away from the moon.
* Semidiurnal tides
	+ As the earth turns upon its own axis in about 24 hours, a point on the earth moves through areas with these different forces acting on it.
	+ In one rotation (one day), a point on earth travels from an area of high tide (where there is a force pulling water outward), through an area of low tide, through an area of high tide again (the opposite pull), and through another area of low tide, before it returns to the point of origin at high tide.
	+ This results in \_\_\_\_\_\_\_\_ high tides and \_\_\_\_\_\_\_\_ low tides in a day (called semidiurnal tides).
* The Tidal Day
	+ The moon does not stay put, but rotates around the earth at a rate of about \_\_\_\_\_ a day, or one rotation a month.
	+ The rotation is in the same direction as the earth’s spin, so by the time the earth has done one rotation, the moon has shifted 12° further, and it takes an extra 50 minutes for the moon to be in the same position relative to a point on the earth.
	+ Therefore, the tidal cycle is not 24 hours long, but\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Because of this, high and low tides are about 50 minutes later every day.
* Brain Check
* Think to yourself, what is the length of a tidal day?
* On your notes answer the following question:
	+ If high tide is at 12pm today, when will it be tomorrow.
	+ Show your answer to a neighbor and discuss it.
* The Sun Tide
	+ The sun’s pull can heighten the moon’s effects or counteract them, depending on where the moon is in relation to the sun.
* Spring Tides
	+ Spring tides are especially strong tides (they do not have anything to do with the season Spring). They occur when the Earth, the [Sun](http://www.enchantedlearning.com/subjects/astronomy/sun/), and the Moon are in a\_\_\_\_\_\_\_\_\_. The gravitational forces of the Moon and the Sun both contribute to the tides. Spring tides occur during the \_\_\_\_\_\_\_\_\_ and the \_\_\_\_\_\_\_\_\_.
	+ The Moon & the Sun’s gravitational force combine to create a particularly strong tide.
* Neap Tides
	+ Neap tides are especially \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ Moon & Sun are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to each other.
	+ Moon & the Sun’s gravity cancel each other out.
	+ They occur when the gravitational forces of the Moon and the Sun are perpendicular to one another (with respect to the Earth). Neap tides occur during quarter moons.
* Brain Check
* Think to yourself, what is the difference between spring and neap tides?
* On your notes, draw a Venn diagram comparing and contrasting spring and neap tides.
* Using your notes as a guide, discuss with your neighbor the similarities and differences of spring and neap tides.
* **Tidal Range**
* The **tidal range** is the difference between the level of the ocean at \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Mont St. Michel
	+ A great example of tidal surge is the castle Mont St. Michel in France.
	+ The tides surrounding the “Mount” can vary by 14 meters between high and low tides, and move in as rapidly as 1 meter a second.
	+ The “Mount” is connected to the mainland by a thin natural land bridge, which before modernization was covered by the sea at high tide, and revealed during the low tide.
* Isaac Newton
	+ Isaac Newton (1642 -1727) was the first person to explain tides scientifically. His explanation of the tides (and many other phenomena) was published in 1686, in the second volume of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Tying it all together
* Think to yourself, what you have learned about tides.
* On a half piece of paper, write a power outline about tides as well as a graphic which describes tides.

|  |  |
| --- | --- |
| Outline | Graphic |
|  |  |

* Why do we have Seasons?
	+ The **Axis of Rotation** is the imaginary line that the Earth turns about.
	+ The axis always points to the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**. This is called **Parallelism of the Earth's axis**.
	+ The imaginary surface of the Earth's yearly trip around the sun is the Plane of Earth's Orbit.
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- the imaginary point in the sky directly above the observer on earth with an altitude of 90 degrees
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- the line where the sky and the earth appear to meet
	+ Altitude- angle between object and horizon
* Circumpolar Stars
	+ Polaris is one of many northern stars that move in circles small enough that they always remain above our horizon. Such stars are called “circumpolar”.
	+ How many stars appear circumpolar depends on where you are on the Earth; those living closer to the north pole see a larger portion of the sky being circumpolar.
* Celestial Equator
	+ The **celestial equator** is the band around the celestial sphere midway between the north and south poles.
	+ These are the stars that move in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ Of course, again, there is no celestial sphere. The celestial equator is actually the points above the Earth’s equator.
* Earth’s rotation
	+ The Earth rotates on its axis (imaginary vertical line around which Earth spins) every 23 hours & 56 minutes.
	+ One day on Earth is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the Earth.
	+ Day on Earth is when our side of the Earth faces the sun.
	+ Night on Earth is when the side of Earth we are on faces away from the sun.
* Earth’s revolution
	+ It takes the Earth 365 days (or rotations) to travel or revolve around the Earth once.
	+ This is called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Why do we have seasons?
	+ The Earth’s orbit around the sun is NOT a perfect circle. It is an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Seasons are not caused by how close the Earth is to the sun.
	+ In fact, the Earth is closest to the sun around \_\_\_\_\_\_\_\_\_\_ and farthest away from the sun around July 4.
	+ Seasons are the result of the \_\_\_\_\_\_\_of the Earth's axis.
	+ Earth’s axis is tilted \_\_\_\_\_\_\_\_\_
	+ This tilting is why we have SEASONS like fall, winter, spring, summer.
	+ The number of daylight hours is greater for the hemisphere, or half of Earth, that is tilted toward the Sun.
	+ Summer is warmer than winter (in each hemisphere) because the Sun's rays hit the Earth at a more direct angle during summer than during winter
	+ Also the days are much longer than the nights during the summer.
	+ During the winter, the Sun's rays hit the Earth at an extreme angle, and the days are very short. These effects are due to the tilt of the Earth's axis.
* **Solstices**
	+ **Solstices** occur \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a year, when the tilt of the Earth's axis is oriented directly towards or away from the Sun, causing the Sun to appear to reach its northernmost and southernmost extremes.
	+ Winter solstice is the shortest day of the year. In the Northern Hemisphere. It occurs on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and marks the beginning of winter.
	+ The Summer Solstice is the longest day of the year. It occurs on \_\_\_\_\_\_\_\_\_\_\_ and marks the beginning of summer.
	+ **During the winter the Northern Hemisphere day lasts fewer than 12 hours and the Southern Hemisphere day lasts more than 12 hours.**
	+ **During the winter solstice, the North Pole has a 24-hour night and the South Pole has a 24-hour day.**
	+ **Sunlight strikes the earth most directly at the Tropic of Capricorn.**
* Equinoxes
	+ A day lasts 12 hours and a night lasts 12 hours at all latitudes.
	+ Equinox literally means "\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_".
	+ Sunlight strikes the earth most directly at the equator.
	+ This occurs \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a year.
	+ The vernal (spring) equinox occurs \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ The autumnal (fall) equinox occurs \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ The Earth's seasons are not caused by the differences in the distance from the Sun throughout the year.
	+ The seasons are the result of the tilt of the Earth's axis.
* Take a trip around the Solar System
* Before we start exploring, let’s talk about distances
* The distances between most objects in space are huge, and mind boggling.
* Because of the vast distances in space we use 2 measurements.
* Astronomical Unit
* When we talk about distances inside the solar system:
	+ **Astronomical Unit** (AU) : distance between \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or 93 million miles.
* Need to know terms:
* Revolution: how long it takes a planet to go around the sun.
* Rotation: how long it takes a planet to turn once on its axis.
* Light Year
* **Light Year**: the distance light travels in one year or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

PLANETS! ☺

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Distance from Sun | What do we know? NASA | Rotation | Revolution | Temperature | Atmosphere | Named | Facts  |
| Mercury |  |  |  |  |  |  |  |  |
| Venus |  |  |  |  |  |  |  |  |
| Earth |  |  |  |  |  |  |  |  |
| Mars |  |  |  |  |  |  |  |  |
| Jupiter |  |  |  |  |  |  |  |  |
| Saturn |  |  |  |  |  |  |  |  |
| Uranus |  |  |  |  |  |  |  |  |
| Neptune |  |  |  |  |  |  |  |  |
| Dwarf Planets |  |  |  |  |  |  |  |  |