May 7, 2019

6th Grade Space Review

*SUN – Mercury – Venus – Earth – Mars – asteroid belt – Jupiter – Saturn – Uranus – Neptune*



*Background vocab*

* Orbit: the *pathway* of an object around another
	+ Ex. Earth’s orbit around the sun
* Revolution: the *movement* of a planet or moon around another body, such as the sun or a planet
* Rotation: the turning of a planet, moon, etc. on its axis
* Gravitational force: the force that exists between all objects because of their mass
	+ The force of gravity acts to pull objects together
	+ Keeps planets, moons, asteroids, etc. in orbit
	+ *As the mass of an object increases, its gravitational force increases*
	+ *As two celestial objects get closer and their distance* ***decreases****, the gravitational force between them* ***increases***
* Force: a push or pull on an object
	+ Force causes an object to accelerate in the direction of the force
* Light-year: the distance that light can travel in one Earth year
	+ The speed of light is approximately 300,000,000 meters per second (300 *million* meters per second)
	+ **It takes light 8 minutes to get from the sun to Earth**
* Photon: a particle of light

*Space specifics*

* Big Bang: occurred approximately **13.7 billion years ago**
	+ All of the energy and matter that would fill the universe was concentrated into a teeny tiny point
	+ This teeny tiny point EXPLODED (there was a BIG BANG), which created *time and space*
		- After a few hundred thousand years, the first atoms began to form, leading to the development of stars and more complex atoms
	+ **Universe is still very active**
		- Continues to expand as more and more galaxies form
* Universe: composed of galaxies
	+ Includes all of space and time
* Galaxy: a large system of gas, dust, and millions of stars
	+ Galaxies were the first complex systems to form after the Big Bang
		- New galaxies are still forming today
	+ We live in the **Milky Way Galaxy**, which is 13.2 billion years old
* Nebula: a cloud of dust and gas where stars and planets can form
* Solar system: composed of one or more stars and the planets, asteroids, comets, and

meteors that revolve around the star

* + **Earth and our solar system formed 4.6 billion years ago**
* Sun: the sun is our closest star and the center of our solar system
	+ Earth is 8 light-minutes away from the sun (almost 93 million miles!)
	+ The central temperature of the sun is approximately 27 MILLION degrees Fahrenheit!
	+ Composed of 75% hydrogen and 25% helium
	+ Every star is the center of its own solar system
		- Every star is a sun!
	+ **Our solar system formed approximately 4.6 billion years ago**
* Rocky planets: Mercury, Venus, Earth, Mars
	+ 4 inner planets
	+ Rocky spheres with solid crusts
* Gas giants: Jupiter, Saturn, Uranus, Neptune
	+ 4 outer planets
	+ Made of gas and ice
	+ All very large, but Jupiter is the BIGGEST
* Moon: a satellite that orbits a planet
	+ The inner planets have few moons, while the outer planets have many moons
		- Ex. Earth has one moon, Mars has two moons, and Saturn has *at least 56* moons
	+ Moons can be larger or smaller than other planets, but moons MUST be smaller than the planets they orbit
		- For example, the moon Ganymede is larger than Mercury, but smaller than Jupiter (the planet that Ganymede orbits)
* Asteroids: big rocks that orbit the sun
	+ Most (millions) are located in the **asteroid belt**, between Mars and Jupiter
	+ Jupiter’s gravity keeps asteroids in the belt
* Comets: “dirty snowballs” composed of ice and rock that orbit the sun
	+ Visible because they reflect the sun’s light
	+ Reappear regularly, for example Halley’s Comet will return in July, 2061
* Meteoroids: hunks of metal or rock that are smaller than asteroids
	+ Meteoroids are often created by collisions between asteroids
* Meteors: a meteoroid that has entered Earth’s atmosphere
	+ This is what we know as shooting stars!
* Meteorites: a meteor that has reached Earth’s surface
	+ You can hold a meteorite in your hand
* Hubble Telescope: long-term, science-based observational telescope
	+ Orbits Earth outside of our atmosphere, which allows Hubble to take tons of clear, high-quality pictures of space

Phases of the moon

* The moon takes approximately 28 days to revolve once around the Earth
	+ The moon revolves counterclockwise around Earth
	+ The moon takes about 28 days to rotate once on its axis, so we always seen the same face of the moon
* Waxing: the moon is getting bigger
	+ A “waxing” moon is *always* visible on the right
* Waning: the moon is getting smaller
	+ A “waning” moon is *always* visible on the left
* Crescent: less than half of the surface of the moon is visible
* Gibbous: more than half of the surface of the moon is visible
* New moon: appears as though there is no moon in the sky
* *New moon 🡪 waxing crescent 🡪 first quarter moon 🡪 waxing gibbous 🡪 full moon 🡪 waning gibbous 🡪 third quarter moon 🡪 waning crescent 🡪 new moon*



Nebular theory: HOW OUR SOLAR SYSTEM FORMED (and other solar systems too)

* Nebula: a cloud of dust and gas where stars and planets can form
* Steps:
1. There is a huge cloud of dust and gas out in the universe
2. The cloud is so big that it begins to collapse in on itself due to gravity
3. This gravity pulls the dust and gas into a central mass
	1. Matter in the nebula begins to orbit around the central mass
4. This central mass eventually undergoes nuclear fusion and becomes a sun!
5. The sun’s gravity pulls in more and more matter
	1. This matter slams into each other and sticks together to create planets
6. The remaining gas and dust clears and the new planets cool to create our solar system!

Big Splash theory

* About 4.5 billion years ago, a Mars-sized body (Theia) slammed into Earth and a *ton* of rocks and dust shot off into space
* Some of the rocks and dust gravitated together, and this formed our moon
* Earth’s gravitational pull captured this new moon and has held on ever since
* The moon’s gravitational pull causes high and low tide on Earth!

A day on Earth

* Earth rotates on its axis in a counter-clockwise direction
* It takes one day for Earth to complete one rotation – this NEVER changes
* Earth’s rotation gives us night and day
	+ It is always daytime somewhere on Earth and nighttime somewhere else on Earth *at exactly the same time*

Earth’s seasons

* Earth’s axis is always tilted at an angle of 23.5º
* This tilt affects how much daylight Earth’s hemispheres get at different times of the year
	+ When the north pole is tilted towards the sun, it is summer in the northern hemisphere
		- The sun’s rays hit the northern hemisphere *directly*, so the north receives more solar energy (light and heat)
		- The sun’s rays strike the southern hemisphere at a *glancing angle*, so the southern hemisphere receives less solar energy and is experiencing winter
	+ When the south pole is tilted towards the sun, it is summer in the southern hemisphere
		- The sun’s rays hit the southern hemisphere directly, so more light and heat reach the southern hemisphere
		- The sun’s rays hit the northern hemisphere at a glancing angle, so the northern hemisphere receives less solar energy and is experiencing winter
* Earth is farthest away from the sun on July 4th
	+ This shows that it is the tilt of the Earth, *NOT* Earth’s distance from the sun, that causes the seasons
	+ If there were no tilt, Earth’s seasons would never change

What causes the sun to keep burning? NUCLEAR FUSION!

* Nuclear fusion: when 4 hydrogen atoms come together with so much force that their *nuclei fuse*
	+ This only occurs near the center of a star, where temperature and pressure are VERY high
	+ **The 4 hydrogen atoms slam together to create 1 helium atom and release energy in the form of a photon**
		- Nuclear fusion reactions release energy – this means that suns *convert matter into energy*
* The relationship between energy, mass, and light is represented as **E=mc2**
	+ E = energy, m = mass, and *c = speed of light*
* The sun converts 9 billion pounds of matter to energy *per second*

Newton’s First Law of Motion: an object at rest will stay at rest and an object in motion will stay in motion, unless the object is acted upon by an external (outside) force

* In space, *gravity* is the “external force” that keeps moons and planets in orbit!
	+ Without the pull of gravity on a planet, the planet would move in a straight line right past the sun
* If there is too little gravity, the planet would fly out into space
	+ This can occur if a star is too small or if a planet is too far away
* If there is too much gravity, the planet would be pulled into the sun!
	+ This can occur if a star is too big or if a planet is too close

Looking into the past…

* Looking at the stars is like looking into the ancient past
* Stars and nebulae are so far away that light takes thousands of years to reach us
* What we see now may be long gone!
	+ Ex. “Pillars of Creation” formation

*LabLearner Focus Questions*

Based on your model, why do you think we observe different phases of the Moon from the Earth?

* The position of the Sun, Earth, and Moon cause the phases of the moon.

What causes the orbit of the planets around the Sun and the Moon around the Earth? Why are they important in maintaining the orbit of the planets and the Moon?

* The combination of forward motion and gravity cause the planets to orbit the Sun and the Moon to orbit the Earth. Without this precise amount of gravity, planets would either fly out of orbit in a straight line or they would be pulled toward the Sun.

If Earth did not rotate, what would happen?

* Day and night would never change!