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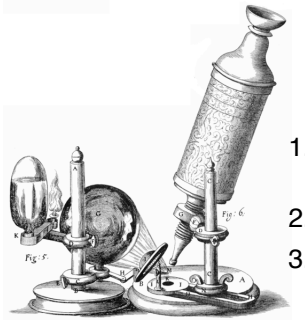
Formation of the Universe

The organization of Space

_____ → _____ → _____

Theory: A theory is



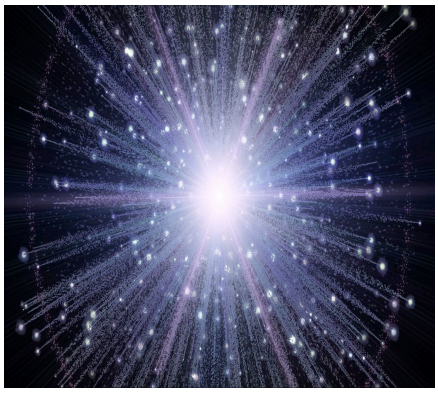
An example is cell Cell Theory

1.
2.
3.

-To understand how the universe formed, scientists study thee movement of galaxies.
-Careful measurements have shown that most galaxies are moving apart.

The Big Bang Theory

This theory states that the universe began almost 14 billion years ago with a tremendous explosion.



Notes:

All the contents of the universe was compresses under extreme pressure, temperature and density in a very tiny spot.

Then, the universe rapidly expanded and matter began to come together and form galaxies

Explain how the universe is like raisin bread:

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Formation of the Solar System

Right now you are moving at a speed of 30 km/s!

All of the ingredients needed to build planets, moons and stars are found in the vast seemingly empty regions of space.

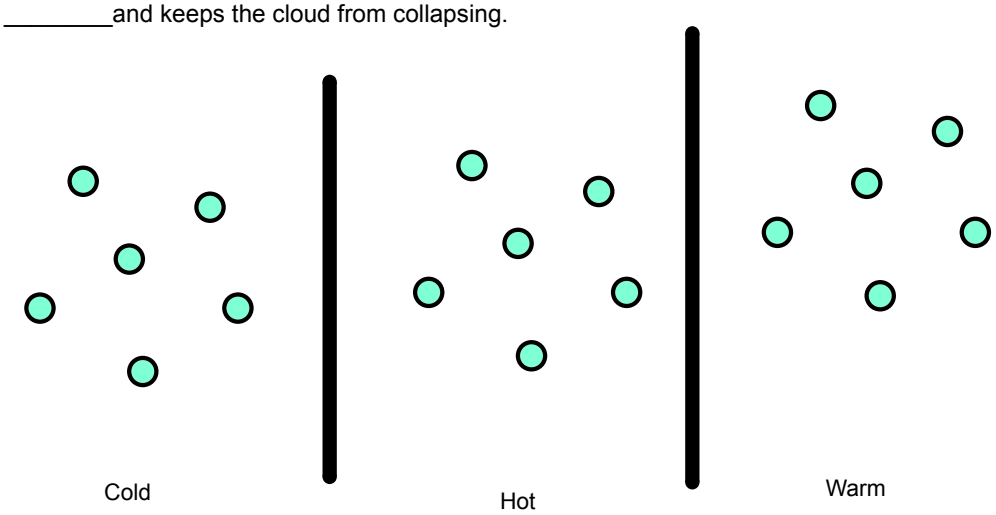
- Just as clouds in the sky, there are clouds in space called _____
- Most nebulas are mixtures of gases, mostly _____ and _____ and dust made of _____ and _____

How can a cloud of dust and gas form planets and stars?

Gravity:
- Gas and dust made of matter, held together by gravity
-Most nebulas have a lot of space between the particles, less dense than air
-Makes gravitational attraction very weak.
-Just enough gravitational force to keep particles from drifting apart.
-"Pulls" on particles

Pressure:
-Keeps particles from collapsing due to pull of gravity
-Temperature has a direct result on pressure
-Low temp causes low energy of particles which = low pressure
-Fast particles = high temp = high pressure
- As particles move around they collide w/ e.o.
- Causes particles to push away from each other, creating <u>pressure</u>

In a nebula outward _____ balances inward _____ _____and keeps the cloud from collapsing.



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Upsetting the Balance

If two nebulas collide, the balance can be upset
-Compress, or push together small regions of nebula called globules , or gas clouds
-May be so dense they contract under their own gravity
-As matter collapses inward, temperature increases and a star can now be formed, referred to as a solar nebula

Steps of Solar System Formation

1. The young solar nebula begins to collapse

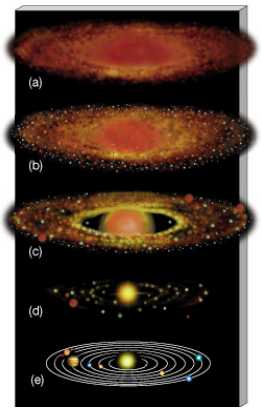
2. The solar nebula rotates, flattens, and becomes warmer near its center

3. Planetesimals begin to form within the swirling disk

4. As the largest planetesimals grow in size, their gravity attracts more gas and dust

5. Smaller planetesimals collide with the larger ones, and planets begin to grow

6. A star is born and the remaining gas and dust are blown out of the new solar system



The Planets Form

- Largest planetesimals formed near outside of rotating solar disk, where Hydrogen and helium were located
-Grew to huge sizes and became the "gas giants" -

Closer to the center of the nebula, temperatures were to hot for gas to remain, planets formed made of mostly rocky material -

Birth of a Star

-As planets were forming, other matter in the solar nebula traveled towards the center.
-Center became so dense and hot that hydrogen atoms began to fuse, to form helium
-This releases huge amount sof energy and created enough outward pressure to balance the inward pull of gravity.
-Our sun was born and solar system became complete

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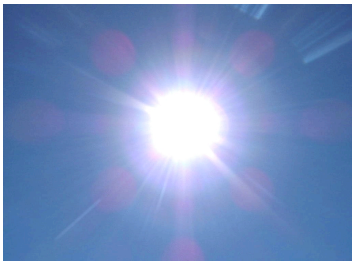
The Sun



- Makes up 99% of the mass of our solar system
- Basically a large ball of helium and hydrogen held together by gravity

1. Core

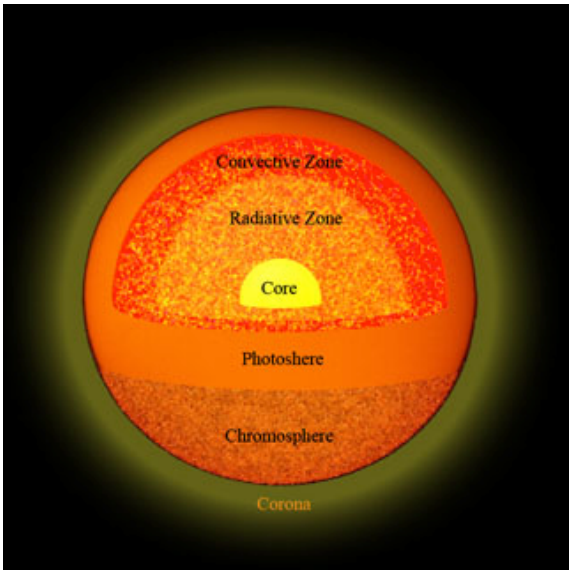
2. Radiative Zone

3. Convective Zone -

4. Photosphere -

5. Chromosphere -

6. Corona



Powering the Sun

-Until the 20th century, scientists remained puzzled about how the sun's energy was produced
- Was it a burning a fuel source?
- Was it releasing gravitational energy as it shrunk?

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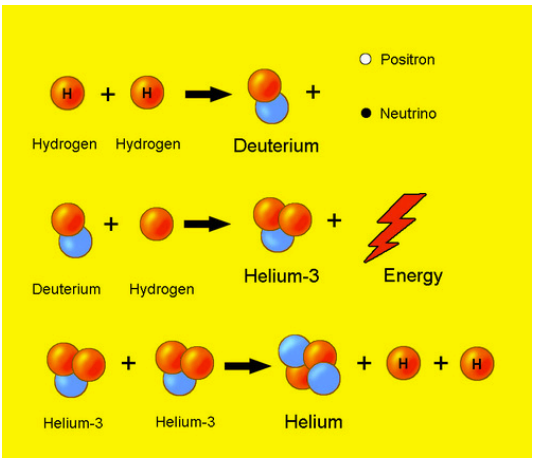
$E = mc^2$

What does it mean?



- Matter and energy are interchangeable

- Matter can change into energy

E = energy
m= mass
c = the speed of light (299,792,458 m/s)

- Because c is such a large #, tiny amounts of water can produce a huge amount of energy

- With this, scientists began to understand a very powerful source of energy

Nuclear Fusion

Example: 4 hydrogen nuclei can fuse together to form a single nucleus of helium.

- During this process, energy is produced

Fusion in the Sun

Investigate: What are sun spots and solar flares?

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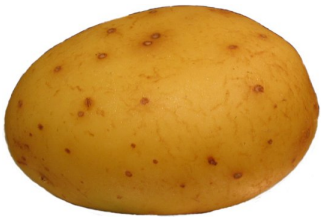
The Earth Takes Shape



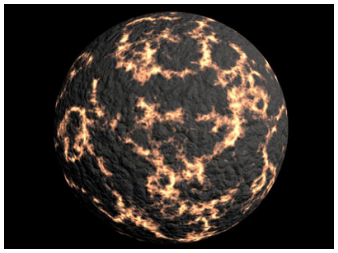
The Effects of Gravity

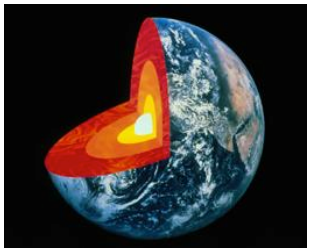
The Effects of Heat

-Volcanoes, earthquakes and hotsprings are effects of this energy trapped inside

Formation of Layers

-Layers formed b/c of density





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Formation of Earth's Atmosphere

Earth's Early Atmosphere

Earth's Changing Atmosphere

How did ultraviolet (UV) radiation affect influence the appearance of life on earth?

Explain how oxygen became prevalent:

Explain how the oceans and continents formed:

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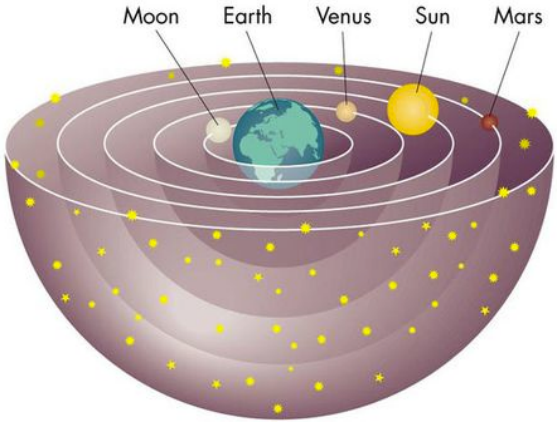
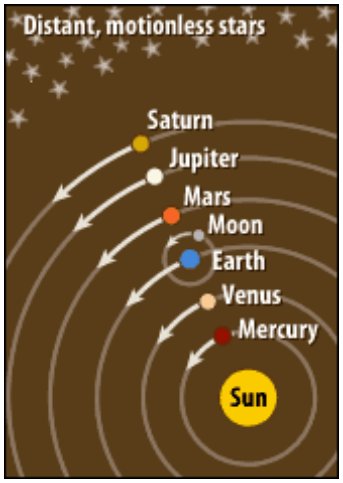
Early Astronomers

Ptolemy: The Earth Centered Universe



Copernicus: A Sun-Centered Universe



Planetary Motion

- With the understanding that the was the central object that other planetary object revolved around, _____ _____ set out to decide the motion of the planets.

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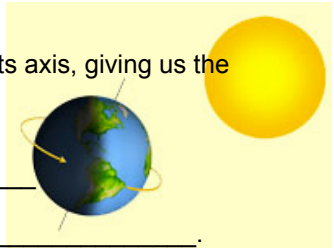
Planetary Motion

- Each Planet spins on it's _____, called _____.

-As it rotates, only _____ of planet faces sun, making _____ on that side and _____ on the opposite side.



-It takes Earth _____ to rotate once on its axis, giving us the length of a _____.

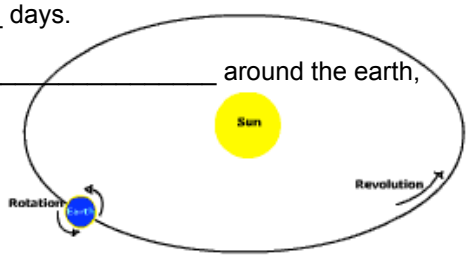
- The path that a planet follows is called its _____

-One complete trip around it's orbit is called a _____.

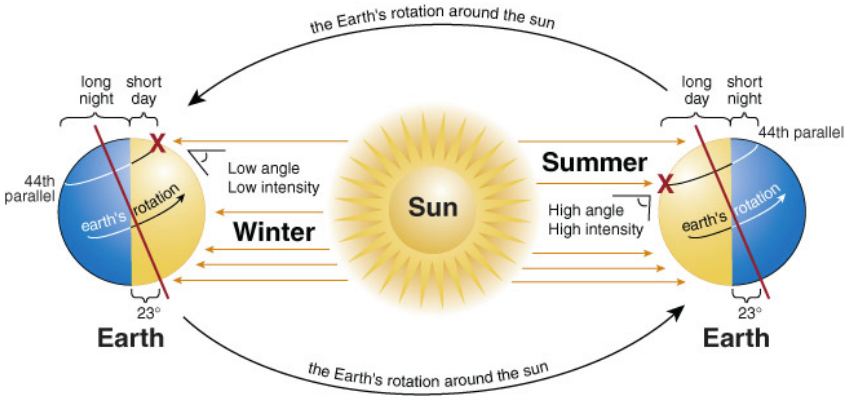
-The amount of time to complete a single trip around the sun is called _____ _____.

- Earth's POR is about _____days, or a _____, whereas Mercury orbits the sun in only _____ days.

-A month is based on the _____ _____ around the earth, which takes approximately _____ days.



Seasons and Daylight



- Earth is tilted on it axis _____degrees.

-How does the tilt of the earth and it's motion around the sun create seasons?

- How does the tilt affect length of day?

-How does tilt affect intensity of sun?

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Kepler's Laws

-Kepler described the planets' motion in three laws, all based around the sun centered theory.

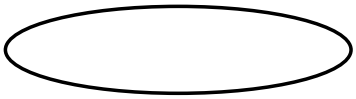
Kepler's First Law

- Kepler's first discovery came from his careful study of Mars.

-He noticed that Mars moved across the night sky in one direction, but then reversed direction, and then reversed again!

-He eventually discovered that Mar's motion was not a circular path but an _____.

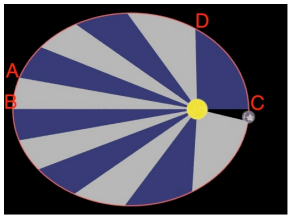
-An ellipse is a

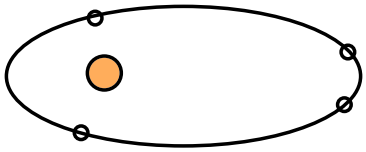


Kepler's Second Law

- His second discovery was that the planets seemed to move faster when they were closer to the sun, and slower farther away.

-Imagine planet attached to sun by a string, string must move faster to cover the same area





Kepler's Third Law

-Kepler noticed that planets that are more distant from the sun take longer to orbit the sun
-This law explained relationship between period of revolution and it's semi-major axis.
-Once he knew how long it took a planet to orbit the sun, he was able to calculate its distance to the sun using the following formula: $p^2=a^3$

Semi-Major Axis (in)	Time (10s) / Revolutions	Seconds / Revolution

What can you conclude from this demonstration?