

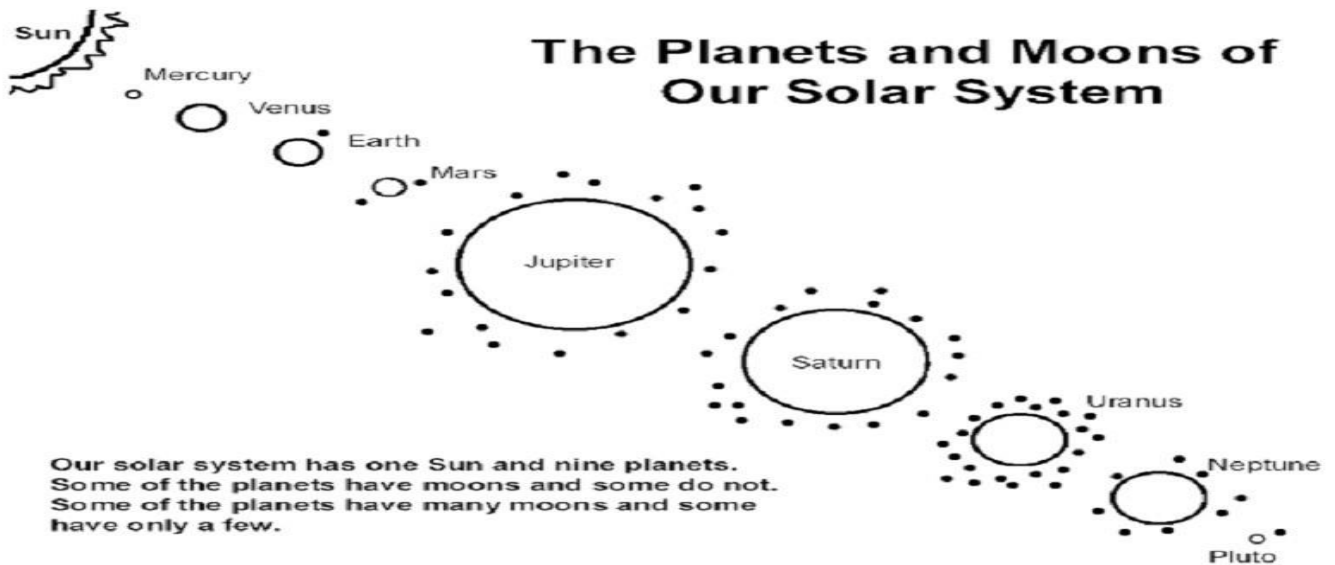
Astronomy Unit Notes

Name: _____

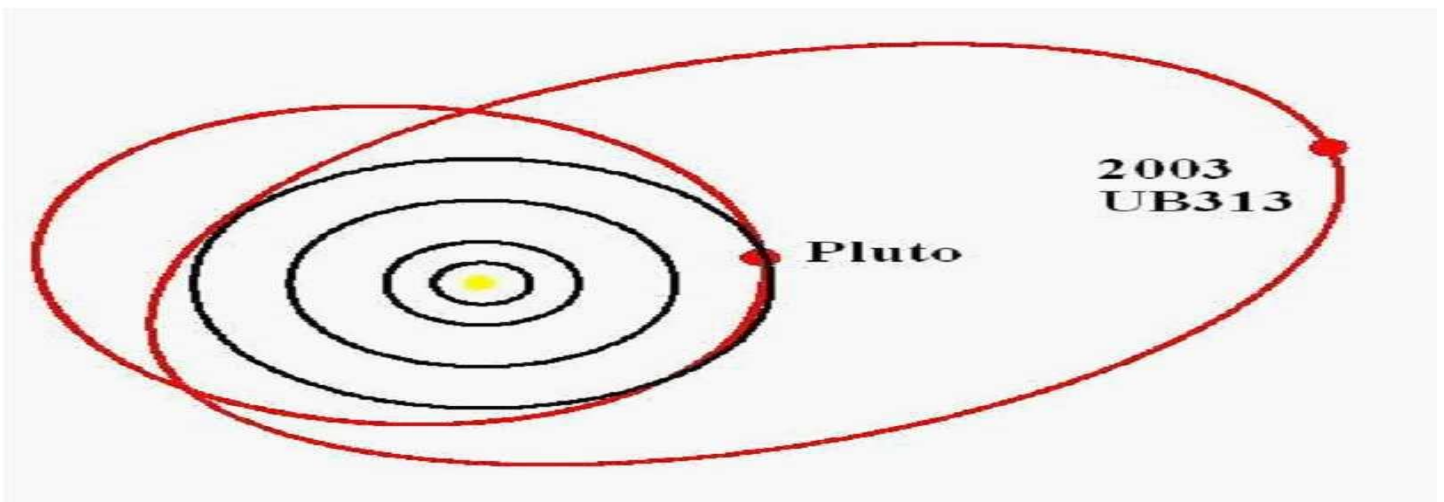
(DO NOT LOSE!)

To help with the planets order

- 1 My = Mercury
- 2 Very = Venus
- 3 Eager = Earth
- 4 Mother = Mars
- 5 Just = Jupiter
- 6 Served = Saturn
- 7 Us = Uranus
- 8 Nachos = Neptune

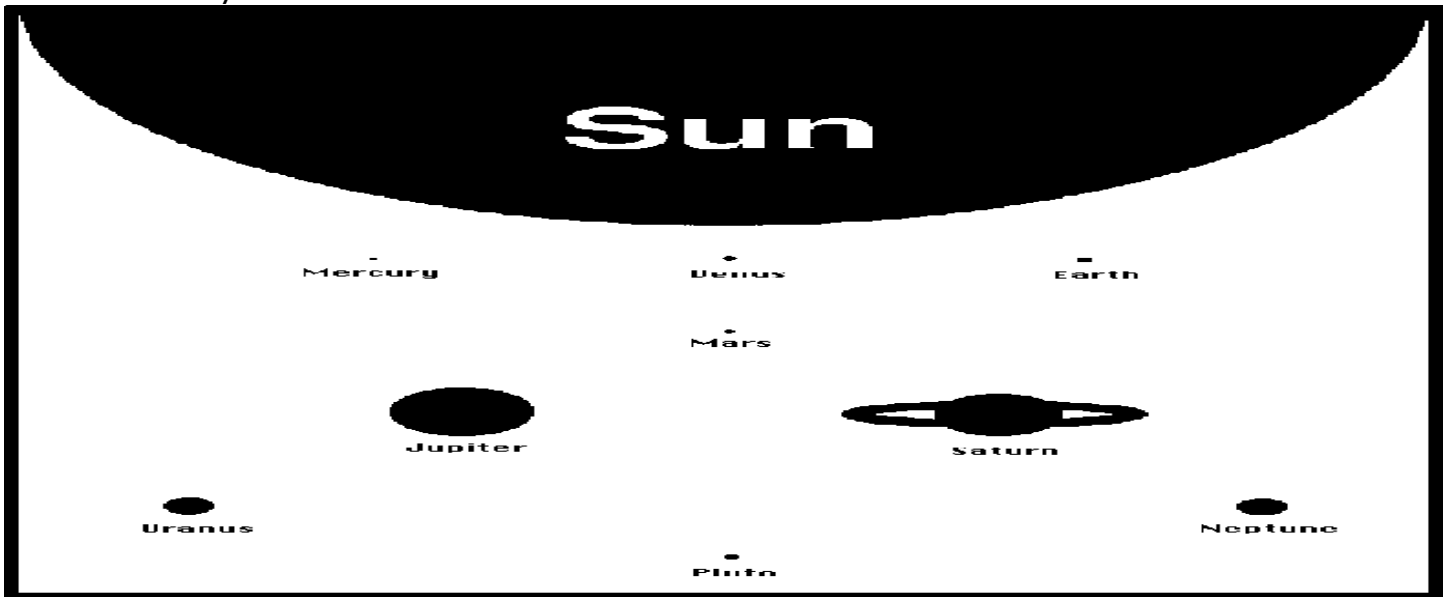


Orbit: The path (usually elliptical) of one celestial body in its revolution around another.



The Sun is by far the largest object in the solar system.

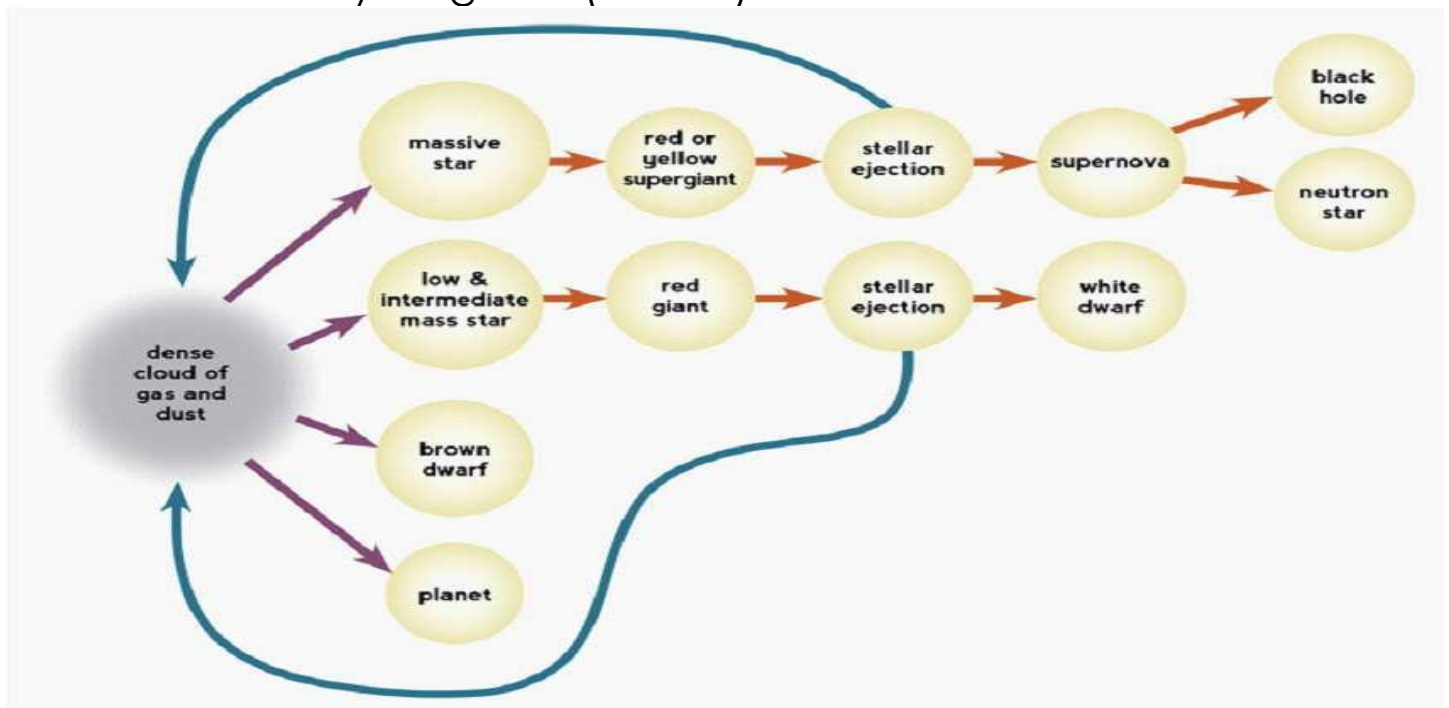
- It contains more than 99.8% of the total mass of the Solar System.



All energy for our solar system comes from the sun.

The Sun is presently made of...

- 70% hydrogen
- 28% helium
- 2% Everything else (metals)

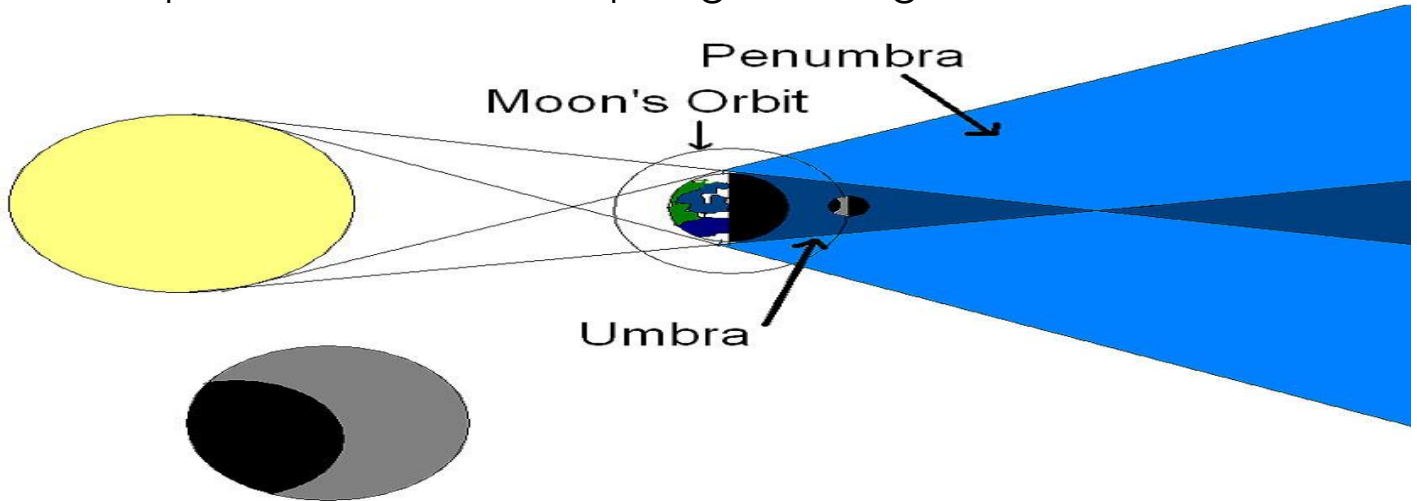


The Sun is made of Plasma: Electrically charged particles. Higher state of matter beyond gas

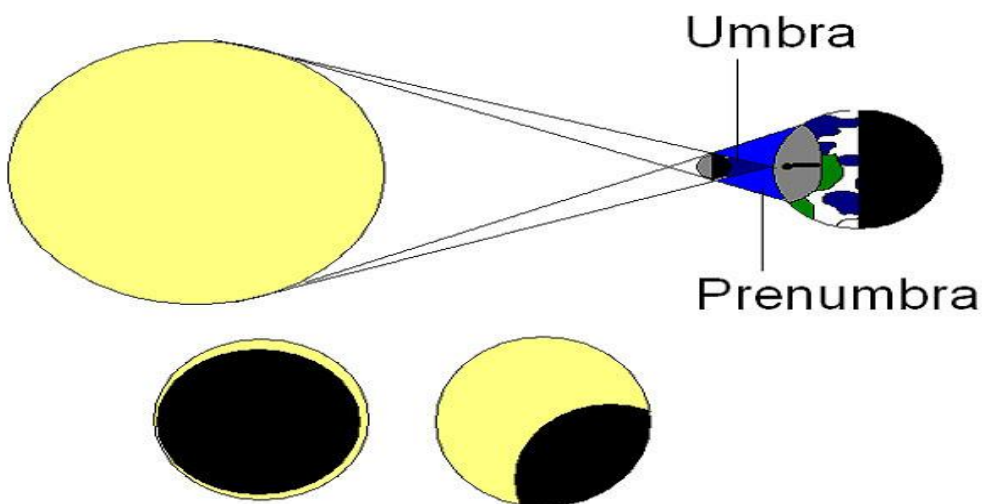
All energy for our solar system comes from the sun.

NEW AREA OF FOCUS: SUN, EARTH, MOON

Lunar Eclipse - The earth interrupts light shining on the moon



Solar Eclipse - When the Moon passes between the Sun and the Earth so that the Sun is wholly or partially obscured



Partial Eclipse – Only part of a body is covered.

NEW AREA OF FOCUS: THE INNER PLANETS

AU = Astronomical Unit, Distance from earth to the sun. (93 Million Miles, 150 Million Kilometers)



Craters can be found on earth, but most craters are eroded away by wind and water. Most meteorites also burn up in our atmosphere.

- The winter solstice is the moment when the earth is at a point in its orbit where one hemisphere is most inclined away from the sun.
 - Shortest day and longest night of the year (Around December 21st)
 - Summer solstice is when axial tilt is most inclined towards the sun (June 21st ish)
- Equinox: Either of the two times each year
 - (about March 21 and September 23) when the sun crosses the equator.
 - Day and night are everywhere on earth are equal
- The tilt of the earth's axis 23.5 degrees
 - Summer = Northern Hemisphere is tilted into more direct light.

- Winter = Northern Hemisphere tilts away from the direct light.

Phases of the Moon



Tides are the rising of Earth's ocean surface caused by the gravitational forces of the Moon and the Sun acting on the oceans.

-Two high tides, and two low tides per day. Equals one tidal cycle per day. - - Separated by about 12:34 hours



Gravity - The force of attraction between all masses in the universe.

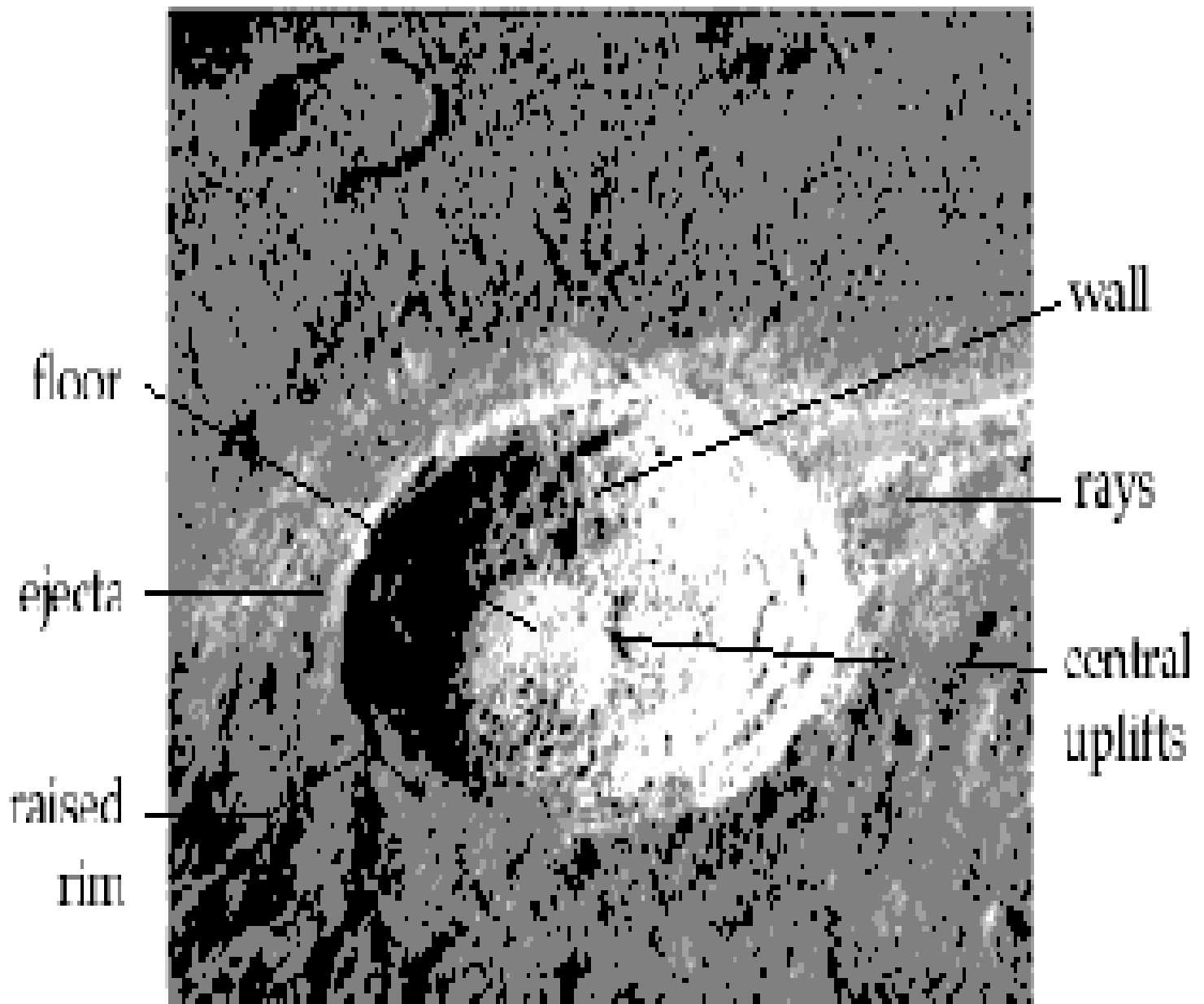
Asteroids are rocky and metallic objects that orbit the Sun but are too small to be considered planets.

Meteorite – Space matter that has fallen to the earth's surface from outer space.

Meteoroid – Small (dust size to coin) piece of matter that hits the earth's atmosphere (burns up)

Parts of a Crater

Aristarchus



THE SUN

The Sun is by far the largest object in the solar system. It contains more than 99.8% of the total mass of the Solar System. All energy for our solar system comes from the sun. Check out the Corona Ejections

The Sun is, at present, about 70% hydrogen and 28% helium by mass everything else ("metals") amounts to less than 2%. The sun is approximately 93 million miles from Earth.

Mercury is a small, rocky planet. ~ Mercury has been visited by the Mariner 10 spacecraft. Mariner 10 has mapped a little less than half (45%) of Mercury's surface. ~ Scientists think that there may be *volcanic activity* on Mercury. They are still studying information sent to Earth from the Mariner spacecraft to make sure. ~ The temperature on Mercury ranges from 90 K to 700 K.



Mercury

Mars is a small, rocky planet which is cold and lifeless. ~ The first spacecraft to visit Mars was Mariner 4 in 1965. Several others followed including the two Viking landers in 1976. After a long break, Mars Pathfinder landed successfully on Mars on July 4, 1997. ~ Mars has permanent ice caps at both poles made up mostly of solid carbon dioxide. We know this as "dry ice." ~ Very strong winds and vast dust storms sometimes blow through the entire planet for months! ~ Mars has two tiny moons which orbit very close to the surface. Their names are Phobos and Deimos.



Venus

Venus is a small, rocky planet blanketed in a thick layer of yellowish clouds. These clouds are not made of water (like the ones here on Earth). Instead, they are formed from a poison called sulfuric acid. ~ Venus' surface is very hot - about 400 degrees Celsius! ~ Even though Venus is very cloudy, it's simply *too hot* for rain to form. ~ The first spacecraft to visit Venus was Mariner 2 in 1962. Venus has since been visited by more than 20 spacecraft in all so far! Some of these visiting spacecraft include: Pioneer Venus, Venera 7, Venera 9 and Magellan.

Earth

Earth is a small, rocky planet which supports a variety of life! As far as we know, Earth is unique from all other planets in this respect. ~ Temperatures at the Earth's center (called the "core") may be as high as 7500 K - That's hotter than the surface of the Sun! ~ The Earth is the densest major body in the solar system. This means that it's the most "compact" of all the planets. For example, you have two loaves of bread, both of the same amount. You smash one loaf of bread flat. Even though both loaves are of the same amount, the smashed bread is *denser* because it is more compact. The Earth is 4.5 to 4.6 billion years old, but the oldest known rocks are less than 4 billion years old. Rocks older than 3 billion years are rare. The oldest fossils of living organisms are less than 3.9 billion years old! ~ The Earth is orbited by one moon.



Asteroid Belt

Mars





Jupiter

Jupiter takes about 12 years to orbit the sun and rotates in about 10 hours. This short Jupiter "day" is amazing since the planet is roughly 11 Earth diameters wide.

Unlike the rocky planets, Jupiter is a ball of dense hydrogen, helium, water, nitrogen and other gases over a tiny rocky core. Powerful winds dominate the atmosphere with criss-crossing jet streams, lightning and huge hurricane-like storms like the Great Red Spot. This storm has been raging for over 300 years and is about 2 Earth diameters wide. The Great Red Spot can be seen on Jupiter along with four moons: Io (smallest), Europa, Callisto and Ganymede.

The planet contains 71% of the planetary matter in the solar system and so its huge gravity pulls every object toward it. In fact, most of its moons were captured rather than forming with Jupiter. Scientists watched in awe as comet Shoemaker-Levy 9 broke up and smashed into Jupiter making explosions the size of the Earth.

Like Jupiter, Saturn is made mostly of hydrogen and helium. Its volume is 755 times greater than that of Earth. Winds in the upper atmosphere reach 1,600 feet (500 meters) per second in the equatorial region. (In contrast, the strongest hurricane-force winds on Earth top out at about 360 feet, or 110 meters, per second.) These superfast winds, combined with heat rising from within the planet's interior, cause the yellow and gold bands visible in the atmosphere.

Saturn's ring system is the most extensive and complex in the solar system, extending hundreds of thousands of kilometers from the planet. In the early 1980s, NASA's two Voyager spacecraft revealed that Saturn's rings are made mostly of water ice. They also found "braided" rings, ringlets, and "spokes," dark features in the rings that circle the planet at different rates from that of the surrounding ring material. Material in the rings ranges in size from a few micrometers to several tens of meters.

Neptune is the outermost planet of the gas giants. It has an equatorial diameter of 49,500 kilometers (30,760 miles). If Neptune were hollow, it could contain nearly 60 Earths. Neptune orbits the Sun every 165 years. It has eight moons, six of which were found by Voyager. A day on Neptune is 16 hours and 6.7 minutes. predictions made by Urbain Jean Joseph Le Verrier. The first two thirds of Neptune is composed of a mixture of molten rock, water, liquid ammonia and methane. The outer third is a mixture of heated gases comprised of hydrogen, helium, water and methane. Methane gives Neptune its blue cloud color.

Saturn



Neptune



Uranus

Uranus is the seventh planet from the Sun and is the third largest in the solar system.. It has an equatorial diameter of 51,800 kilometers (32,190 miles) and orbits the Sun once every 84.01 Earth years. It has a mean distance from the Sun of 2.87 billion kilometers (1.78 billion miles). It rotates about its axis once every 17 hours 14 minutes. Uranus has at least 22 moons. The two largest moons, Titania and Oberon, were discovered by William Herschel in 1787. The atmosphere of Uranus is composed of 83% hydrogen, 15% helium, 2% methane and small amounts



New Area of Focus: The Outerplanets and Gas Giants

Gas Giant: A large, massive, low-density planet composed primarily of hydrogen, helium, methane, and ammonia in either gaseous or liquid state.

JUPITER

- 1 Twice as massive as all other planets combined.
- 2 Fourth brightest object in sky
- 3 Gas Giant (Gets denser as you go down)
- 4 May have a small rocky core
- 5 Mostly Hydrogen and a bit of Helium
- 6 High Velocity Winds cause bandings
- 7 Red Spot (Giant Storm)
- 8 63+? Moons or Satellites
 - Moons
 - Io –
 - Rotten orange with acne
 - Tidal active (no water, Sulfur)
 - Volcanically active
 - No impact craters because of
 - volcanic dust

SATURN

- 1 Saturn
 - 62+? Moons
 - Not very dense (can float in water)
 - Very similar in composition to Jupiter
 - Hydrogen 75% and Helium 25%
 - Missed becoming a star
 - Has rings (A, B, and C)
 - Billions of particles from dust to meters long
 - Mostly water and ice

URANUS

- 3rd Largest Planet
- Takes 84 earth years to orbit sun
- Methane absorbs red and reflects blue
- Winds of 360 mph
- Tipped on side (Early Comet Strike)
- 27+? moons

NEPTUNE

- Outermost gas planet
- Orbits sun 165 Earth Years
- Molten Rock, Methane, Water, Ammonia
- Winds of 1,200 mph
- 4 faint rings
- 13+? Moons

Kuiper Belt (Pronounced Kyper)

- A disk-shaped region of minor planets outside the orbit of Neptune.
- 70, 000 minor planets, many like Pluto

- Scientific notation: A method for expressing, and working with, very large or very small numbers.

$$5.7 \times 10^6 = 5700000$$

1
2
3
4
5
6

Comet - A frozen mass (3-5 mile diameter) that travels around the sun in a highly elliptical orbit.

Nebula – Large cloud of gas and dust which can form stars and galaxies.

A light-year is a unit of distance.

- It is the distance that light can travel in one year. (9,500,000,000,000 kilometers.)
- Light moves at a velocity of about 300,000 kilometers (km) each second in a vacuum.

Black Hole: A region of space resulting from the collapse of a star with an extremely high gravitational field.

- A region of spacetime from which gravity prevents anything, including light, from escaping.

Neutron Star – Neutron Star: Type of star leftover when a star collapses.

Galaxy – Large group of stars, gas, and dust that constitute the universe. By a large group, we mean hundreds of billions.

The Big Bang Theory - The cosmic explosion that is hypothesized to have marked the origin of the universe.

Evidence for the Big Bang Theory

- **Redshift of Galaxies**
 - The redshift of distant galaxies means that the Universe is probably expanding.
 - If we went back far enough in time, everything must have been squashed together into a very small space.
- **Microwave Background**
 - Early on the whole Universe was extremely hot. As it expanded, the heat left behind a "glow". The Big Bang theory predicts that this glow should exist, but that it should be visible as microwaves (EM Waves)

- The Cosmic Microwave Background has been accurately measured by orbiting detectors.
- **Mixture of Elements**
 - As the Universe expanded and cooled some of the elements that we see today were created.
 - The Big Bang theory accurately predicts how much of each element should have been made in the early universe. The numbers add up.
- **Looking back in time**
 - The alternative to the Big Bang theory of the Universe is called the Steady State theory. In this theory the Universe does not change very much with time.
 - Light takes a long time to travel across the Universe, when we look at very distant galaxies, we look back in time.
 - Galaxies a long time ago are different from those today, showing that the Universe has changed.
 - This fits better with the Big Bang theory than the Steady State theory.

Dark Matter – A hypothetical form of matter that is believed to make up 90% of the universe; it is invisible (does not absorb or emit light)

Dark Energy – A hypothetical form of energy that permeates space and exerts a negative pressure, which would have gravitational effects to account for the differences between the theoretical and observational results of gravitational effects on visible matter.

Law Conservation of Matter

- In any physical or chemical change, matter is neither created nor destroyed but merely changed from one form to another.

General Relativity is a theory of the structure of spacetime.

- Time slows down with increased velocity.

Special Relativity:

- The laws of physics are equally valid in all frames of reference moving at a uniform velocity.
- The speed of light from a uniformly moving source is always the same, regardless of how fast or slow the source or its observer is moving.

E=MC²

- E = Energy (Joules)
- M = Mass
- C = Speed of Light in vacuum
 - 300,000,000 meters per second (really 299, 792,458)

Almost all of the energy on earth comes from our sun.

