

# Science Final Exam Study Guide

By: Anna Jakimcius

# Scientific Method & Metrics

## Scientific Method

- **Observation** – objective (based on fact), quantitative (based on measurements numbers) qualitative (based on description, words) subjective ( based on opinion) inference (when you explain or interpret an observation.)
- **Hypothesis**- educational guess, based on observations (if, then, because)
- **Experiment**- independent variable (the variable you change on purpose) dependent variable ( what changes due to the independent variable) control (the group in the experiment that does not include the independent variable) constant (things in an experiment that stay the same in every trial)
- **Evidence** – observations you make in the experiment are called data. Scientists use the metric system of measurement to collect data.
- **Question Statement** - states the purpose of the experiment and includes independent and dependent variables.
- **Conclusion** – written summary of experiment. Was your hypothesis supported or refuted. What did you learn from this experiment. Are there any new questions you have.

## Metric System

The metric system is a decimal based system of measurement units based on 10.

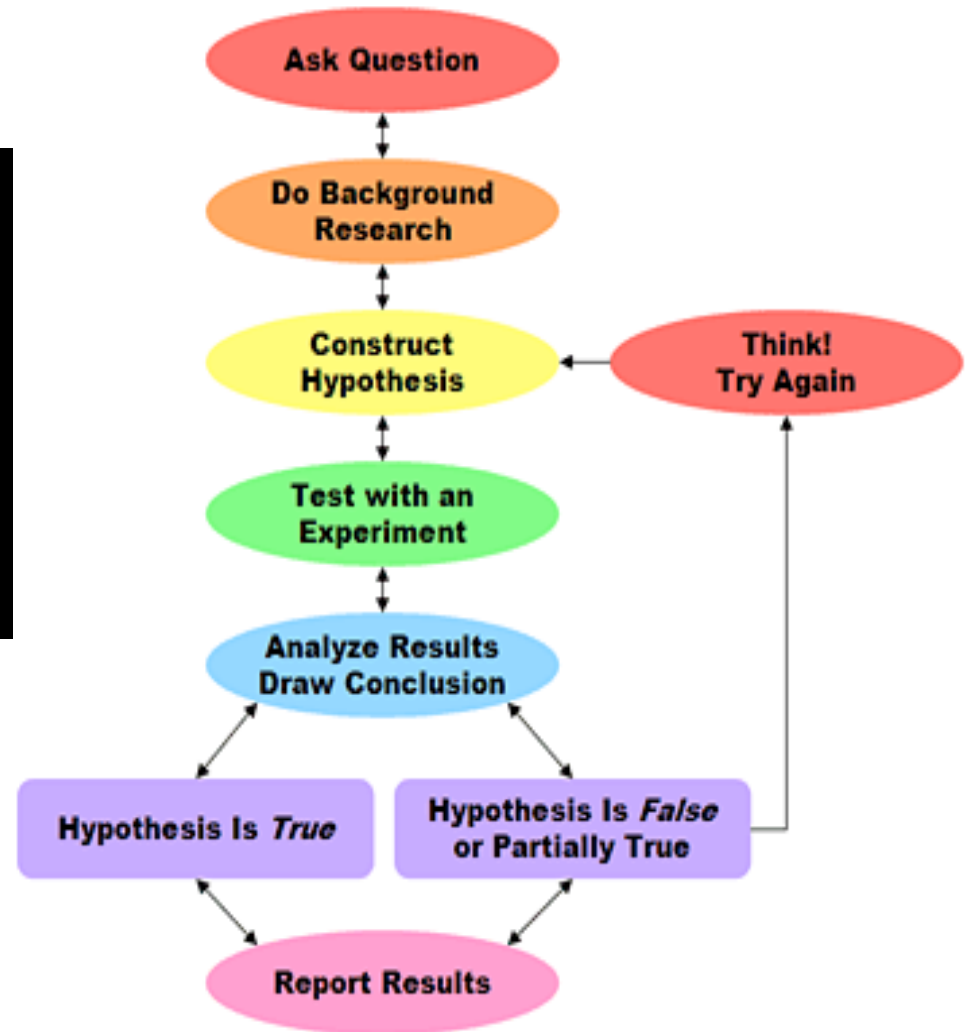
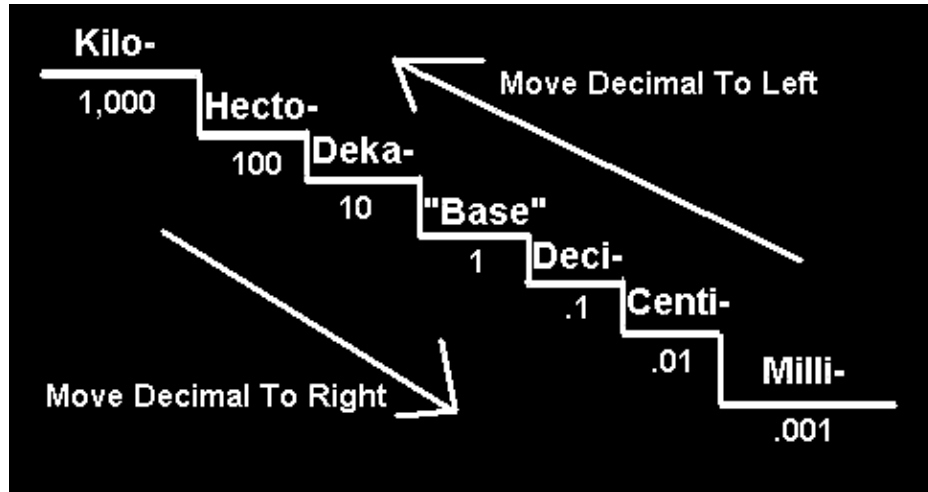
Kilo. Hecto. Deka. Meter. • Deci. Centi. Milli

**1 kilometer = 10 hectometers = 100 dekameters = 1000 meters = 1 meter = .01 centimeters = .001 millimeters**

**Kilogram- kg   Meter-m   gram – g   milliliter – mL   Millimeter-mm   Liter-L   Kilometer- km   Centimeter – cm   Milligram- mg**

length	meter
Volume	liter
Mass	gram
Temperature	Celsius

# Scientific Method & Metrics Cont.



# Matter & Chemistry

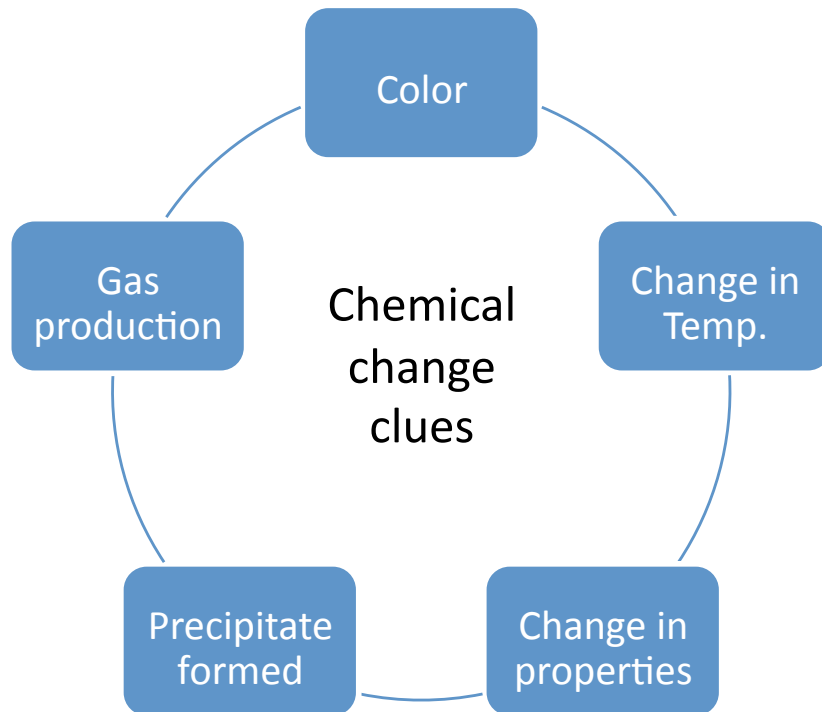
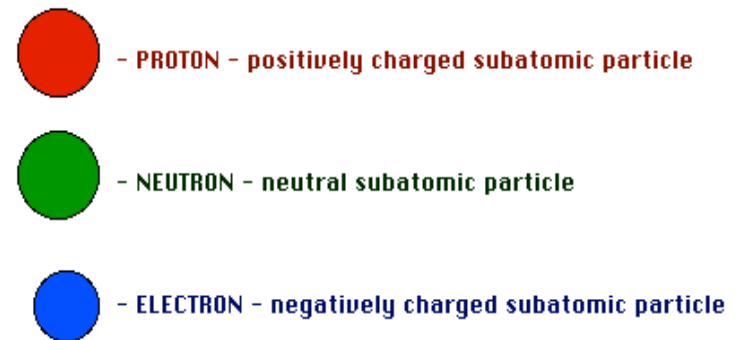
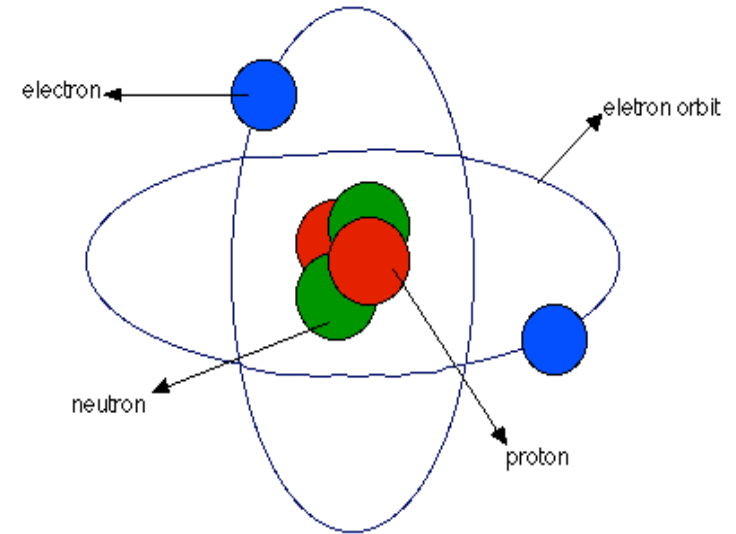
- **Matter** - solid, liquid, gas, plasma. Anything with mass and volume. Anything made up of atoms
- **Mass** – the amount of matter in something
- **Volume** – the amount of 3-dimensional space something takes up
- **Atoms** – the smallest form of matter
- **Nucleus** – the center of the atom
- **Protons** – positively charged particles in the nucleus.
- **Neutrons** – neutral charged particles in the nucleus.
- **Electrons** – negatively charged particles that spin around the outside of the nucleus.
- **Chemical formulas** – a combination of symbols that represent the elements in a compound or molecule.
- **Coefficient** – the big number that comes before the chemical equation.
- **Subscript** – the small number that comes after the element in the molecule.
- **Physical Properties** – color, luster, texture, density, volume, mass, phase, crystal structure, odor, solubility, melting and boiling point.
- **Chemical Properties** – how does it react with other substances? Does it burn? What is its chemical make up?
- **Ion** – an atom or group of atoms that has become electrically charged.
- **Ionic Bond** – the attraction between oppositely charged ions.
- **Polar** – the description of a covalent bond in which electrons are shared unequally.
- **Non-polar** – the description of a covalent bond in which electrons are shared equally.
- **pH scale** - a measure of the concentration of hydrogen ions in a solution
- **Neutralization** – a reaction of an acid with a base, yielding a solution that is not as acidic or basic as the starting solution was.
- **Acid** – H<sup>+</sup> ions, substance that tastes sour, reacts with metals, carbonates, . pH level 1-6.
- **Base** – OH<sup>-</sup> ion, substances that taste bitter, feels slippery. pH level 8-14
- **Density** – the amount of matter in a given volume.
- **Element** – individual atoms of the same type
- **Molecule** - combination of two or more elements bonded together
- **Compound** – a molecule that is made up of two or more different elements chemically bonded together.
- **Mixture** – a combination of two or more molecules of elements not chemically bonded.

# Matter & Chemistry Cont.

## Examples of Physical Change

- Change of state (such as from solid to liquid or from gas to liquid)
- Absorption of water into a towel
- Crumbling a piece of paper
- Cutting a material such as wood

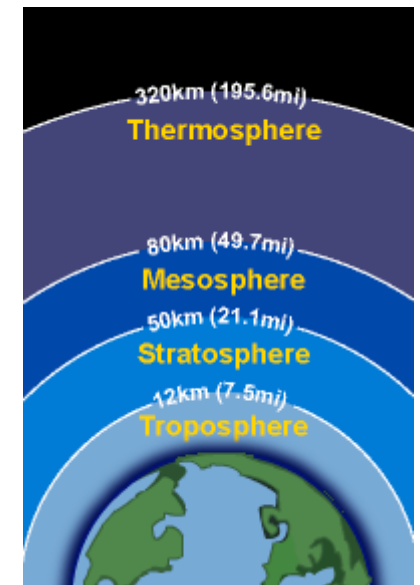
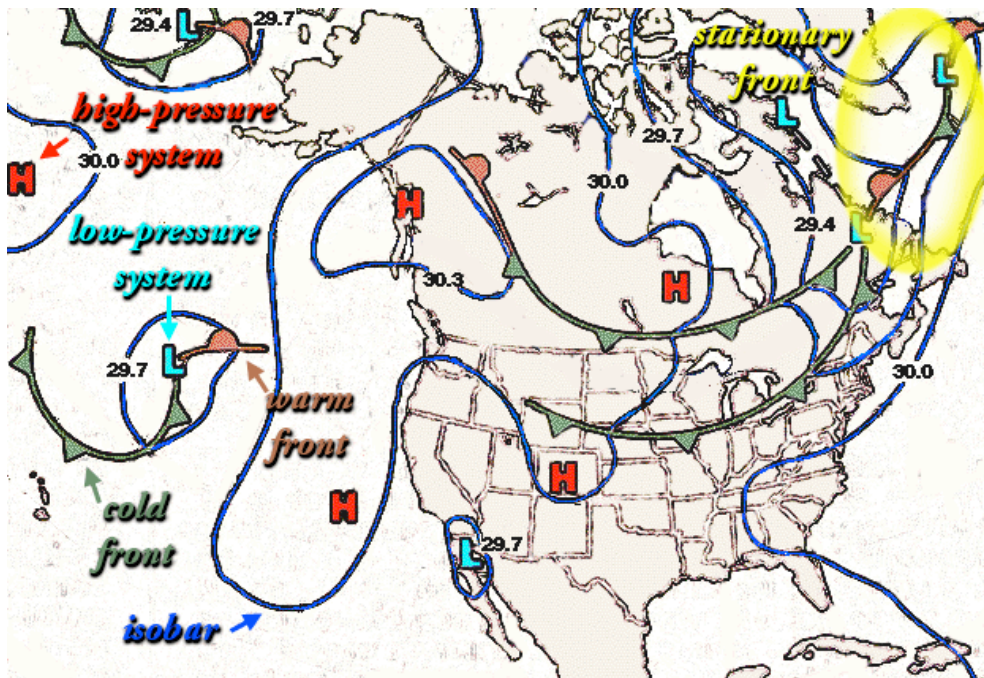
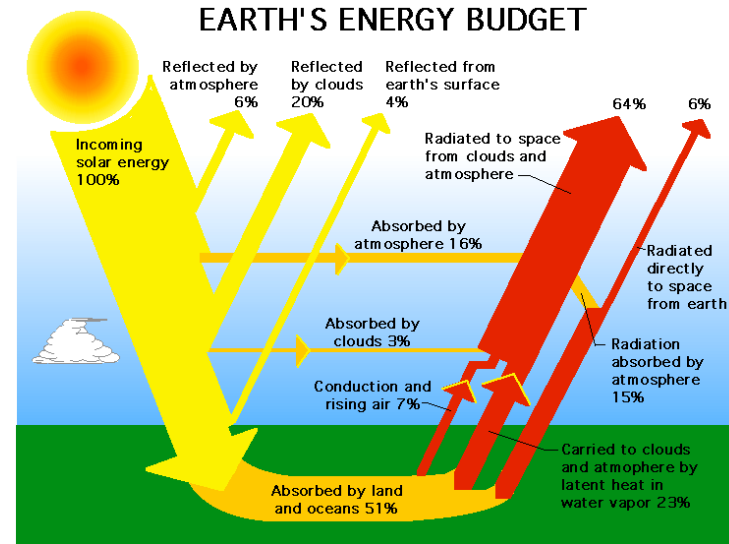
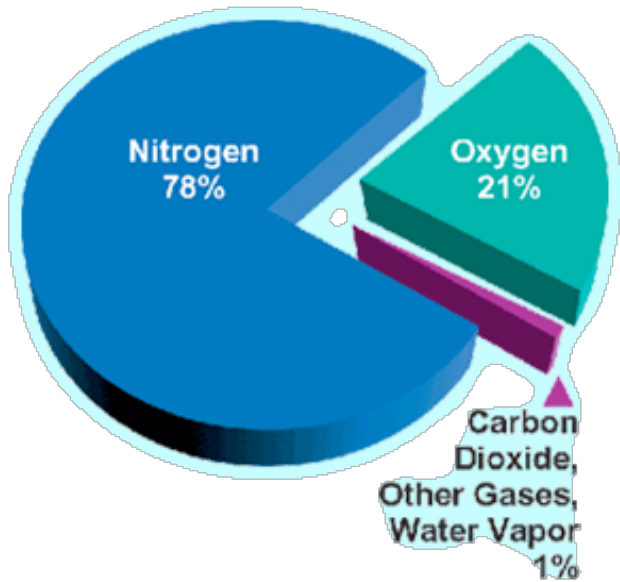
## A model of the Helium atom



# Weather

- **Air mass** – a huge body of air that has similar temperature humidity and pressure throughout.
- **Cyclone** – a swirling center of low pressure winds move counter-clockwise in towards the center.
- **Anti-cyclone** – high pressure centers of dry air-winds move clockwise away from the center.
- **Winds** – created by differences in air pressure.
- **Local winds** – winds that blow over short distances.
- **Global winds** – winds that blow steadily in a specific direction over long distances.
- **The coriolis effect** – as the winds move, the earth rotates from west to east making winds curve.
- **Monsoons** – a wind system that influences large climatic regions and reverses direction seasonally.
- **Low pressure** – warmer air, more humid, clouds, possible storms.
- **High pressure** – colder air, clear dry, fair weather.
- **Altitude vs. air pressure** – at lower altitudes, air pressure is higher.
- **Altitude vs. air density** – at lower altitudes the density of air is higher.
- **Warm air** – rises, less pressure, less dense, hold more water. Low pressure ☹️
- **Colder air** – sinks, more pressure, more dense, holds less water. High pressure 😊
- **Radiation** – the direct transfer of energy by electromagnetic waves.
- **Conduction** – the direct transfer of heat from one substance that is touching it.
- **Convection** – the transfer of heat by the movement of a fluid.
- **Visible light** – a form of energy that is a mixture of all the colors you see in the rainbow.
- **Infrared** – a form of energy with wavelengths that are longer the red light.
- **Ultraviolet** – this form of radiation has shorter wavelengths than violet light.
- **Scattering** – reflection of light in all directions
- **Ozone** – most of earths incoming ultraviolet radiation is absorbed by this.
- **Greenhouse effect** – the process by which gases hold heat in the atmosphere by absorbing infrared radiation
- **Dew point** –the temperature at which water condenses.

# Weather Continued

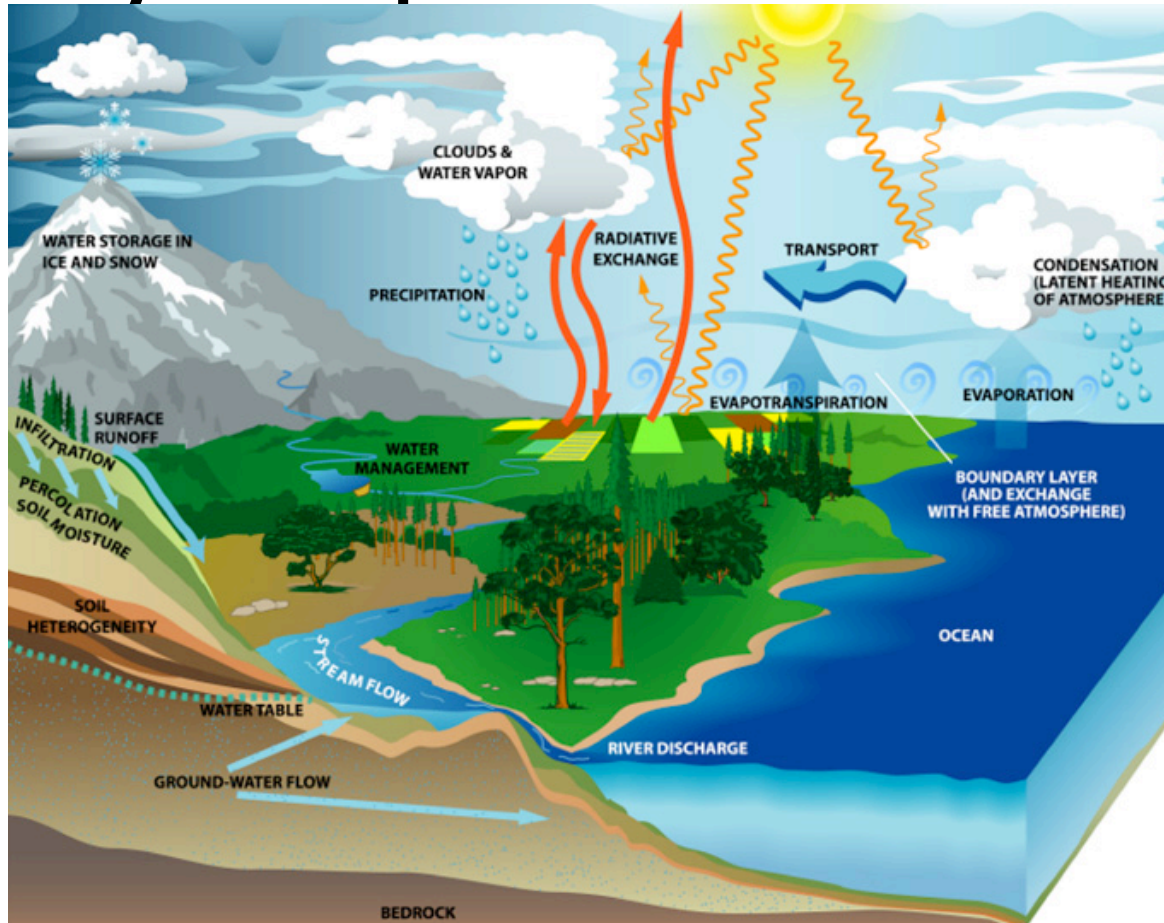


# Hydrosphere

- **polar molecule** – a molecule with electrical charge
  - **The water cycle** – the continuous process that replenishes earth's fresh water source by cycling water between the earth and the atmosphere.
  - **Capillary action** – the ability of water to move against the force of gravity by pulling other molecules upward through small spaces and openings.
  - **Surface tension** – the tightness across the surface of water due to water's cohesive force.
  - **Universal solvent** – water is given this title because of its ability to dissolve so many different solutes.
  - **Cohesion** – the combined forces of attraction between water molecules due to hydrogen bonds.
  - **Hydrogen bond** – a weak bond formed between water molecules because the positive charge on the hydrogen on 1 water molecule is attracted to the negative charge of oxygen on another water molecule.
  - **Evaporation** – the stage in the water cycle where liquid turns into a gas and enters the atmosphere.
  - **Precipitation** – the stage in the water cycle where liquid water seeps into the ground through rocks and soil.
  - **Surface runoff** – the stage in the water cycle where water moves across the surface of the ground to form streams, creeks, and rivers.
  - **Condensation** – the stage of the water cycle where water vapor turns into a liquid when the temperature reaches the dew point.
  - **Transpiration** – the process of unused water being evaporated from trees and vegetation as part of the water cycle
- 
- **Salt water** – 97% of all water on earth exists as this
  - **Deep groundwater** – 11% of all freshwater exists as this
  - **Shallow ground water** – 12% of all freshwater exists as this
  - **Lakes and rivers** – 0.34% of all freshwater exists as this
  - **Ice** – 76% of all freshwater exists as this.



# Hydrosphere Continued



## Freshwater

76% ice  
11% deep groundwater  
12% shallow groundwater  
.34% Lakes & rivers  
.037% water vapor.

## Salt Water

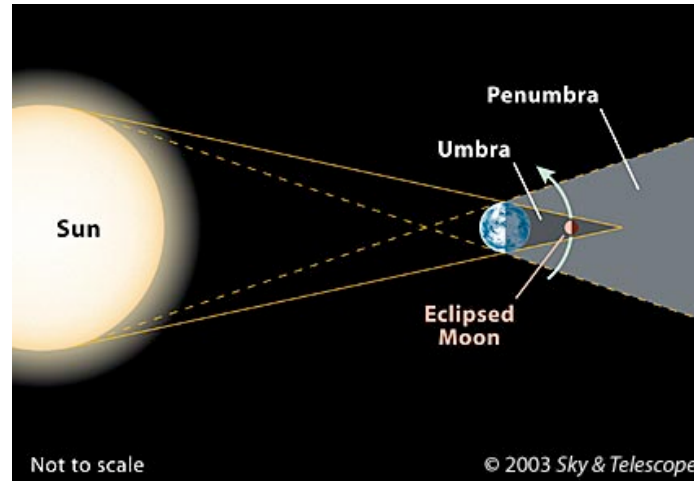
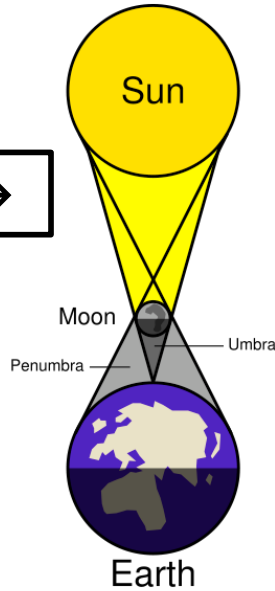
97% oceans  
&  
Salt lakes

# Astronomy

- **Rocky Planets** – Earth, Mercury, Venus Mars. Also known as “inner planets” and “terrestrial planets.” gravity has much less force. Atmospheres have more oxygen & other gases.
- **Gas Planers** – Jupiter, Saturn Uranus, Neptune. Also know as “outer planets”. Exert much stronger gravitational force. Humans would be crushed by atmosphere and gravity.
- **Galaxies** - Spiral, Elliptical and Irregular. We live in Spiral galaxy. Spiral-young & old stars. Elliptical-mainly old stars. Irregular- young stars.
- **Comets** – chunks of ice and dust whose orbits are usually very long narrow ellipses. Tail is always pointed away from the sun.
- **Asteroids** – Made up of rock & metals. Orbit sun in the same direction as the planets. Asteroids are too small and too numerous to be moons.
- **Constellation** – patterns of stars in the sky (big dipper little dipper etc.)
- **Electromagnetic spectrum** – radio waves, x-rays, and infrared radiation.
- **Stars life-** how long a star lives depends on its mass. The earliest stage is a protostar, a star is born when nuclear fusion begins inside a protostar. Smaller stars live longer because it takes more fuel and energy to keep a big star alive so they run out of energy of fuel faster.
- **Classifying stars** – stars are classified into 3 main characteristics, size, temperature and color. The color of a star reveals its temperature, red stars being cool, and white/blue being very hot. The 5 sizes of stars (from largest to smallest) is super giant, red giant, medium, white dwarf and neutron.
- **Brightness of stars-** apparent magnitude (brightness seen from earth), and absolute magnitude (brightness if all stars were lined up at the same distance from earth), show how bright a star is. An HR diagram, is a graph that compares brightness vs. temperature.
- **Parallax-** apparent shift in an object when looking at it from different perspectives. Astronomers used parallax to measure distances of nearby stars.
- **Light year** - distance light travels in 1 year. Measurement of distance, not time.
- **Eclipsing binary** – a star system in which one star blocks the light from another
- **Radio Telescope** – a device used to detect radio waves from objects in space.
- **Refracting Telescope** – focuses light through a transparent lens
- **Reflecting Telescope** – collects and focuses light using a mirror.
- **Nebula** – a giant cloud of gas and dust in the galaxy.
- **Tides-** tides are caused by the force of gravity that pulls the moon and earth towards each other. spring tide- when the sun & moon are in a straight line. Neap tide – when the moon is at a right angle to the sun.
- **Solstices-** summer solstice – late June, winter solstice – late December. (in the northern hemisphere.)
- **Equinoxes** – both hemispheres receive the same amount of energy from the sun.
- **Geocentric Theory** - The Greek theory that the earth is the center of the universe
- **Heliocentric Theory** – The theory in which the earth and other planets revolve around the sun.

# Astronomy Continued.

Solar Eclipse →



Lunar Eclipse ^



Planets ^

Phases of the moon →



← HR diagram

