NOTES FOR THE TINSTAAFLOFE Name:_____

(DO NOT LOSE)

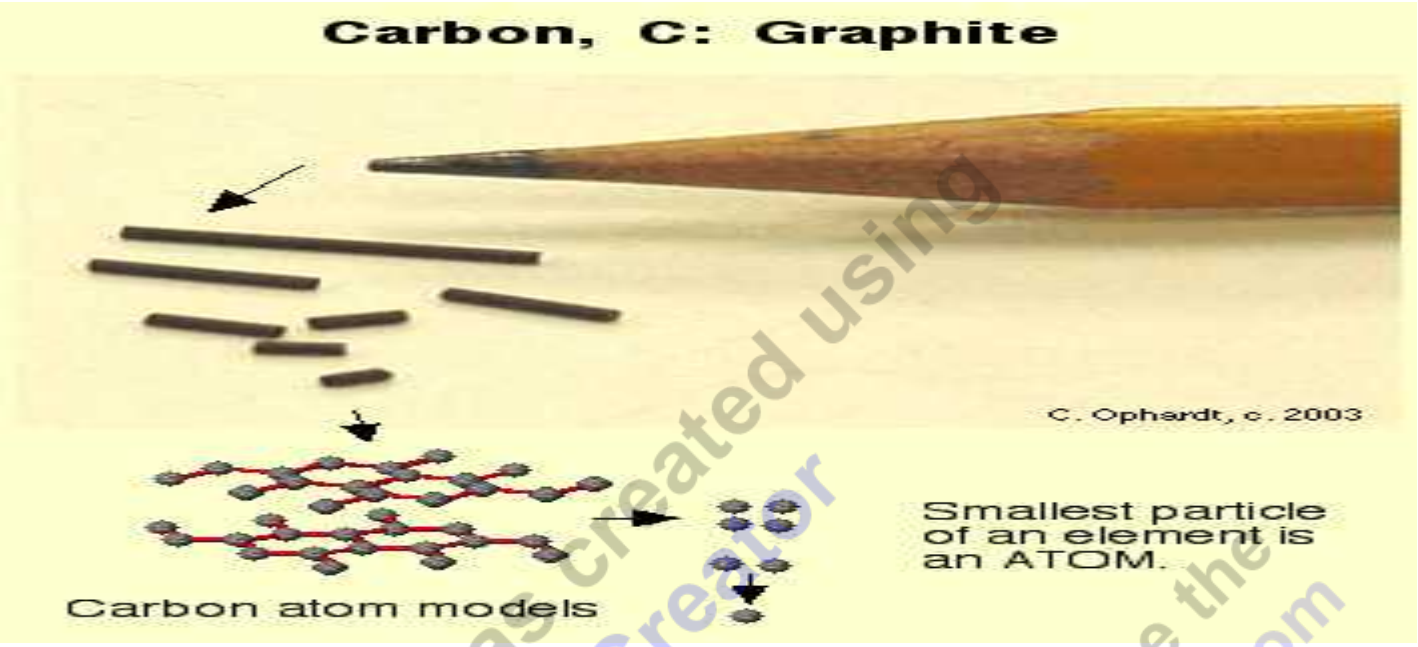
THINK TINSTAAFL

- There
- Is
- No
- Such
- Thing
- As
- A
- Free
- Lunch

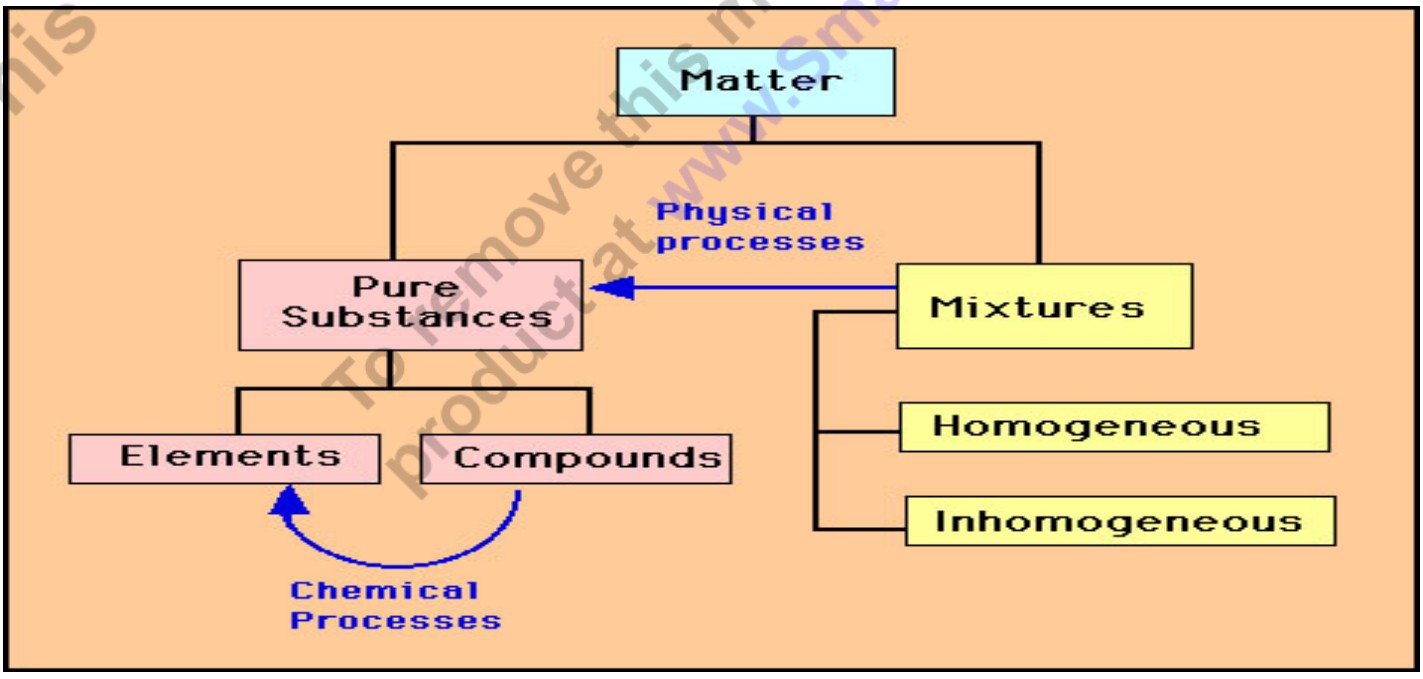
Energy comes from somewhere – nothing is free.

Energy cannot be created or destroyed but can diminish in quality from useful to less useful.

Matter: Anything that has mass and takes up space.



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

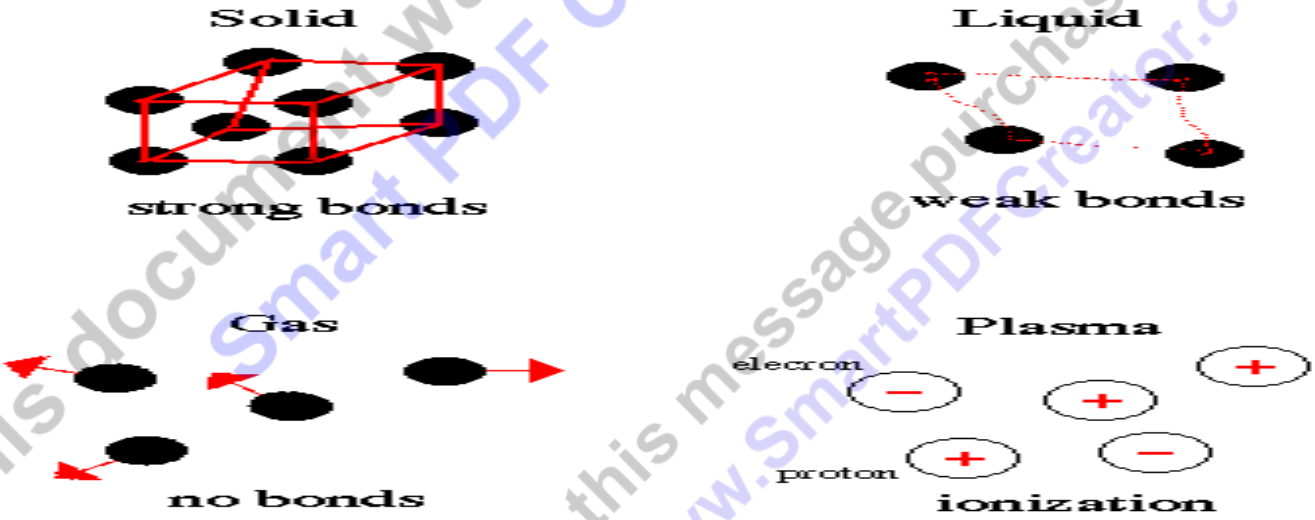


Element – A substance that is made entirely from one type of atom
Compound – Made up of two or more elements bonded together.

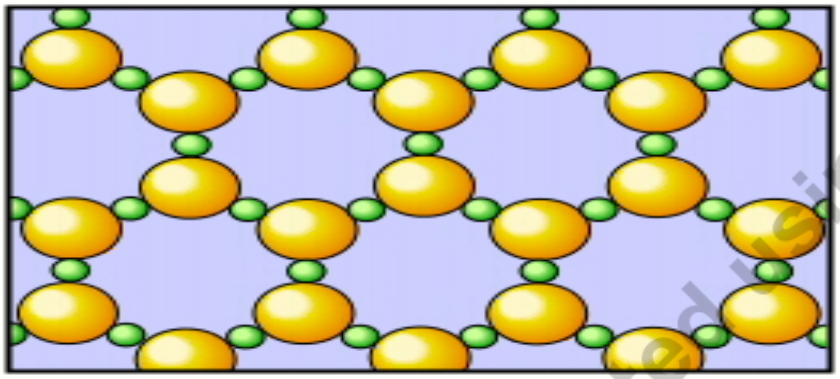
Kinetic Molecular Theory:

- The molecules are in constant motion.
- This motion is different for the 3 states of matter.

States of Matter -

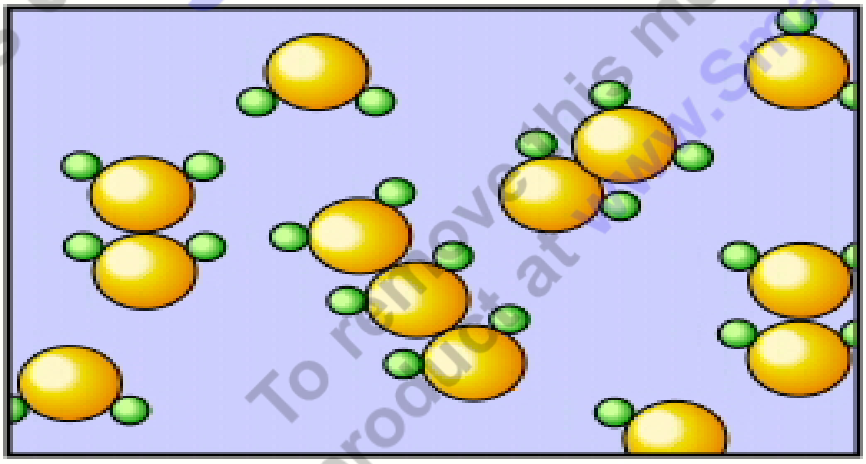


Solid (s) has a definite shape and volume



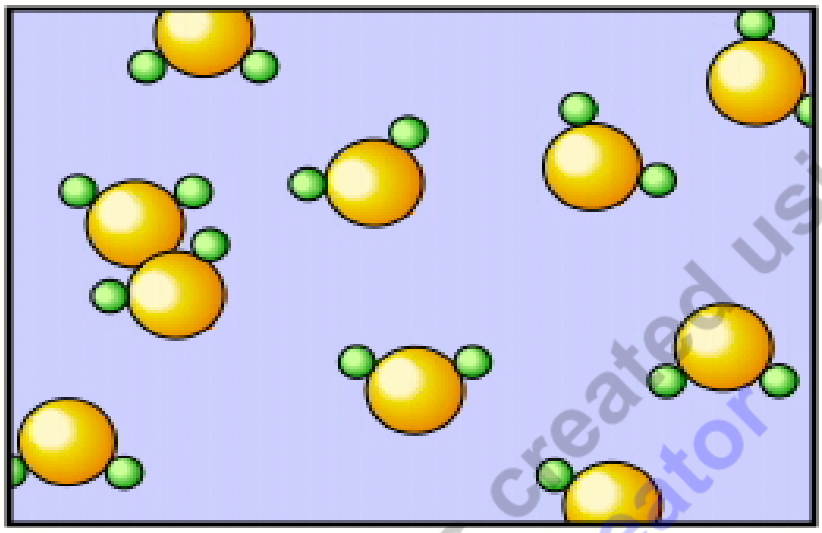
Ordered Molecular Structure of Frozen Water

Liquid (l) Has definite volume but not shape



Semi-Ordered Molecular Structure of Liquid Water

Gas (g) No definite shape or volume



Random Molecular Structure of Vaporized Water

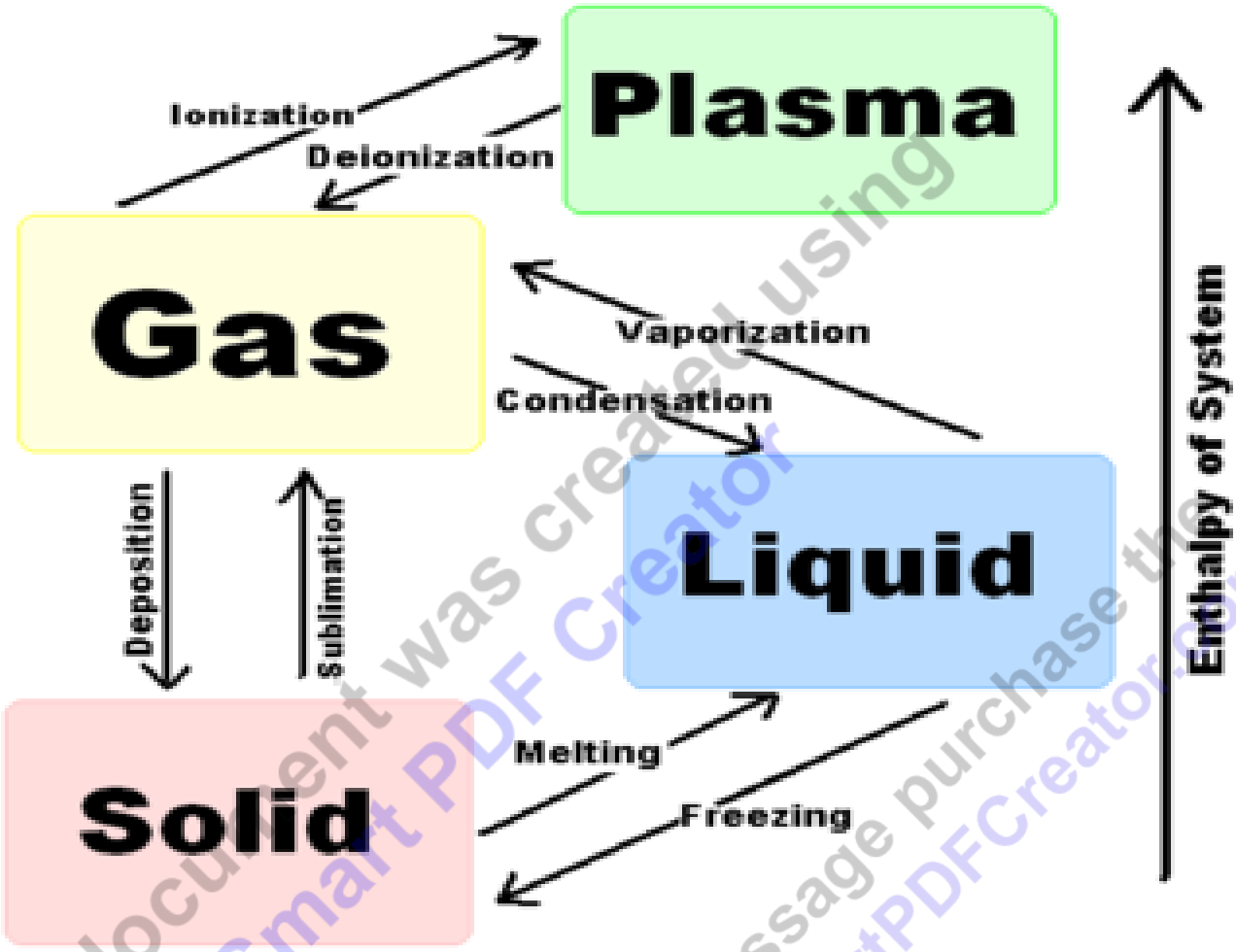
Plasma (p) Ionized gas that emits electrons.

Law Conservation of Matter

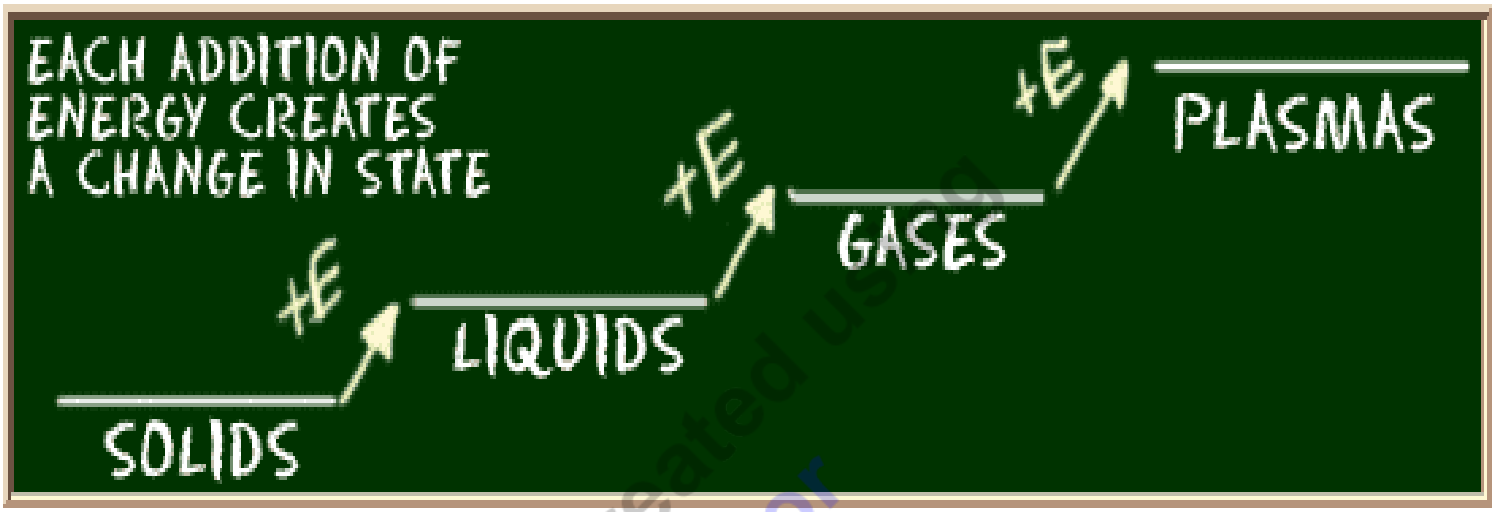
- In any physical or chemical change, matter is neither created nor destroyed but merely changed from one form to another.

Physical Change

- Changes form solid > liquid> gas> plasma
- Doesn't change identity



- The effort needed to compress a substance decreases from a S->L->G.



Chemical Change: The change of substances into other substances through a reorganization of the atoms.

Gases

Charles Law - Volume of a gas increases with temperature.

Avogadro's law - Equal volumes of gases, at the same temperature and pressure, contain the same number of particles, or molecules.

The ideal gas law: PV = nRT (pressure times volume equals the number of molecules times the gas constant times temperature).

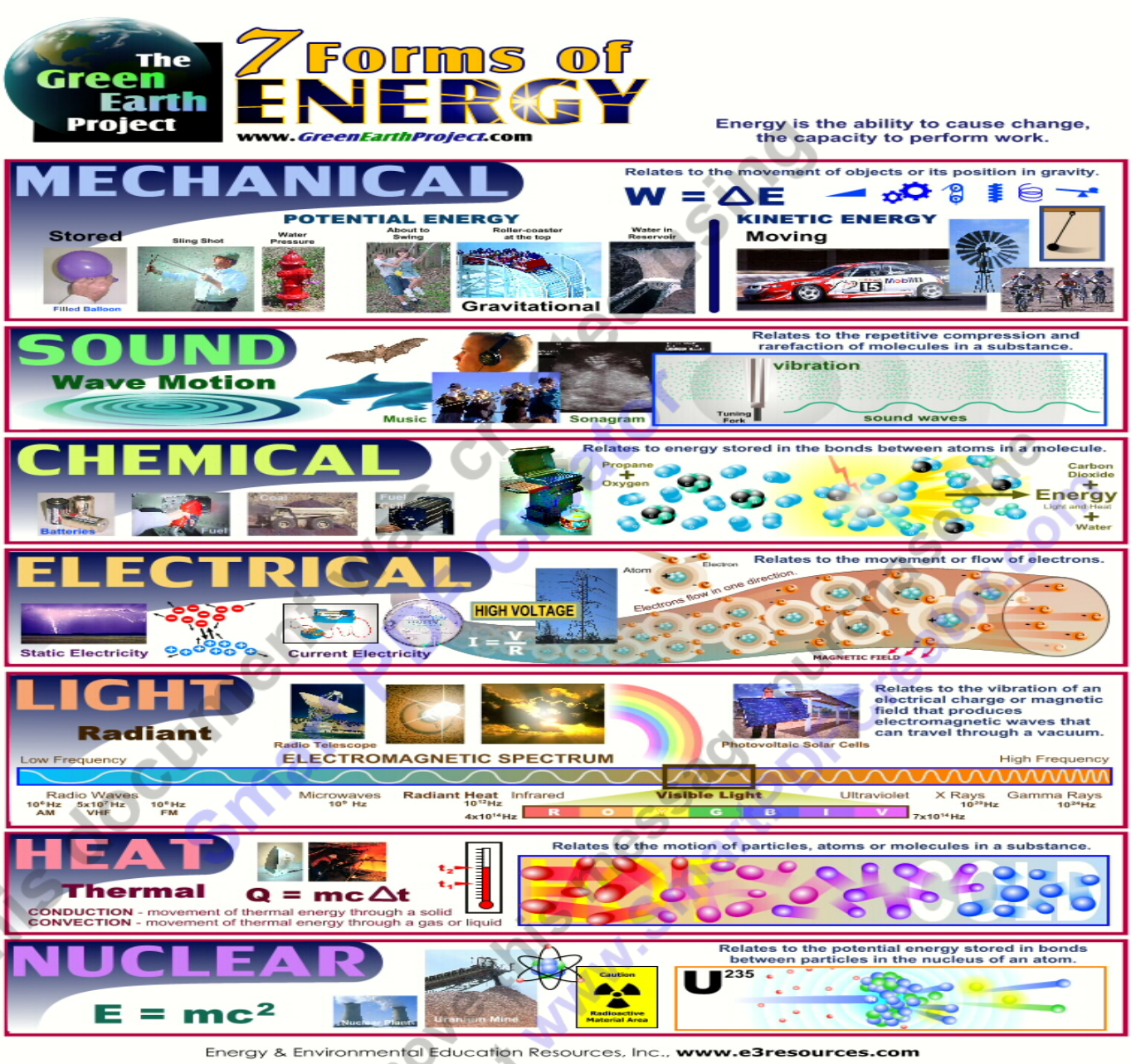
- P=Pressure
- V=Volume
- n=number of molecules
- R=gas constant
- T=temperature

Pascal's Law states that if you apply pressure to fluids that are (or), the fluids will then (or) that same pressure in all directions at the .

Archimedes Principle - A body that is submerged in a fluid is buoyed up by a force equal in magnitude to the weight of the fluid that is displaced.

Buoyancy - Buoyancy force is equal to the weight of fluid displaced by the body.

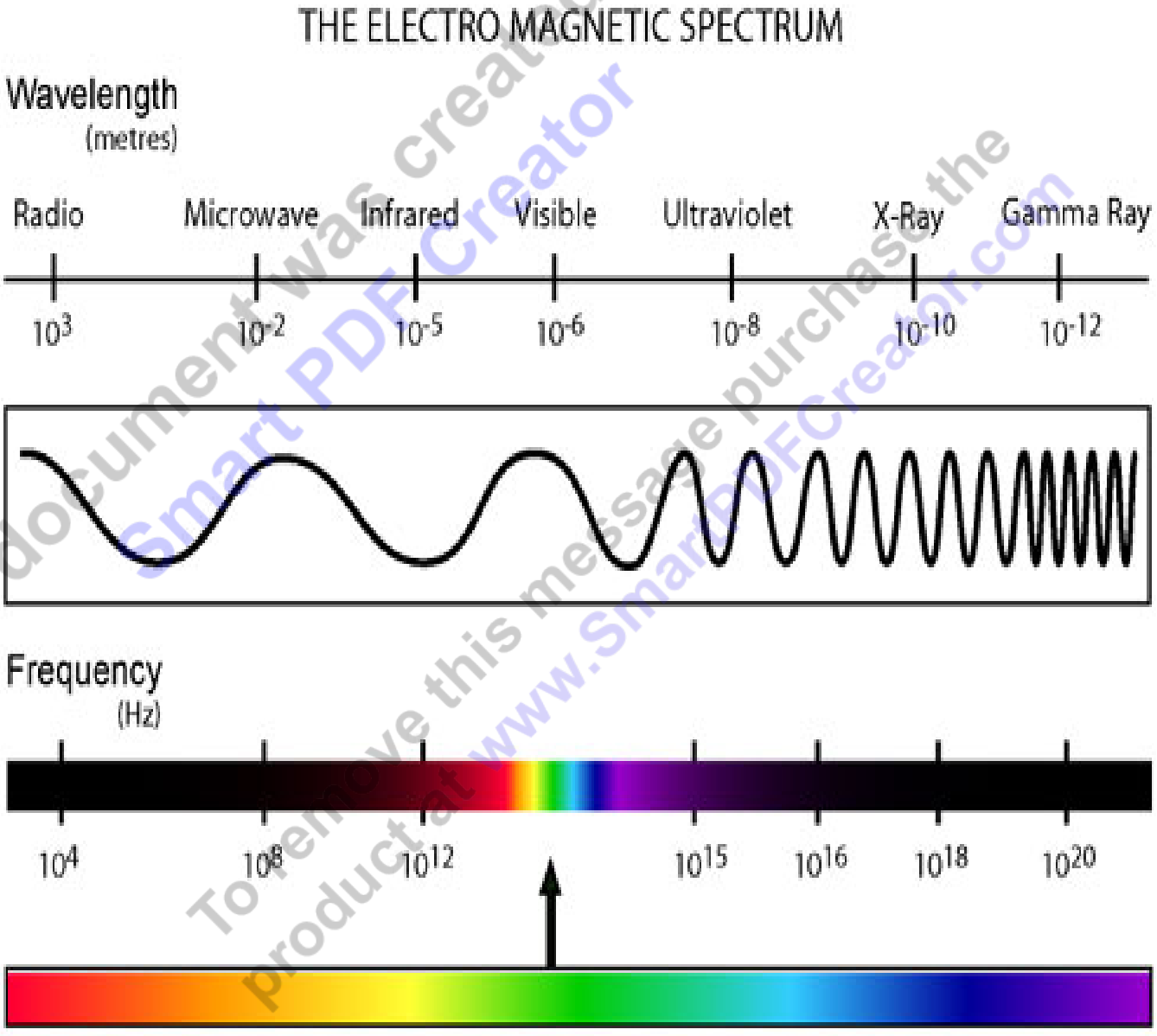
The seven forms of energy



Nuclear Energy- The energy that deals with the changes in the nucleus of an atom. Nuclear energy is produced when the nuclei of two atoms join together (fusion) or when the nucleus of an atom splits apart (fission).

New Area of Focus: The electromagnetic spectrum

- Particle: A tiny piece of anything.
  - An atom or nucleus.
  - Elementary particle, quark, gluon.
  -
- The Electromagnetic spectrum: The entire frequency range of electromagnetic waves.



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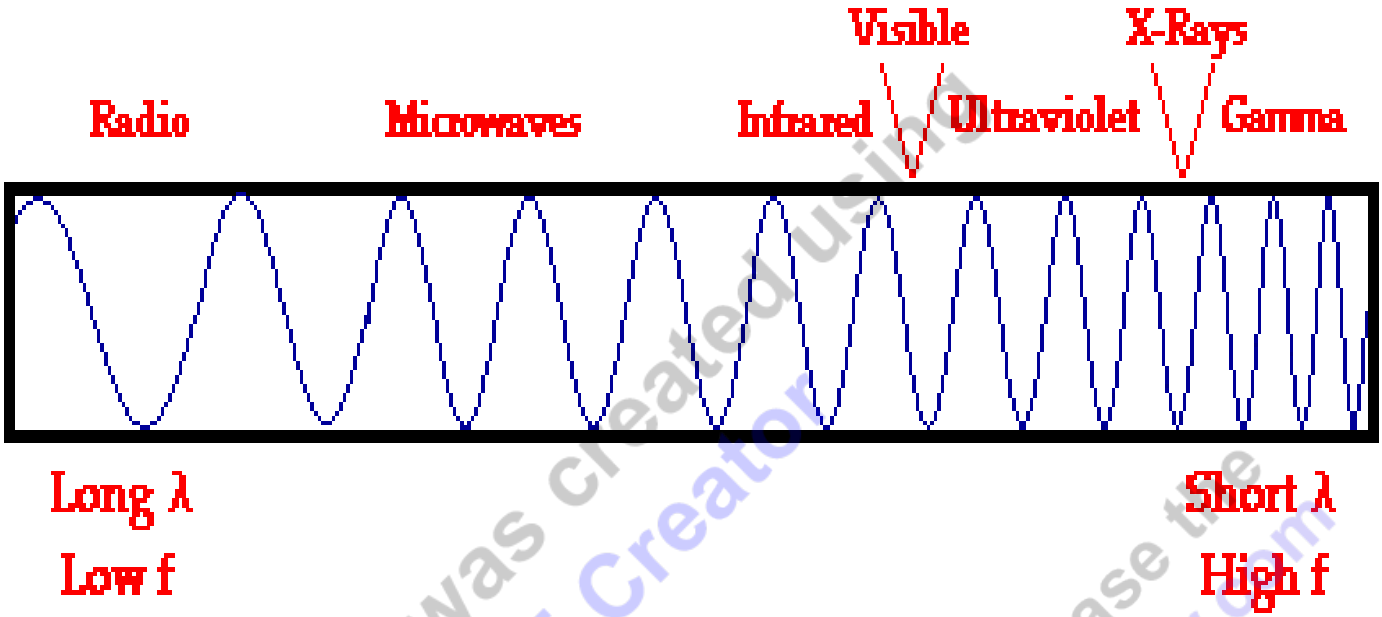
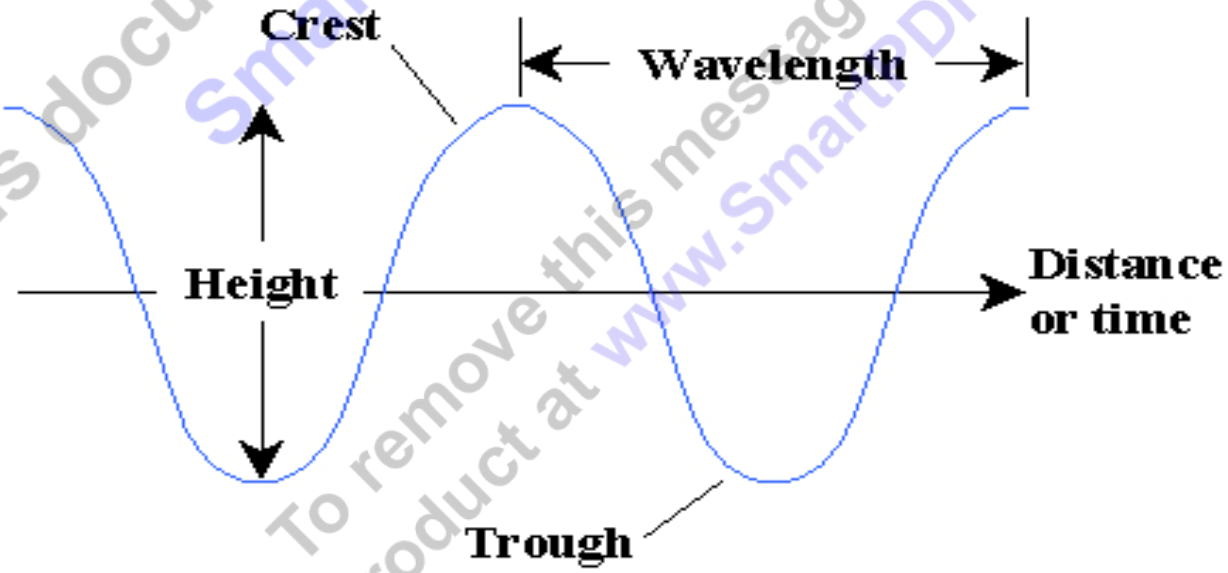
- Long waves are less powerful, short are more powerful.

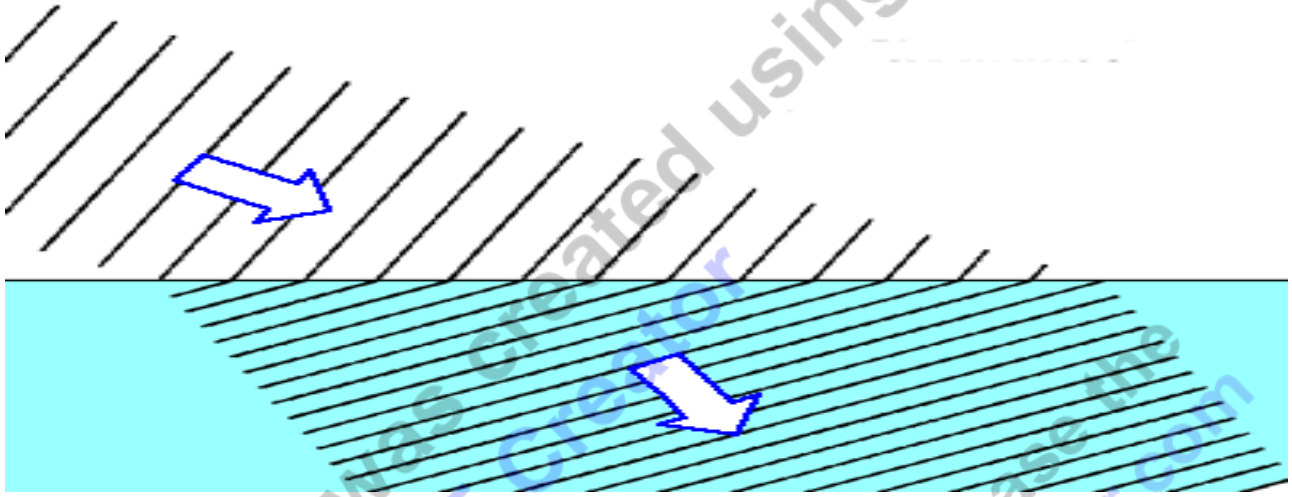


- A wave: In physics - A wave is the movement up and down or back and forth.

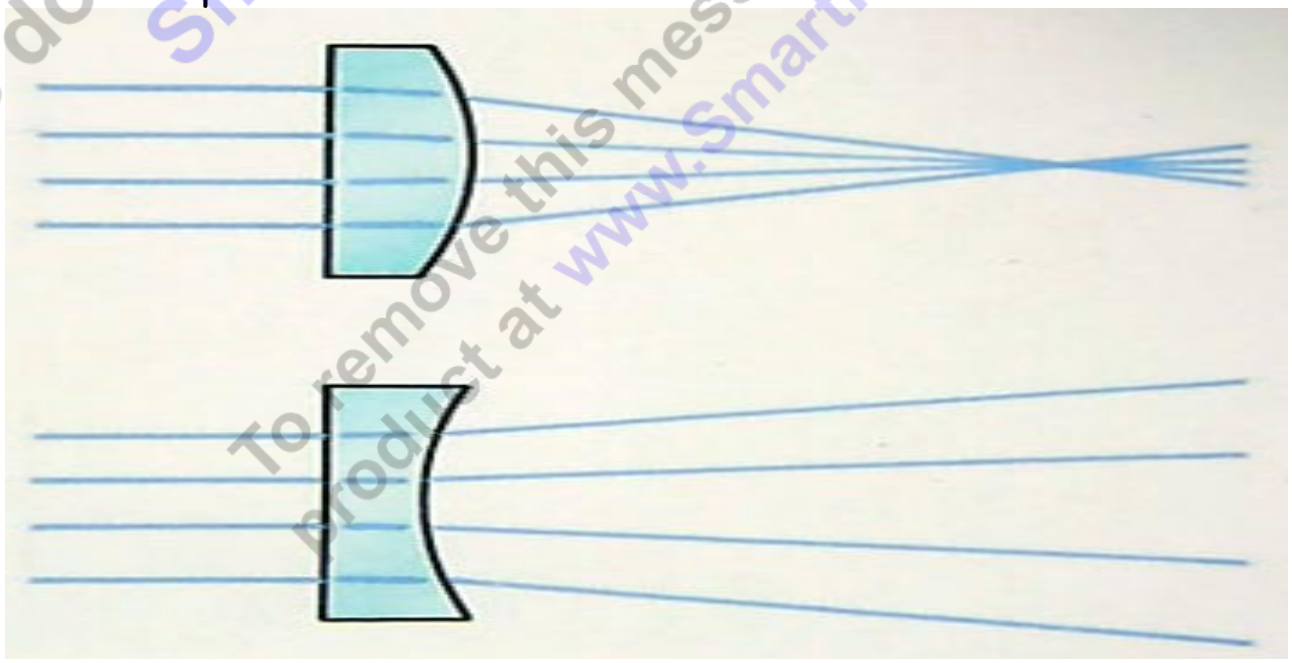


- Light is a particle and a wave and goes out in a straight line unless it bumps something.

- Refraction: The bending of a wave when it enters a medium where it's speed is different.



- Diffraction- Bending of waves.
- Lens: A transparent optical device used to converge or diverge transmitted light and to form images.
- Convex top / Concave bottom



- Waves of the electromagnetic spectrum travel at the speed of light. 186,000 miles per second or 300,000 kilometers per second in a vaccum.

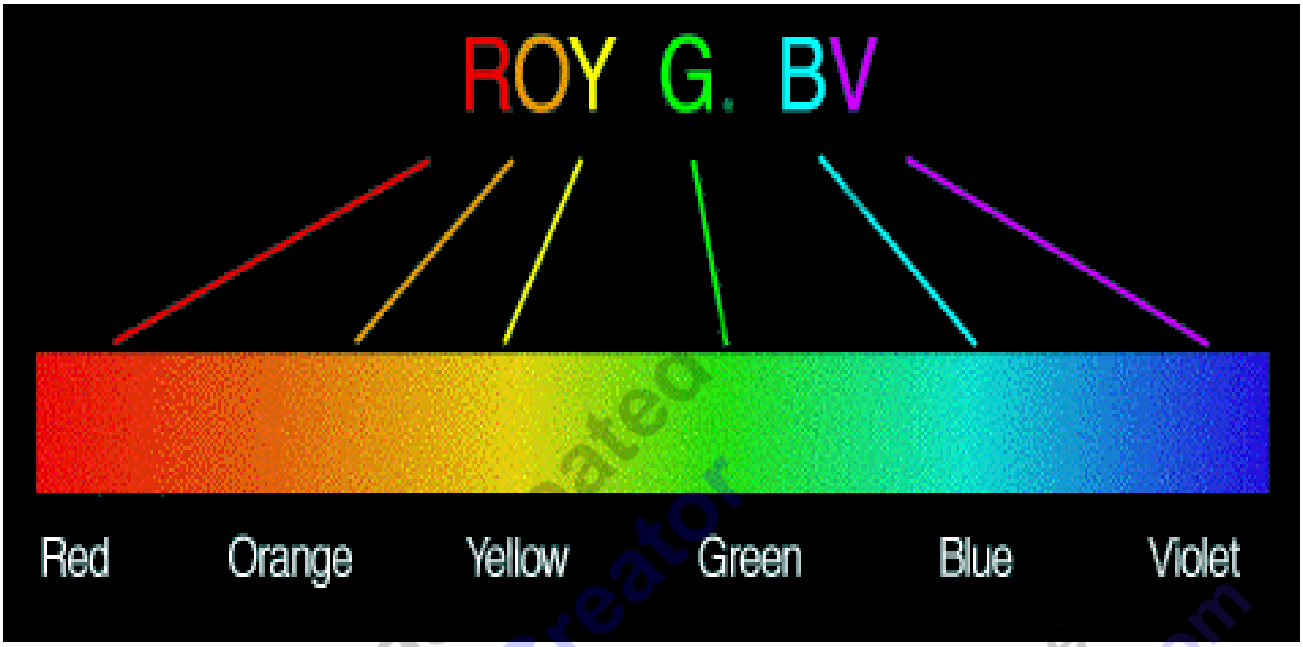
- Visible light measured in lumens.
- All others are measured in radiation.

- Radiation when it hits something can be…
  - Absorbed
  - Reflected
  - Scattered (Diffraction, Refraction)
  - Transmitted

  - Nothing, it missed.

- Temperature of an objects relates to the amount of radiation released.
- The hotter, the more radiation released.

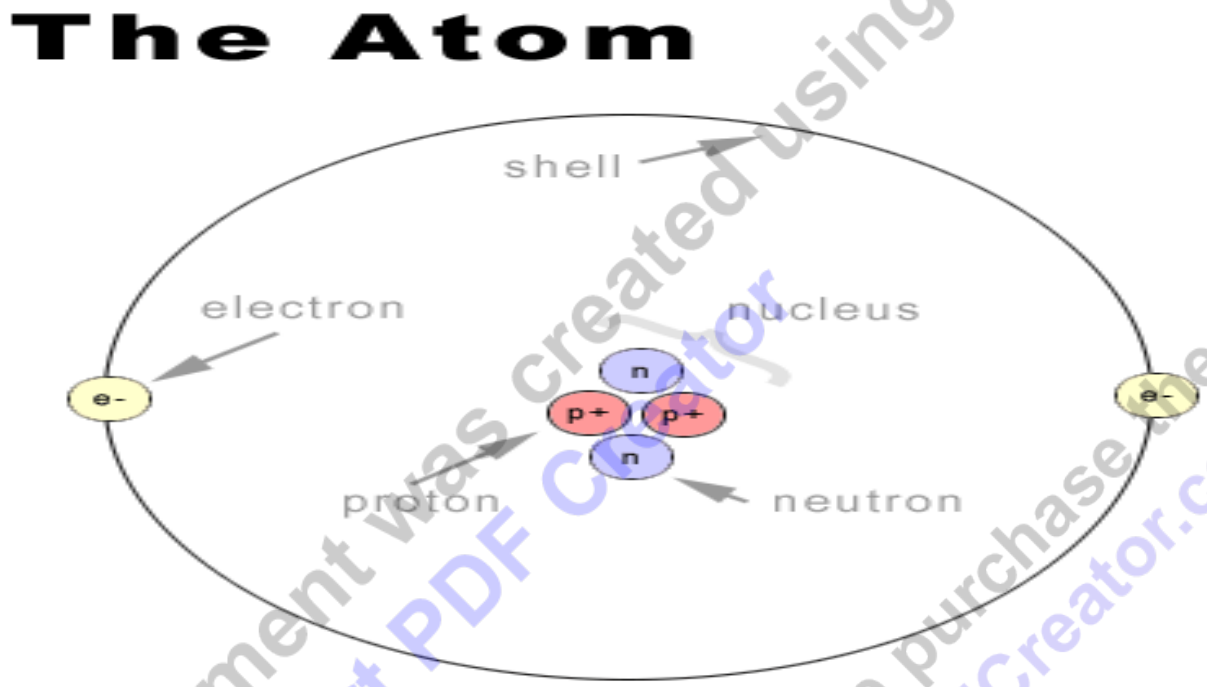
- Radiowaves: Longest wave in the spectrum, size of a football field. Not very powerful.
- Microwaves: Waves with wavelengths ranging from 1 m down to 1 mm.
- Infrared Radiation: Wavelengths between microwaves and visible light. (heat)
- Visible light consists of…



- Violet has a stronger wave length than Red. UV Ultra-violet, Infrared
- Ultraviolet - Has shorter wavelengths than visible light. – thus it more powerful than visible light.

- Ultraviolet has many wave lengths as well. All of which can cause cancer.
  - UVA
  - UVB
  - UVC
- X-Rays: They have smaller wavelengths and therefore higher energy than ultraviolet waves.
- Gamma ray: Highest energy, shortest wavelength. Emitted during radioactive decay of a fission product.
- Laser - Light Amplification by Stimulated Emission of Radiation.
  - Lasers cross over many parts of the EM scale.

Electricity - Electricity is related to charges, and both electrons and protons carry a charge.



Lightning is a big spark that occurs when lots of electrons move from one place to another very quickly. Unequal distribution of electrons.

Static Electricity: The imbalance of positive and negative charges.

Magnetism

Electric Fields: The funky area near any electrically-charged object

- replace electrostatic for funky

Coulomb's Law there is always two charges and a distance between them as the three critical variables which influence the strength.

- Sign + or –
- Magnitude of the Charge

- Distance
  - As distance increases, the forces and electric fields decrease.

Current is a flow of **electrons**, or individual negative charges

Conductors, Insulators, Semi-conductors: How easily energy is transferred through the object by moving charge.

Conductor – Electrons flow easily, semi flows in the middle.
Semi-conductor: Conductivity between conductor and insulator (electronics use)
Insulator – Electrons do not flow easily

There are two main kinds of electric current, direct current (DC) and alternating current (AC).

- (DC) Direct current is a flow of charge always in one direction. (Batteries)
- (AC) -Alternating current is a flow of charge back and forth, changing its direction many times in one second. (Plugs and outlets / household)

Ampere. How much current moves through a wire in one second is measured in amperes. Basically, the larger the size of wire, the greater the ampere capacity.

Watt. The amount of electricity consumed per second is measured by what are called watts, calculated by multiplying volts times amps. Most household electrical usage is billed in kilowatt hours, or the amount of hours times 1,000 watts.

Resistance. Anything in an electrical circuit that impedes the flow of current is referred to as resistance.

Magnetism

A magnet is an object or a device that gives off an external magnetic field.

Faraday's law: The changing of a magnetic field can create voltage.
Electromagnets: By running electric current through a wire, you can create a magnetic field.

Compass: A navigational instrument for determining direction relative to the Earth's magnetic poles.

- New Area of Focus: Relativity, Einstein, and E=MC2

General relativity is a theory of the structure of spacetime.

- Time slows down with increased velocity.
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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.

Energy

- The ability to work
- To cause something to move/change

- Energy is transferred but not destroyed
- Energy is lost in quality due to friction/force/heat

First Law of Thermodynamics: Energy can be transformed (changed from one form to another), but it can neither be created nor destroyed.

2nd Law: The energy content of the universe is always diminishing in quality. Heat Flow -> Warm to cold.

The third law of thermodynamics: All molecular movement stops at absolute zero.

Environmental Science / Studies

is the study of interactions among physical, chemical, and biological components of the environment.

Environmental studies is the systematic study of human interaction with their environment.

– Believing the ecosphere, rather than any individual organism, is the source and support of all life.

The 4 R's

- -Reduce
  - Our stuff becomes harmful waste
- Reuse
  - So we can reduce
- Recycle

- Last because it uses energy and TINSTAAFL

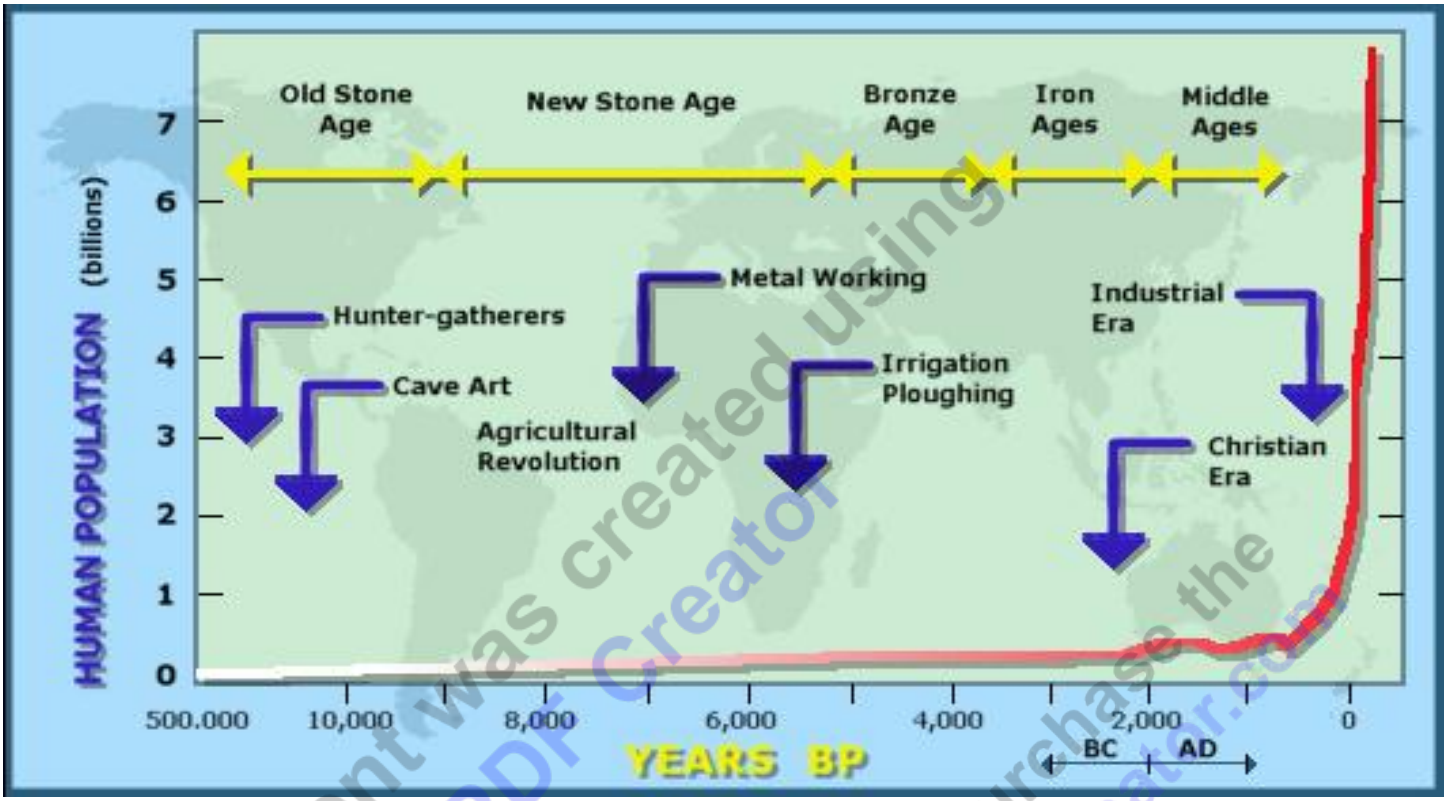
- Rethink: Reinvent everything with the R's in mind.

is about getting the maximum value for your dollar while living.

■

- Meeting the needs of the present without compromising the ability of future generations to meet their own needs.

Human Population Growth



Anthropogenesis: humans shaping their environment.

Fossil fuels are borrowed light: The energy rich organic matter from millions of years ago.

Carrying Capacity: the amount of food that an area of land will yield and, therefore, the number of people that an area of land will support.

Megalopolis

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Forms of renewable energy

- Hydropower.
- Damless Hyrdropower.
- Ocean thermal energy conversion.
- Wave Energy.

- Tidal Energy.
- Wind.
- Solar Chimney.
- Solar Thermal.
- Liquid Biofuels.
    - Vegetable oils
    - Ethanol
    - Biobutanol
    - Sweet Sorghum (food and fuel)
- Solid Biofuels.
    - Wood
    - Manure
    - Crop waste
    - Biogasification
- Biogas.
    - Digesters that produce flammable gas.
    - Algae as a fuel source.
- Nuclear (kind of clean / renewable)
    - Nuclear waste needs to stored away forever.
    - Nuclear material is not an abundant resource.

SAVE THESE NOTES FOR THE TINSTAAFLOFE! DO NOT LOSE!