

MATTER, ENERGY, and the ENVIRONMENT Unit Notes

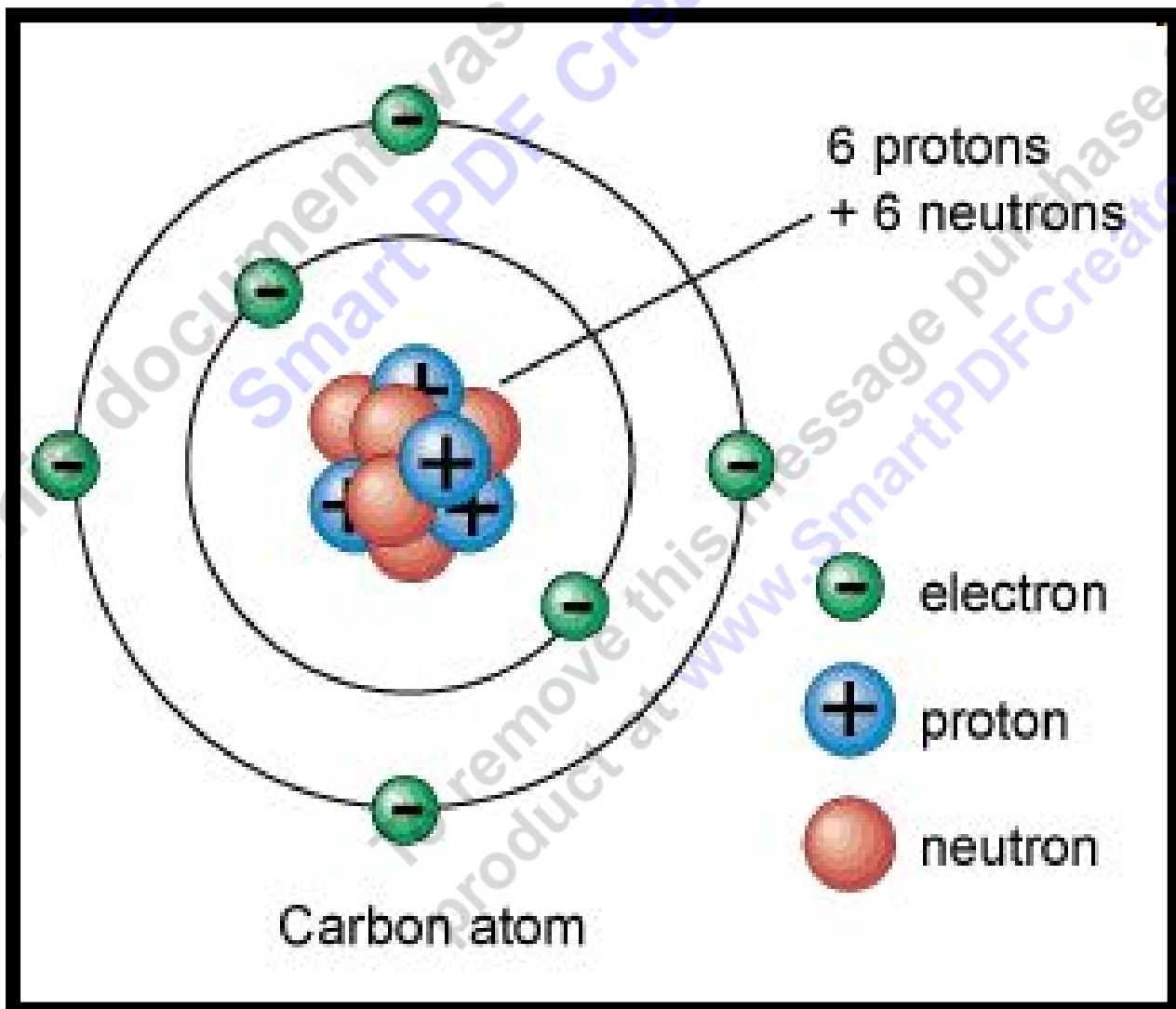
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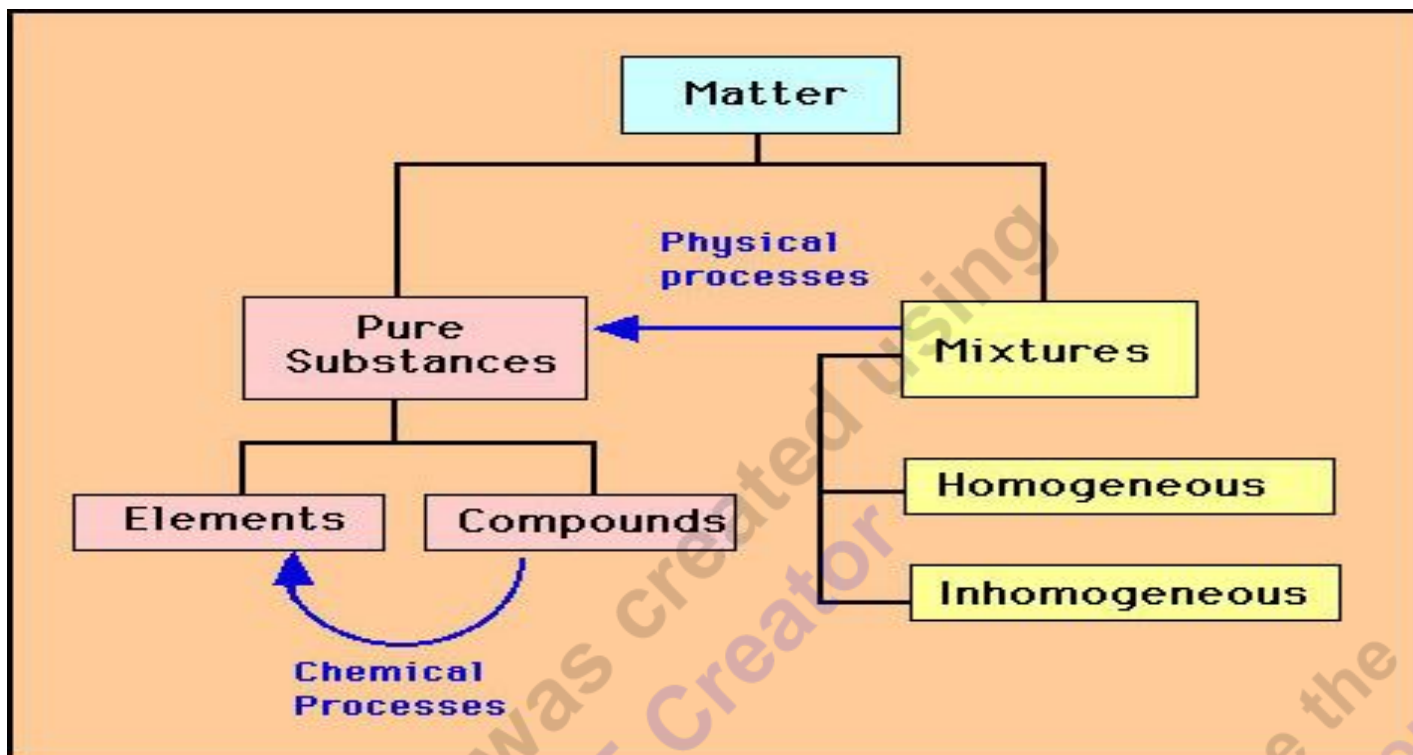
(DO NOT LOSE)

First Area of Focus: Matter

Matter: Anything that has _____ and takes up _____.

■ **Atom:** A basic unit of _____ consisting of a dense, central _____ surrounded by a cloud of negatively charged _____.





Element – A substance that is made entirely from _____ type of atom

Compound – Made up of _____ or more _____ bonded together.

Universal Solvent: Liquid water is able to _____ a large number of different chemical compounds.

Homogeneous mixture – _____ throughout.

Heterogeneous – A mixture of _____ or more _____. The mixture is not _____ throughout (Ex. Chicken Noodle Soup)

Solvent – The substance that does the _____ (usually larger amount) – _____ is the universal solvent.

Solute – The substance that gets _____ (usually lesser amount)

Solubility - How much _____ can dissolve in a substance before it becomes saturated.

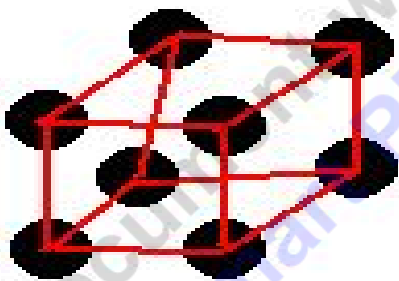
Supersaturated: When no more _____ will dissolve.
(crystals visible)

Kinetic Molecular Theory:

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

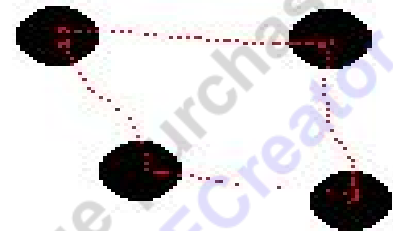
States of Matter -

Solid



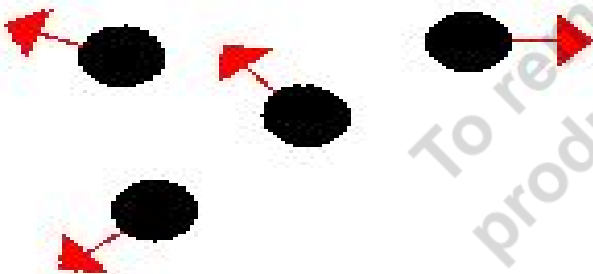
strong bonds

Liquid



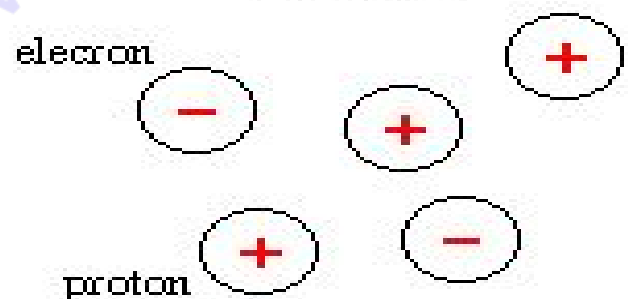
weak bonds

Gas



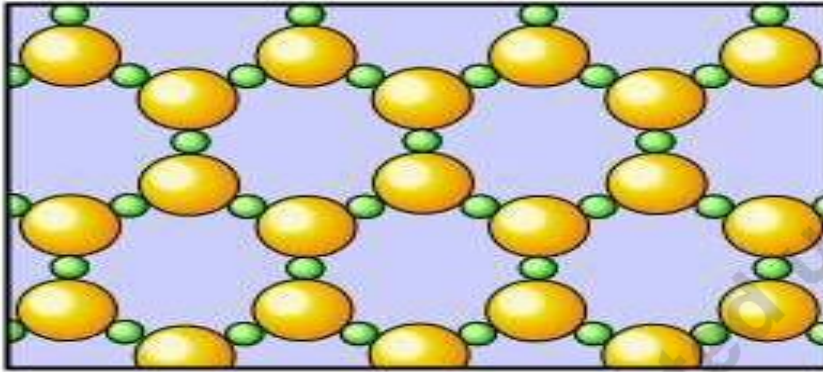
no bonds

Plasma



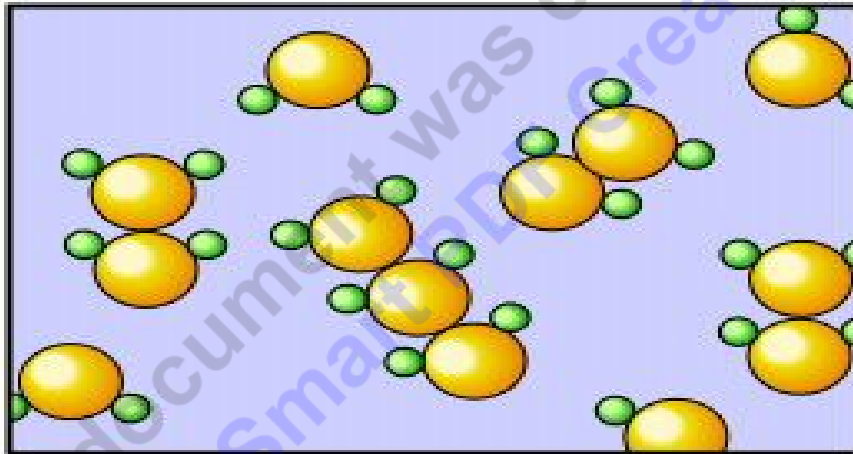
ionization

Solid (s) has a definite _____ and _____



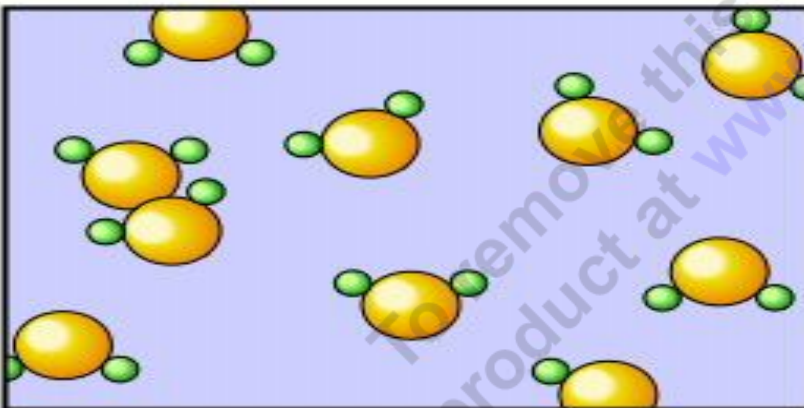
**Ordered
Molecular
Structure of
Frozen Water**

Liquid (l) Definite _____ but not shape



**Semi-Ordered
Molecular
Structure of
Liquid Water**

Gas (g) _____ definite shape or volume



**Random
Molecular
Structure of
Vaporized Water**

Plasma (p) Ionized gas that emits _____.

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

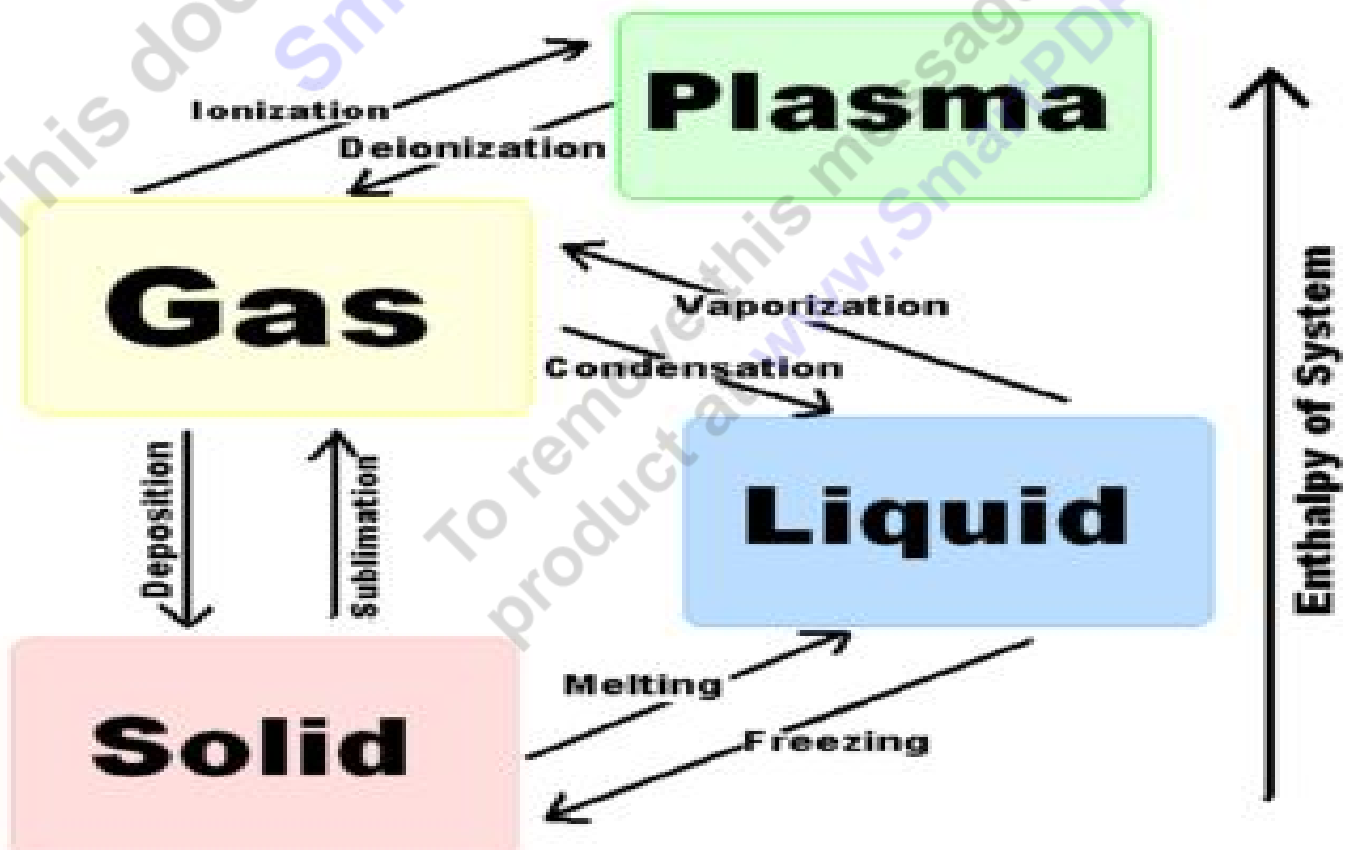
Dark Energy – A hypothetical form of _____ that permeates space and exerts a negative pressure, which would have _____ effects to account for the differences between the theoretical and observational results of gravitational effects on visible matter.

Law Conservation of Matter

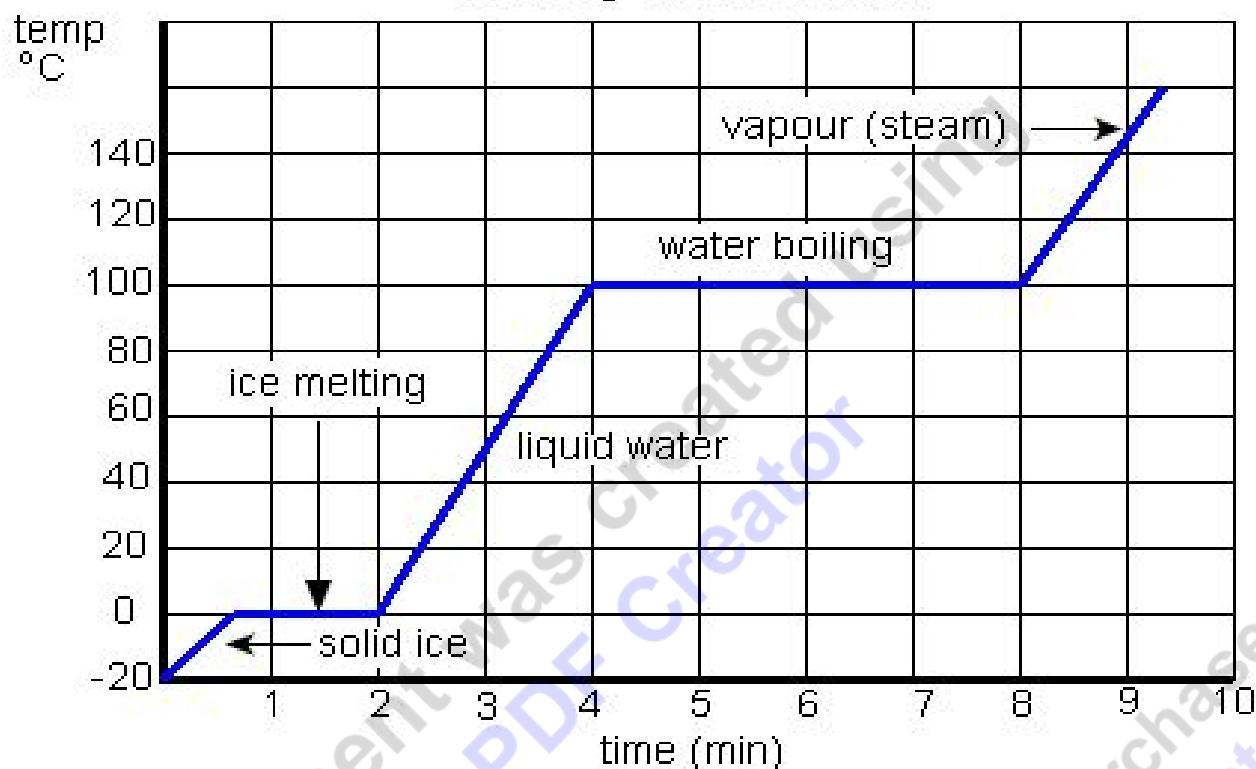
- In any physical or chemical change, matter is neither _____ nor _____ but merely changed from one _____ to another.

Physical Change

- Changes form solid > _____ > gas > _____
- Doesn't change _____



Heating curve for water



- The effort needed to _____ a substance decreases from a _____ S→L→G.

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

The Six Types of Chemical Reactions

- _____: When oxygen combines with another compound to form water and carbon dioxide.
 - $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$
- _____ Reaction: When two or more simple compounds combine to form a more complicated one. $A + B = AB$
 - $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2(\text{g})$
- _____ Reaction: A complex molecule breaks down to make simpler ones.
 - Opposite of Synthesis Reaction. $AB \rightarrow A + B$
 - $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$ (Electrolysis of Water)

- _____ Displacement: When one element trades places with another element in a compound. $BC + A \rightarrow AC + B$
- _____ Displacement: When the anions and cations of two different molecules switch places, forming two entirely different compounds.
 - $AB + CD \rightarrow AD + CB$
 - $AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$
- _____ / Base: When an acid and base react with each other.

Gases

_____ **Law** - Volume of a gas _____ with temperature.

_____ **Law** - Equal volumes of gases, at the same _____ and _____, contain the same number of particles, or molecules.

The ideal gas Law: $PV = nRT$ (pressure times _____ equals the number of _____ times the gas constant times _____).

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

P _____ **Law** states that if you apply _____ to fluids that are *confined* (or *can't flow to anywhere*), the fluids will then *transmit* (or *send out*) that same pressure in all directions at the *same rate*.

■ **Viscosity:** Resistance of liquid to _____.

High viscosity = Travels slow because of high _____.
 Low viscosity = Travels fast because low _____.

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

Buoyancy: Buoyancy force is _____ to the weight of fluid displaced by the body.

New Area of Focus: Energy

THINK TINSTAAFL

- T _____
- Is
- No
- S _____
- Thing
- A _____
- A
- F _____
- Lunch

Energy comes from somewhere – nothing is free.

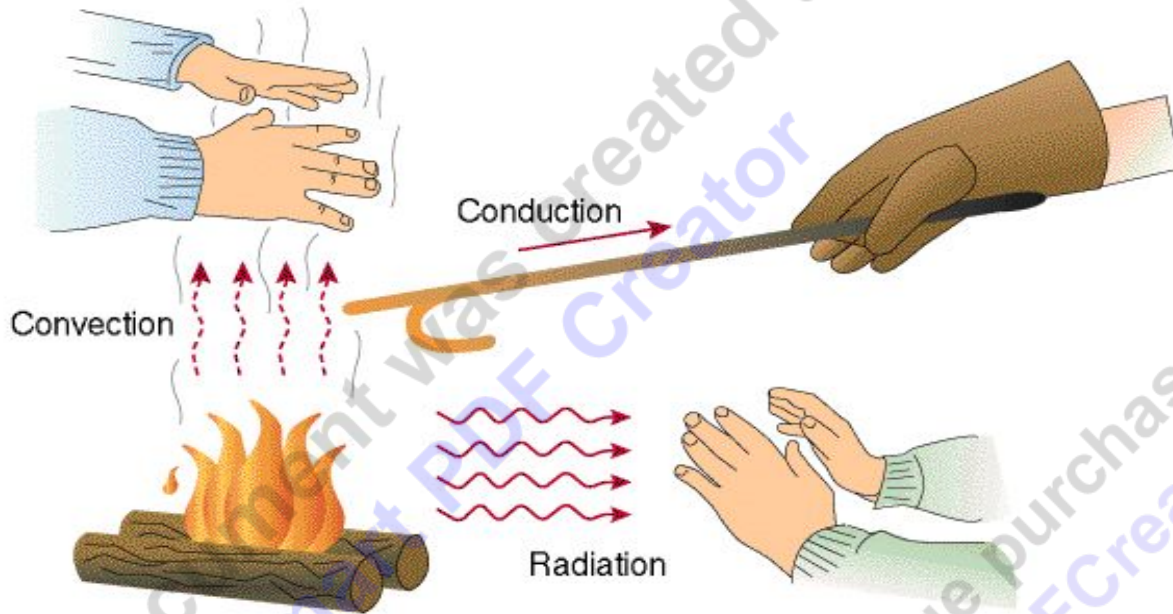
Law Conservation of Energy:

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

The seven forms of energy

- Mechanical (PE+KE)
- Sound
- Chemical
- Electrical
- Light / Radiant
 - o Convection: Vertical circulation in which warm _____ and cool _____. Flow of heat by this circulation.

- Conduction: The movement of _____ from one molecule to another.
 - Radiation: Energy that is radiated or transmitted in the form of rays, waves, or _____.
- Heat / Thermal

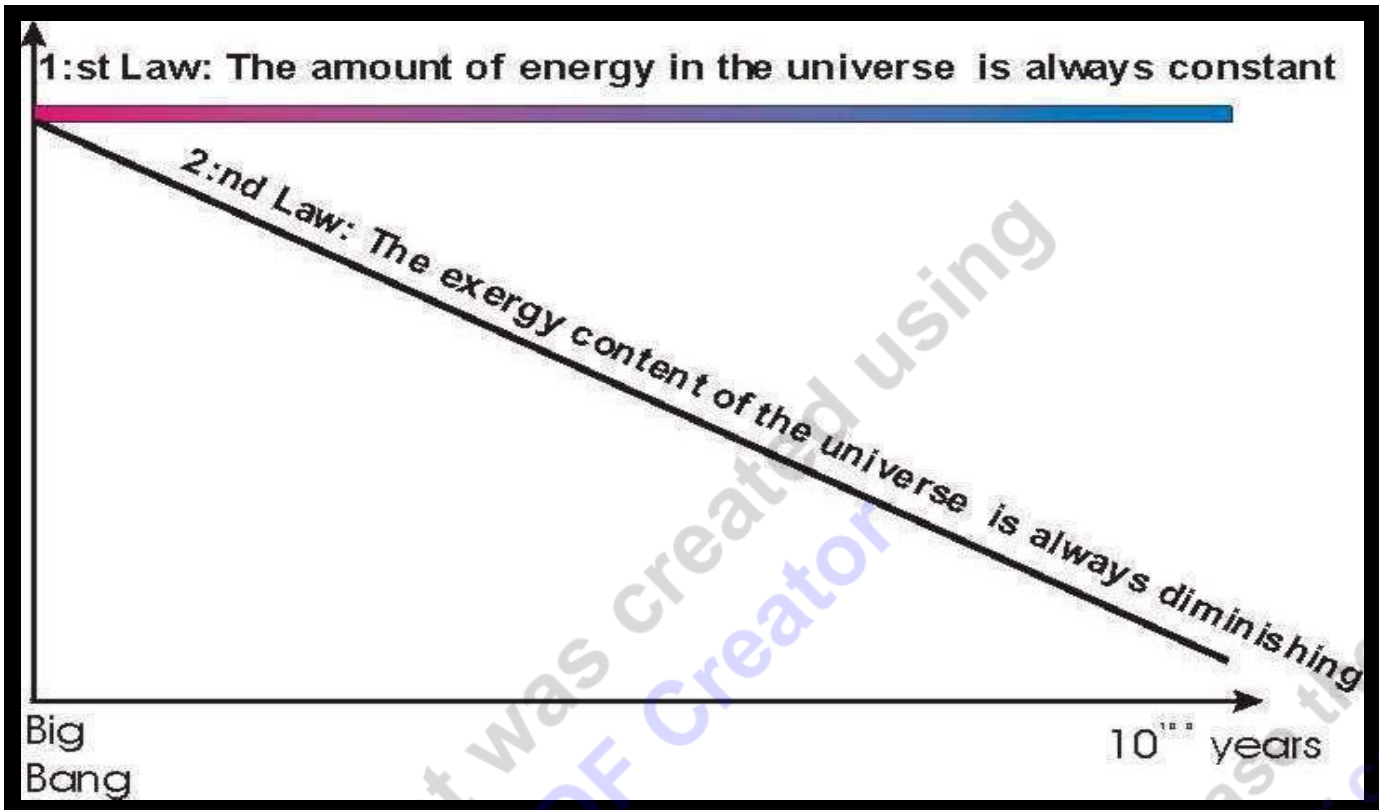


- 1st Law of Thermodynamics
 - Change in energy of a system is _____ to the heat added to the system _____ the work done.
 - You can't get something for nothing.

$$\Delta U = Q - W$$

Change in Energy = Heat Added - Work Done

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

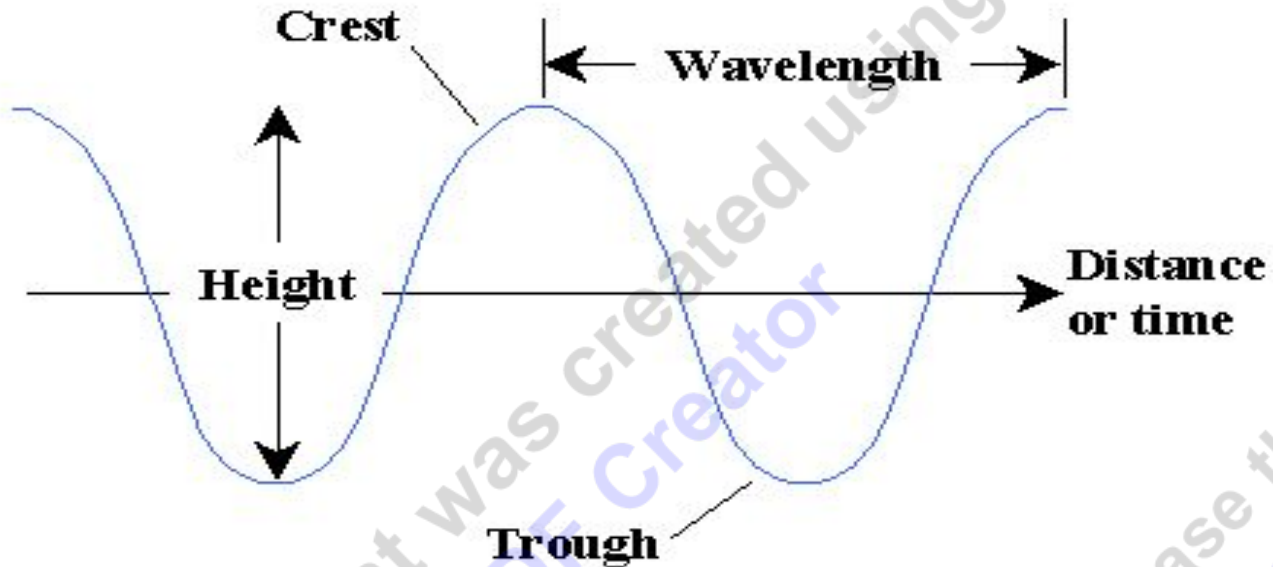


- The third law of thermodynamics: All molecular movement stops at absolute _____.
- Temperature: The degree of _____ or coldness of a body or environment.
- Corresponds to its _____ activity.

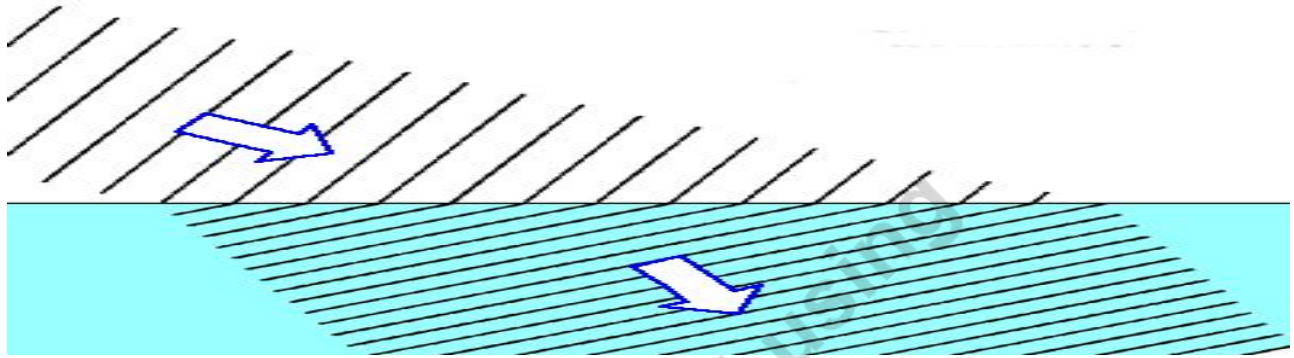
- Nuclear (Another form of Energy)

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

Area of Focus: Waves



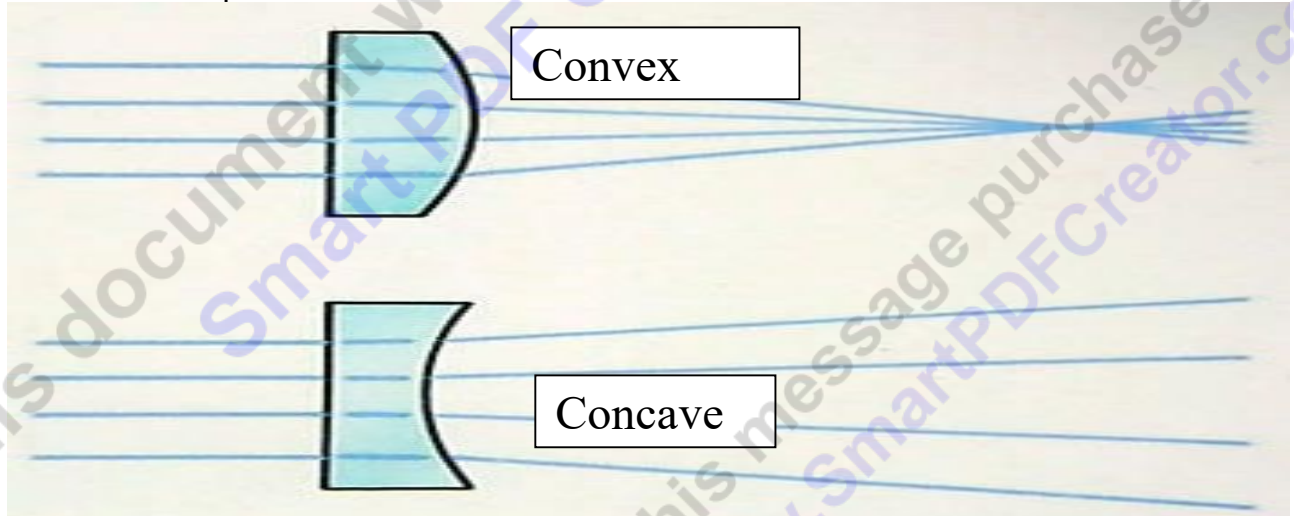
- **A wave:** In physics – A wave is the movement _____ and _____ or back and forth.
- The three types of waves:
 - Mechanical Wave: Moves through a _____.
 - Water, Solid, Gas,
 - Electromagnetic Waves: Do _____ require a medium to move through.
 - Matter Waves: El _____ and Particles.
- Light is a particle and a _____ and goes out in a straight line unless it bumps something.
- **Refraction:** The _____ of a wave when it enters a medium where it's speed is different.



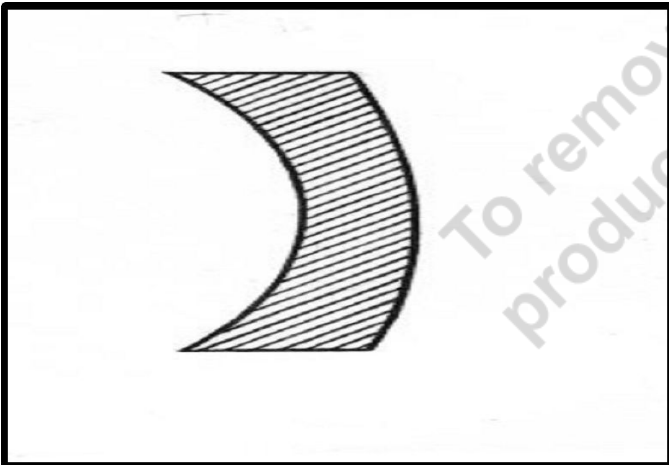
■ **Diffraction:** Bending of _____.

■ **Lens:** A transparent optical device used to _____ or diverge transmitted light and to form images.

■ Convex top / Concave bottom

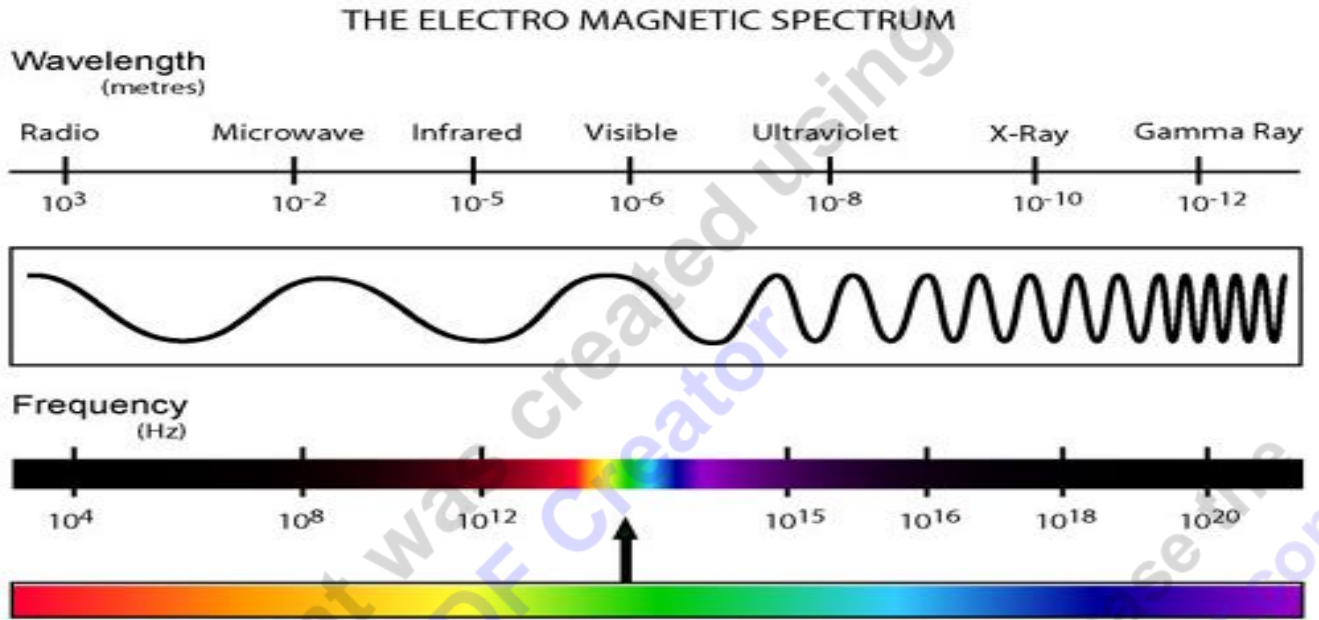


■ Concavo-convex

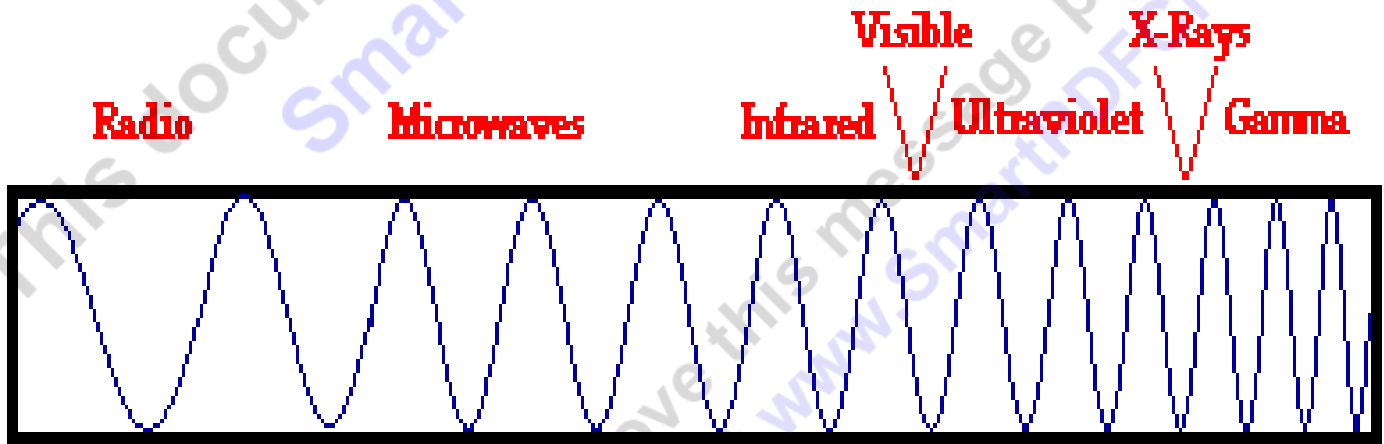


New Area of Focus: The electromagnetic spectrum

- **The Electromagnetic spectrum:** The entire frequency range of electromagnetic waves.



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



Long λ

Low f

Short λ

High f

- Waves of the electromagnetic spectrum travel at the speed of light. _____ miles per second or 300,000 kilometers per second in a _____.
- Visible light measured in _____.
- 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 object relates to the amount of _____ released.
- The hotter, the more radiation released.
- **Radiowaves:** _____ 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 _____ and visible light. (heat)
- Visible light consists of...

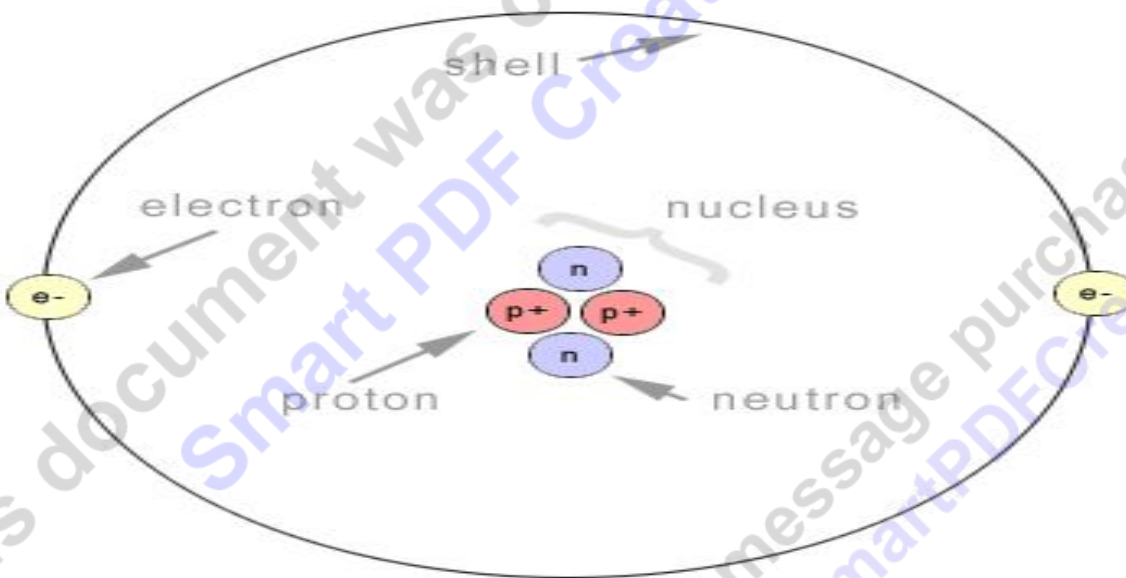


- **Ultraviolet (UV)** - Has _____ wavelengths than visible light. – thus it more powerful than visible light.
- **Ultraviolet (UV)** has many wave lengths as well. All of which can cause cancer.
 - UVA
 - UVB
 - UVC
- **X-Rays:** They have _____ wavelengths and therefore higher energy than ultraviolet waves.

- **Gamma ray:** Highest energy, _____ wavelength. Emitted during radioactive decay of a fission product.
- **Laser** - Light Amplification by S_____. Emission of R_____.
- Lasers cross over many parts of the EM scale.

Electricity: Electricity is related to charges, and both _____ and _____ carry a charge.

The Atom



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

Static Electricity: The _____ of positive and negative charges.

Magnetism

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

- replace electrostatic for funky.

Coulombs Law:

- The greater the _____, the greater the _____.
- The greater the _____ between them, the smaller the force.

Current is a flow of electrons, or individual _____ charges

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

Conductor: Electrons flow easily, semi flows in the middle.

Semi-conductor: Conductivity between _____ and insulator (electronics use)

Insulator: Electrons do not _____ easily

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

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

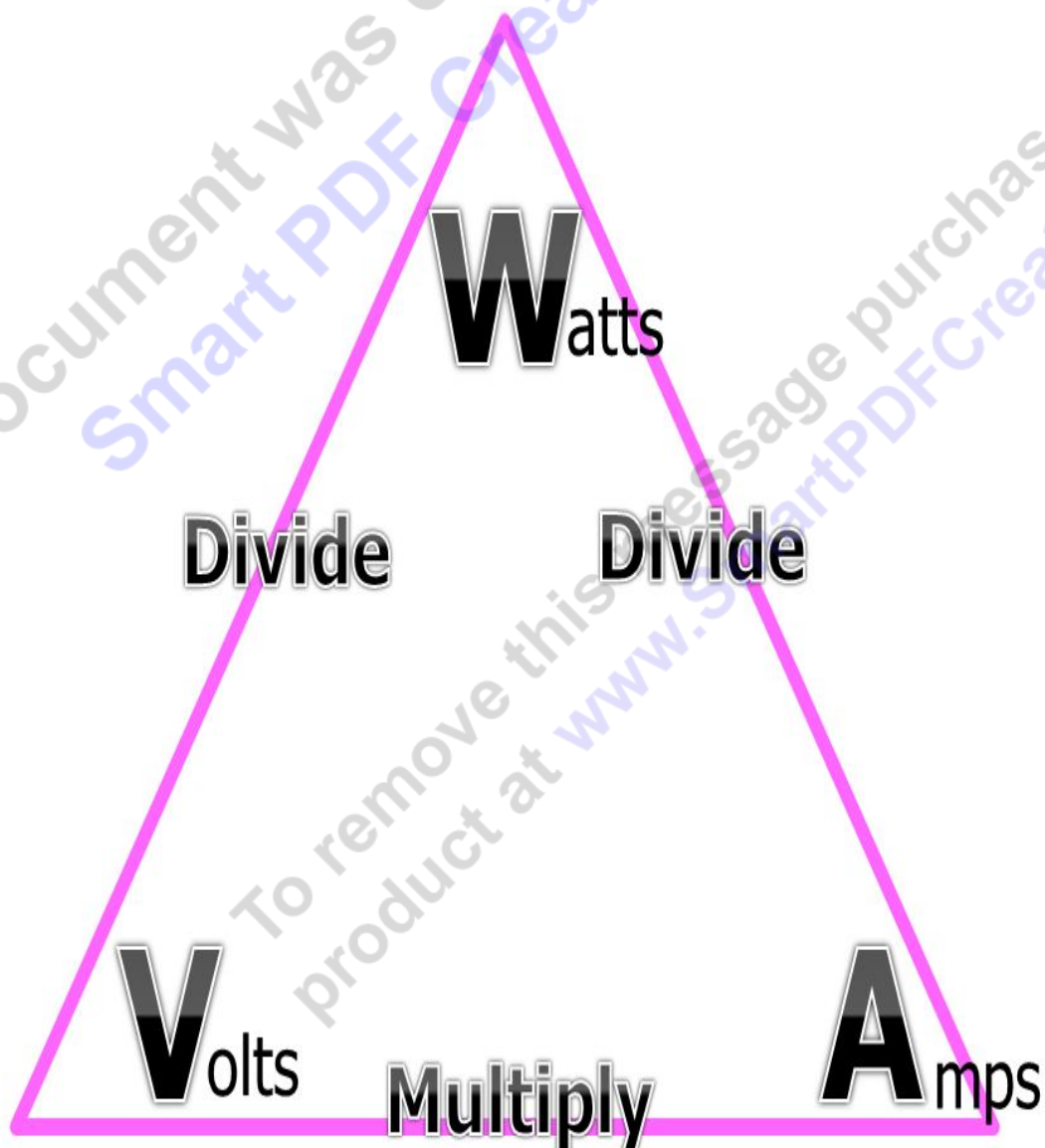
- Volts are a measure of the force or _____ under which electricity flows.
- Amps are a measurement of the _____ flow rate of electrons
- Watts is a measurement of electrical power created.
 - 1 watt is equal to one _____ of energy per second.

Volt: A measure of the _____ or pressure under which electricity flows.

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

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

Electrical Current Conversion Triad



Resistance: Anything in an electrical circuit that _____ the flow of current is referred to as resistance. (ohms) Ω

Ohms Law

$$I \text{ (amps)} = \frac{V}{R \Omega}$$

V = Volts, R = Resistance Ω , I = Current (amps)



Magnetism

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

Faraday's Law: The changing of a magnetic field can create _____.

Electromagnets: By running _____ current through a wire, you can create a magnetic field.

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

- New Area of Focus: Relativity, Einstein, and $E=MC^2$

General Relativity is a theory of the structure of _____.

- Time slows down with increased velocity.

Special Relativity:

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

$E=MC^2$

- 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 _____.

Energy

- The ability to _____
- To cause something to _____/change
- Energy is transferred but not _____
- Energy is _____ in quality due to friction/force/heat

First Law of Thermodynamics: Energy can be

_____ (changed from one form to another), but it can neither be created nor destroyed.

2nd Law of Thermodynamics: The energy content of the universe is always _____ in quality. Heat Flow ->

Warm to cold.

3rd Law of Thermodynamics: All molecular movement stops at absolute _____.

New Area of Focus: The Environment

Environmental Science / Studies

Environmental science is the study of _____ among physical, chemical, and biological components of the environment.

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

Ecocentrism: Believing the _____, rather than any individual organism, is the source and support of all life.

The 4 R's

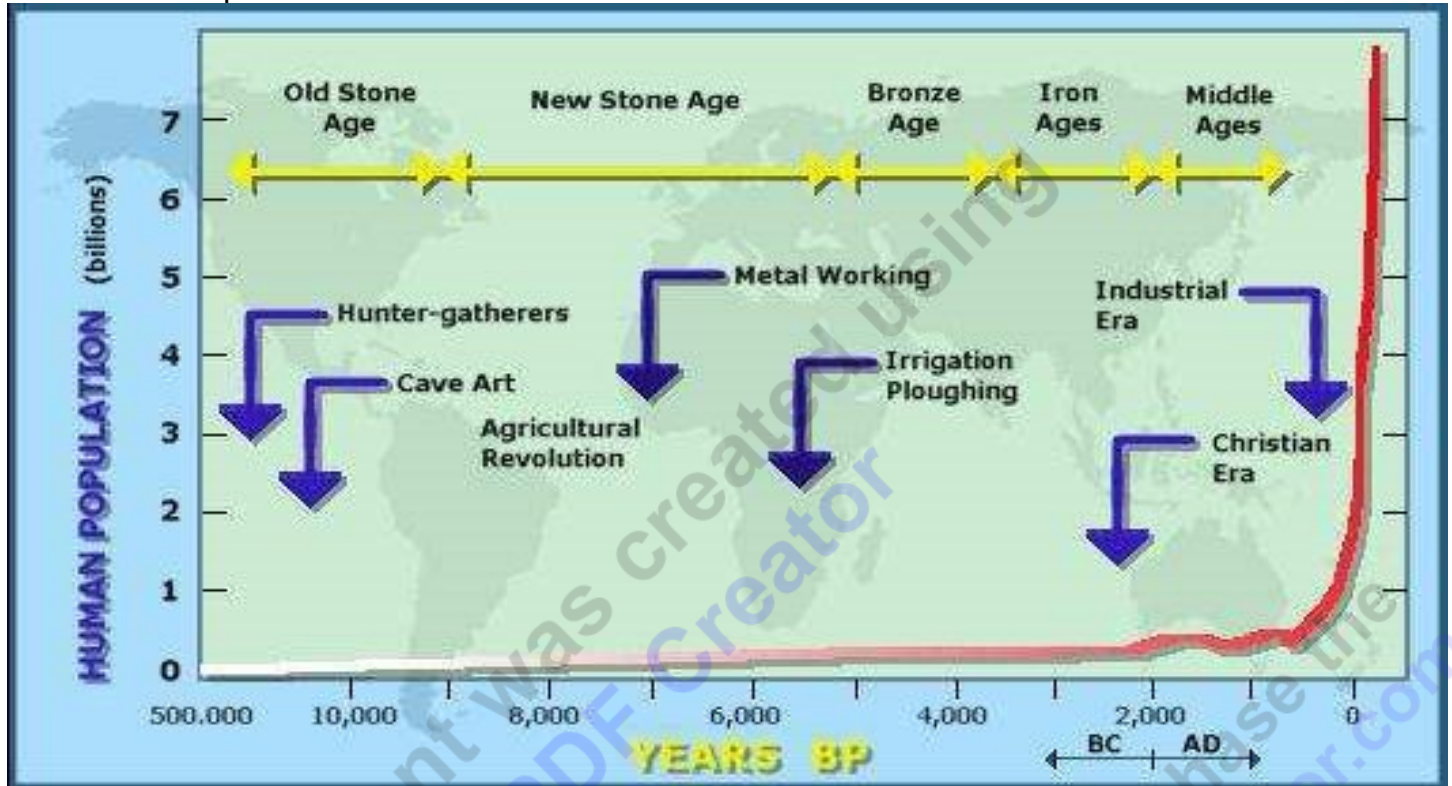
- Re _____
 - Our stuff becomes harmful waste
- Re _____
 - So we can reduce
- Re _____
- Last because it uses energy and TINSTAAFL
 - Rethink: Reinvent everything with the R's in mind.

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

- Strategies of frugality: reduce waste, curb expensive habits, be happy with less, don't be materialistic.*

Sustainability: Meeting the _____ of the present without compromising the ability of future generations to meet their own needs.

Human Population Growth



Anthropogenesis: _____ shaping their environment.

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

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

Megalopolis: A very large _____ complex usually involving several major cities and towns.

Forms of renewable energy

- Hydropower.
- Damless Hydropower.
- 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 be stored away forever.
 - Nuclear material is not an abundant resource.

ECOFRIENDLY CONSTRUCTION

With 32 "green" buildings, Seattle has become a leader in environmentally sensitive building and design. Green construction aims to reduce pollution and reduce dependence on power plants and logging.

▶ GREEN ROOFS:

A thin layer of plants and soil on rooftops provides insulation, reduces stormwater runoff, absorbs carbon dioxide and creates oxygen.

▶ WATER EFFICIENCY

Cisterns collect rainwater to use for landscaping irrigation. Low-flow, waterless or composting toilets help reduce water use.

▶ **VENTILATION:** Vents and operable windows assist in heating and cooling by circulating air better.

▶ **ALTERNATIVE ENERGY:** Roof-mounted wind turbines and solar panels reduce need for outside energy sources.



▶ WINDOWS

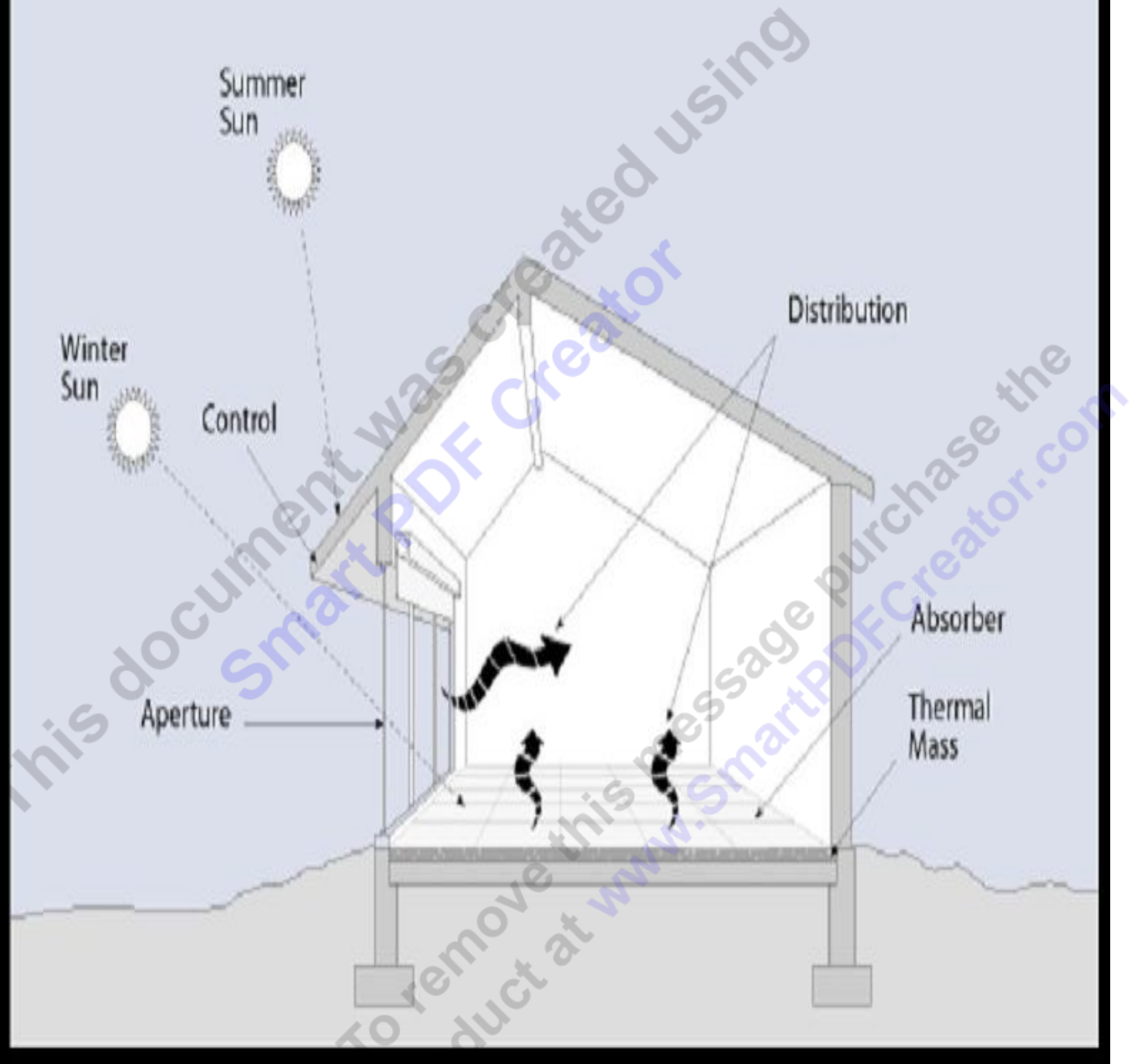
Windows and skylights provide natural lighting and heat. Glazed or double-paned windows provide insulation.

▶ **BUILDING MATERIALS:** Recycled building materials reduce waste. Building with certified lumber helps protect forests and using non-toxic paints and carpets creates a healthier interior space.

Source: P-I reporting

SEATTLE POST-INTELLIGENCER

Five Elements of Passive Solar Design



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