fact sheets included to help with materials in packet. A copy of the period table also included.

Physical Science Fact Sheet 1

P.S.2 - Matter

Matter is anything that has mass and occupies space. All matter is made of particles called **atoms.** Matter can be classified as **elements, compounds, or mixtures.**

- An **element** is a pure substance made of one type of atom that cannot be broken down further.
- A **compound** is a pure substance made of more than one type of atom chemically combined.
  - Organic compounds have carbon (C) and hydrogen (H).
  - Inorganic compounds generally do not (except CO_2 & CO).
  - Acids release hydrogen ions (H^+), have pH < 7, taste sour
  - Bases release hydroxide ions (OH^-), have pH > 7, taste bitter
  - Salts are formed when an acid and base react. Contain a metal and non-metal ion.
- A **mixture** is made of more than one substance physically combined and can be separated.
  - Homogenous look the same throughout
  - Heterogeneous have visibly different parts

Physical Properties can be observed or measured without changing the identity of the substance.

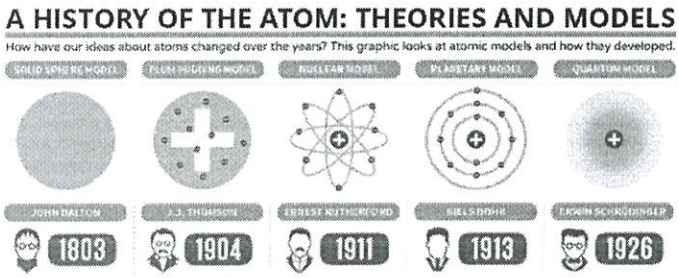
- **Examples**: Mass, Volume, Melting point, Boiling point, Luster (Shininess), Malleability (ability to bend), Conductivity (ability to transfer heat or electricity), Density, Solubility (ability to dissolve), and any other properties detected by your 5 senses.

Chemical Properties form a new substance when observed.

- **Examples:** Ability to burn (Combustibility/Flammability), Ability to rust or tarnish (Corrodibility), Ability to form salts or react with pH indicators (Acidity/Basicity), Ability to otherwise react (Reactivity)

PS.3 - Atomic Theory

Many scientists have contributed to understanding atomic structure.

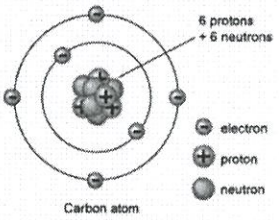


- **Dalton** – (**Solid Sphere Model**) All matter is made of atoms that cannot be created or destroyed. All atoms for an element are identical. Atoms are indivisible spheres.
- **Thomson** (**Plum Pudding Model**) – Atoms are positively-charged spheres with negative electrons embedded throughout.
- **Rutherford** (**Nuclear Model**) – Atoms have a dense positive core made of protons called the nucleus. The electrons are separate and far to the outside of the nucleus.
- **Chadwick** (**Nuclear Model**) – Discovered that the nucleus contains uncharged particles called neutrons.
- **Bohr** (**Planetary Model**) – An atom's electrons move around the nucleus in different orbits, closer or further away according to their energy.
- **Schrodinger** (**Electron Cloud/Quantum Model**) – An atom's electrons move in "clouds of probability" around the nucleus like a particle & wave, not neat orbits like Bohr's theory.

PS.3 - Atomic Theory (Continued)

Parts of an Atom:

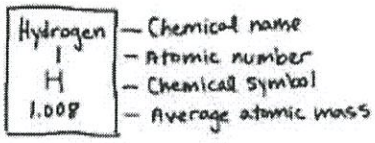
- **Protons**: positive charge, in nucleus
- **Neutrons**: no charge, in nucleus
- **Electrons**: negative charge, outside nucleus, equal to protons.
- **Quarks**: Tiny particles that make up protons & neutrons.



Ions: Formed when an atom gains or loses electrons. Can be positive (electrons lost) or negative (electrons gained).

Isotopes: Formed when an atom gains or loses neutrons. No change in charge results.

Mass number = atomic number + number of neutrons



PS.4 - Periodic Table

The Periodic table is an arrangement of the 118 known & predicted elements according to atomic number (# of protons).

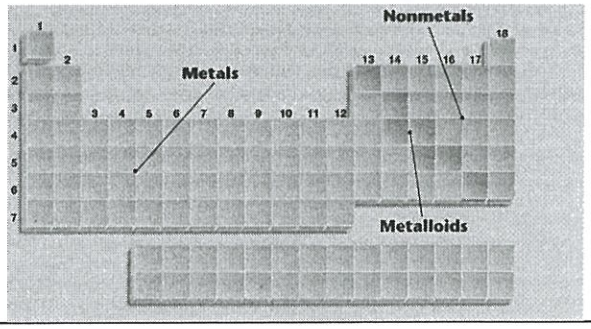
The 7 **Periods** are arranged in horizontal rows (side to side) and determine the number of electron shells an atom has.

- 1st: Up to 2 electrons
- 2nd: Up to 8 electrons
- 3rd: Up to 18 electrons

The 18 **Groups** or **Families** are are arranged vertically in columns (up and down) and determine the chemical reactivity of elements

- Elements in the **same group** or **family** have the **same** number of **valence**, (outer) electrons involved in bonds.
- For Groups 1&2, the number of valence electrons is the same as the group number. For Groups 13-18, it is the same as the one's place (Group 13 = 3 valence, etc.)

- **Metals:** are shiny (lustrous), malleable (bendable), conductive (can transfer heat/electricity), found to the left of the staircase on the table (except H). Alkali Metals (Group 1) are the most reactive.
- **Nonmetals**: are dull, brittle, rigid, poorly conductive elements found to the right of the staircase on the table (except Hydrogen). Halogens (Group 17) are the most reactive. Noble Gases (Group 18) are the least reactive of all the elements.
- **Metalloids:** share properties of both metals and nonmetals, and found between the two on the "staircase."



Physical Science Fact Sheet 2

P.S.5 - Changes in Matter

Physical Changes alter the appearance or state of a substance, but do not make a new substance.

- Examples: melting, boiling, breaking, dissolving

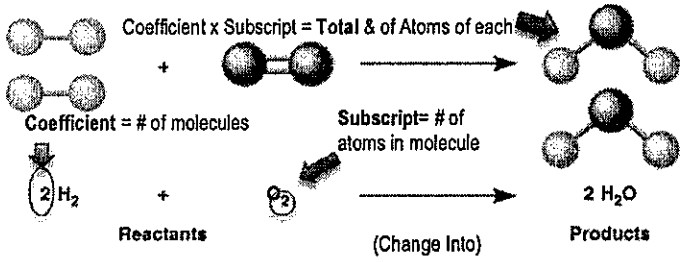
Chemical Changes rearrange atoms to produce new substances through chemical reactions.

- Examples: Burning, rusting, digesting, reacting
- Can be Endothermic (Take in heat), Exothermic (Give off heat)

Chemical Changes occur through **ionic or covalent bonding.**

- Ionic: transfer of electrons between metal & non-metal ion.
- Covalent: sharing of electrons between non-metal atoms.

Law of Conservation of Matter: Matter cannot be created or destroyed, just re-arranged. The Law of Conservation of Matter can be shown with a **balanced chemical equation:**

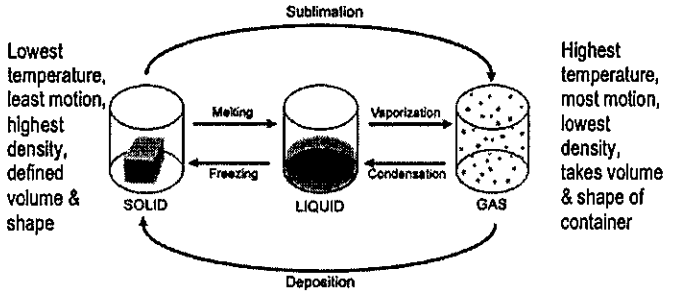


- **Nuclear Changes** alter the nucleus of an atom, changing its identity. Fusion combines nuclei (i.e. hydrogen nuclei combining to form helium in stars) Fission splits nuclei (i.e. uranium atoms in nuclear power plants are split in two to release energy).

PS.7 - Heat and Temperature

Atoms and **molecules** (particles) are perpetually (constantly) in motion.

- As thermal energy is added, the particles of a substance move faster (gain kinetic energy), spread further apart (decrease in density) and increase in temperature.
- There is NO change in temperature during a phase change. Energy is being used to break attractions between particles.



Temperature is the average kinetic energy of the particles of a substance. More thermal energy = more motion = higher temperature.

- Celsius Scale: Water Boils at 100°C, Freezes at 0°C
- Kelvin Scale: No negatives (add 273 to temperature in Celsius).
- Absolute Zero is the lowest possible temperature (0 Kelvin/-273°C) representing no particle motion.

Heat is the transfer of thermal energy from hotter to cooler areas.

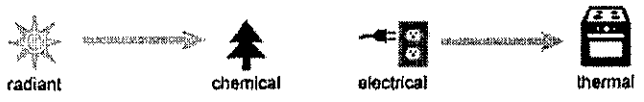
- Conduction: heat transfer through solid by direct contact (touch).
- Convection: heat transfer through liquid or gas by circulation.
- Radiation: Heat transfer through space by electromagnetic waves.

PS.6 - Energy

- **Energy** is the ability to do work or cause change.
- **Potential Energy** is stored energy.
  - Chemical – Energy stored in chemical bonds between atoms (in food, fuels, and living things).
  - Nuclear – Energy that holds together atomic nuclei. Pros: Efficient, no pollution, alternative to fossil fuels. Cons: dangerous radioactive waste must be safely stored.
  - Gravitational – Energy due to an object's height (ability to fall).
  - Mechanical (Elastic) – An object ready/able to move (e.g. stretched rubber band, compressed spring)
- **Kinetic Energy** is energy in use, or the energy of motion.
  - Mechanical – Energy of a moving object.
  - Electrical – Energy from moving electrons.
  - Light/Radiant – Energy from electromagnetic waves.
  - Thermal – Energy from moving atoms. (heat)
  - Sound – Energy from patterns of vibrating matter.

Law of Conservation of Energy: Energy cannot be created nor destroyed, only transformed from one form to another.

- Flashlight: chemical (battery) to electrical (wires) to radiant (bulb)
- Microwave: electrical (socket) to radiant (microwaves)
- Human: chemical (food) to mechanical (motion)
- **Friction:** contact between surfaces causes a loss of energy from an energy transformation from mechanical to thermal. (heat)



PS.10 - Force and Motion

Motion is a change in position compared with a reference point. Motion can be described in terms of speed, velocity, & acceleration.

- **Speed** is a change in distance per unit time (D ÷ T) measured in meters per second (m/s), kilometers per hour (km/h), etc.
- **Velocity** is speed in a given direction (North/South, East/West). May have a positive or negative value depending on direction.
- **Acceleration** is a change in velocity over time (final speed – initial speed ÷ time); measured in meters per second squared (m/s^2). Positive = speeding up. Negative = slowing down. Objects moving in a circle are constantly accelerating because their direction is changing. A distance-time graph for acceleration always curves.

A **Force** is any push or pull on an object, measured in Newtons (N). Forces change the motion of an object, according to **Newton's Laws:**

- 1st Law: Objects at rest stay at rest, objects in motion stay in motion, unless acted on by outside forces. Inertia is an object's resistance to a change in motion.
- 2nd Law: The greater the mass of an object, the greater the force needed to accelerate it.
- 3rd Law: For every action, there is an equal and opposite reaction.

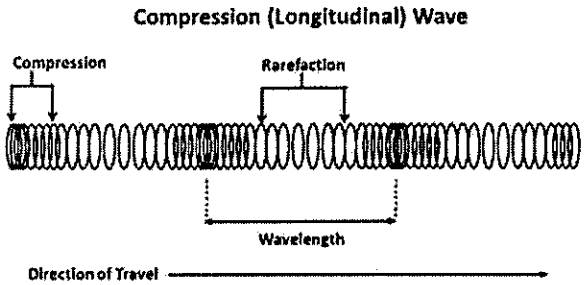
Work is the use of force to move an object some distance (F x D). It is measured in Joules (J). **Power** is the rate, or amount of work being done in a certain time (W ÷ T). Measured in Watts (W)

Simple Machines make work easier by changing the effort, distance, or direction of the applied force.

The six simple machines (Wedge, Pulley, Inclined Plane, Screw, Wheel & Axle, Lever) work together in **compound machines**. Due to friction, a machine's **efficiency** (% of work out ÷ work in) is always < 100%.

Physical Science Fact Sheet 3

PS.8 - Sound Waves



Sound is a type of mechanical energy produced by vibrations that travels in **compression waves** at a speed much slower than light.

- Sound needs a **medium** (material) in which to travel. Sound cannot travel in a vacuum (empty space).
- The **speed of sound** depends on the state of the medium (solid, liquid, or gas) and the temperature. Sound travels fastest through solid materials & at higher temperatures.
- **Pitch** is determined by frequency and describes how high or low a sound is. **Frequency** is the number of waves that pass per second, measured in Hertz (Hz). High frequency = high pitch. The Doppler Effect describes change in pitch when a sound passes an object.
- **Loudness** is determined by **amplitude** and is measured in decibels (dB). Amplitude depends on the energy with which a wave is compressed. Higher amplitude = louder sound.

Interference: occurs when waves combine/overlap.

- Constructive: produces bigger waves/louder sounds.
- Destructive: produces smaller waves/softer sounds.

- **Resonance** is a type of constructive interference that occurs when outside vibrations match an object's natural frequency. Examples include the Tacoma Narrows Bridge collapse, "singing" wine glasses (crystal stemware), & musical instruments

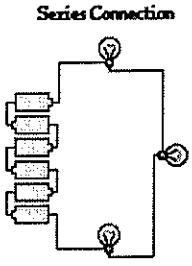
Ultrasonic technology: uses reflected sound waves you can't hear.

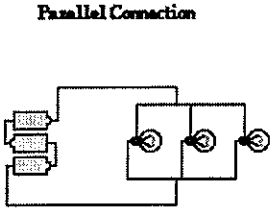
- SONAR is used to locate objects underwater (like echolocation)
- Ultrasound imaging is used to "see" inside the body (soft tissues)

PS.11 - Electricity & Magnetism

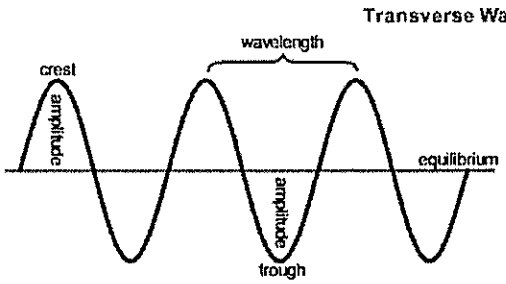
Electricity is caused by the movement of charged particles (electrons). Like charges repel, opposite charges attract.

- **Static Electricity**: the build up of electric charges by friction or other means. A release of static electricity is called a static discharge. (Ex: doorknob shock, lightning bolt)
- **Current Electricity**: the movement of electrons through a circuit.
  - Series Circuit: All devices connected in one path, sharing the same current. (Holiday Lights)
  - Parallel Circuit: All devices connected on their own path, each with its own full circuit. (Home circuits)
  - Alternating Current moves electrons back and forth
  - Direct Current moves electrons in one direction.





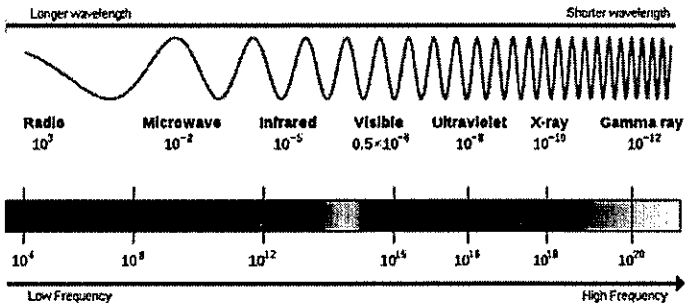
PS.9 - Light Waves



Visible light is a form of radiant energy that travels in transverse waves (electro-magnetic waves)

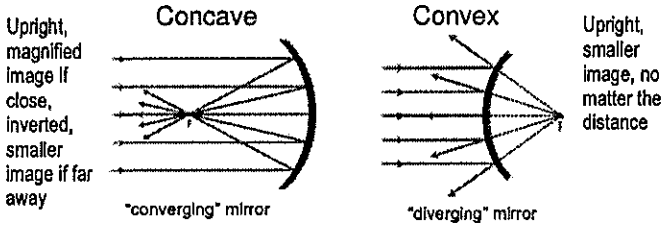
- Electromagnetic waves do not require a medium to travel through.
- Light moves fastest through empty space; then gas > liquid > solid

The **Electromagnetic Spectrum** organizes forms of radiant energy by wavelength. As wavelength decreases, frequency & energy increase. Visible light makes up only a small portion of the spectrum.

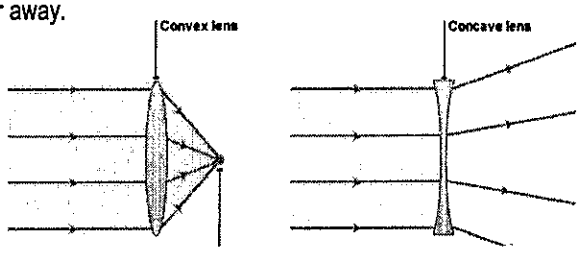


Electromagnetic waves travel in straight lines (rays) until they strike an object, at which point they **can be absorbed** (taken in), **reflected** (bounced back), or **transmitted** (pass through) by the surface.

- The color of an object is determined by the wavelength it reflects.
- Plane (flat), concave (curved in), & convex (curved out) mirrors all reflect light.



- **Refraction** is the bending of light as it changes speed while being transmitted through one medium into another. **Diffraction** is the bending of light around a corner or through an opening.
- **Lenses** refract light. Convex lenses converge light to produce a larger (magnified) upright image. Concave lenses diverge light to produce a smaller image when close and an inverted image when far away.



PS.11 - Electricity & Magnetism (Continued)

Several **factors** affect the **flow of electricity** through a system:

- **Current:** the rate (how fast) of flow of electric charges. (V/R)
- **Voltage** is the amount of energy behind a moving charge.
- **Resistance** is the opposition to the flow of moving charges.
  - **Conductors** (Metals: copper, silver, etc.) are materials that have low resistance & allow electricity through easily.
  - **Insulators** (Non-metals: wood, plastic, rubber, etc.) have high resistance & do not allow electricity through easily.
  - **Semi-conductors** (Metalloids: silicon, germanium, etc.) behave as a conductor and insulator.

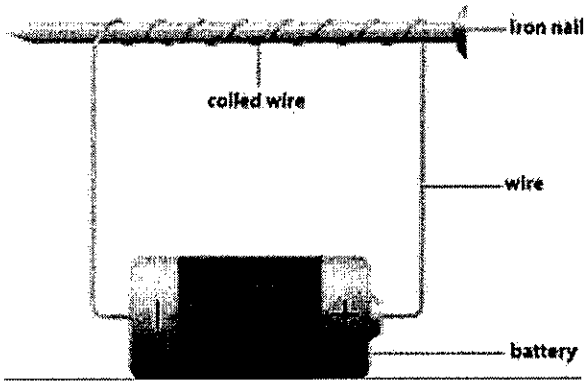
Semiconductor devices are used to control electrical circuits.

- Diodes produce direct current when exposed to light (solar cells)
- Transistors amplify or switch electrical signals (computer chips)
- LEDs (light emitting diodes) produce infrared or visible radiation when a current passes through them (computer screens, transmitters in TV remotes)

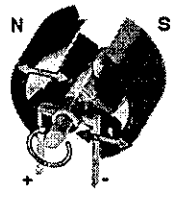
Electricity is related to **magnetism**. Magnetic fields can produce electrical current in conductors. An electric current can produce a magnetic field, causing iron & steel to become magnetic.

Electromagnets are temporary magnets controlled by an electric current. An electromagnet consists of a metal core wrapped with a current-carrying wire (solenoid) to create a magnetic field.

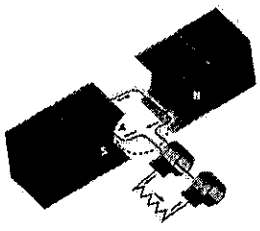
Simple Electromagnet



- You can **increase the strength** of an electromagnet by increasing the strength of the power source (battery), increasing the number of coils of wire, or using a more magnetic material for the core (iron, nickel or cobalt).
- Both a **motor** and a **generator** use electromagnets.
  - Motor: converts electrical energy to **mechanical** energy ("motors make mechanical").
  - Generator: converts mechanical energy to electrical energy ("generating electricity").



MOTOR



GENERATOR

PS.1 - Scientific Investigation Fact Sheet

Controlled Experiments

Variable: Anything that varies in an experiment.
Independent Variable: What is being tested or changed.
Dependent Variable: The results from changing the I.V.
Constant: Anything that stays the same in the experiment.
Control: Standard situation without I.V. (for comparison).
Trial: A repeated measurement in your experiment.
Replication: A repetition of your experiment, often by another scientist.
Validity: how well a scientific experiment measures what it sets out to, or how well it represents reality.

* The more **trials** you test & the better you **control** variables, the more **valid** your results will be.*

Example: *"A student wants to test how different colors of light affect the growth of a plant. She plans to grow the plants in red, blue, green, and white light."*

- **Independent Variable**: The color of light
- **Dependent Variable**: Plant growth
- **Constants**: Type of plant, amount of light, amount of water, soil, etc.
- **Experimental Groups**: plants w/colored light.
- **Control Group**: Plants with white light.

Data and Statistics

Mean: Add all values and divide by the number of values.
Median: The middle value. (if numbers are in order)
Mode: The value that occurs most often.
Range: The spread of data. (Greatest – Least)

Example: A data set includes the values: 2, 5, 9, 3, 5, 4, 7
1) Put the data in numerical order: 2, 3, 4, 5, 5, 7, 9
2) Calculate Mean: (2+3+4+5+5+7+9) ÷ 7 = 5
3) Find the Median: 5 is in the middle, so the median is 5
4) Find the Mode: There are two 5's, so the mode is 5
5) Calculate Range: 9 – 2 = 7

Example Data Table: Effect of Light on Plant Growth

Light per Day	Growth per Week			Average Growth
	Trial 1	Trial 2	Trial 3	
2 hours	1.9 cm	1.9 cm	2.0 cm	1.9 cm
5 hours	2.4 cm	2.5 cm	2.6 cm	2.5 cm
8 hours	7.1 cm	6.9 cm	6.0 cm	7.0 cm

Scientific Notation

Used to express very large and very small numbers.

A **positive exponent** means a number greater than one.
Example: 3.0×10^8 m/s is the speed of light (300,000,000 m/s)

A **negative exponent** means a number less than one.
Example: 8.0×10^{-6} m is the width of a blood cell (0.000008 m)

Scientific to Standard Notation:
1) Move the decimal to according to the exponent.
2) Fill any empty spaces with zeros.

Example: 7.5×10^{-3} becomes 0.0075

Standard to Scientific Notation:
1) Move the decimal until there is 1-9 in the ones place.
2) Drop any outside zeros.

Example: 35,000 becomes 3.5×10^4

Metric Prefixes

King	Henry	Died	By	Drinking	Chunky	Milk
Kilo-	Hecto-	Deca-	Base Unit	Deci-	Centi-	Milli-
1000	100	10	1	0.1	0.01	0.001

Biggest ----------→ Smallest

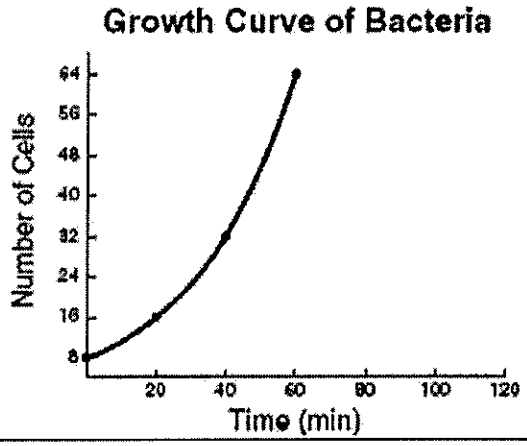
Metric Conversion
1) Start with the unit given.
2) Count the # of decimal places to the unit you want.
3) Move the decimal that number of places and in the same direction, filling empty spaces with zeros.
OR If you are converting to a larger unit, divide by the prefix, and if you are converting to a smaller unit, multiply by the prefix.

Example: *Convert 1.25 km to _____ m*
1) Count to the right from kilo- to the base unit (meter).
2) Move the decimal 3 places to the right and fill in with zeros to get *1,250 m*
OR 1.25 x 1000 = 1,250 m

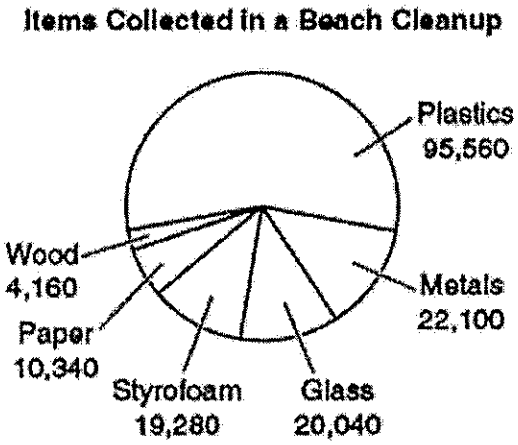
PS.1 - Scientific Investigation Fact Sheet

Types of Graphs

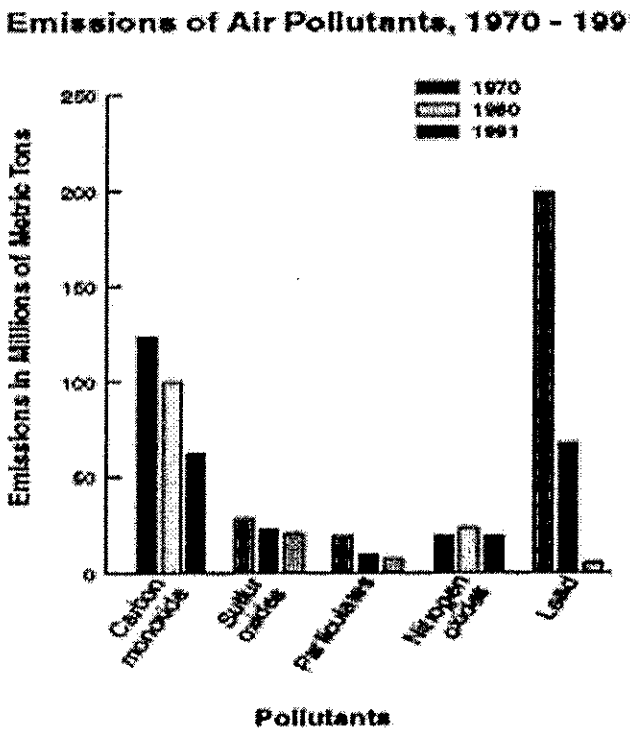
A **line graph** shows how one type of data **changes continuously**; for example how a bacteria grows over time



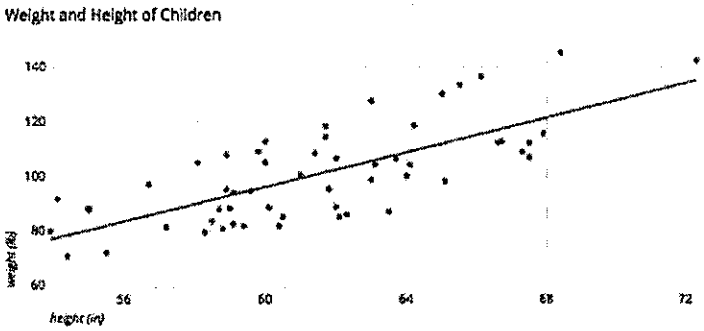
A **circle chart** or **pie graph** shows **parts of a whole**; or percentages.



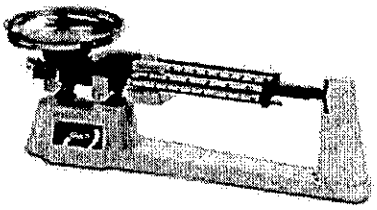
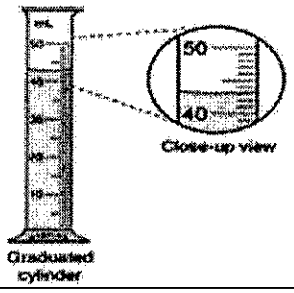
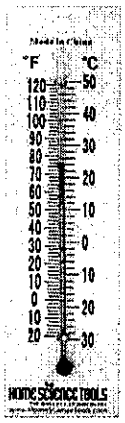
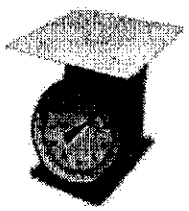
A **bar graph** compares different **categories** of data; usually showing amounts. A **Histogram** is similar, but compares amounts within a **range**, and the bars are touching.



A **scatter plot** is a graph in which two sets of data are plotted in pairs to show a **trend** or pattern of correlation.



PS.1 - Scientific Investigation Fact Sheet

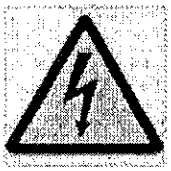
Basic Metric Units & Measurement Tools		
When I measure...	**I will use the base unit...**	**And make my measurement with a...**
Mass	Grams (g)	Balance 
Liquid Volume	Liters (L)	Graduated Cylinder 
Temperature	Degrees Celsius (°C) or Kelvin (K)	Thermometer or Temperature Probe 
Length	Meters (m)	Metric Ruler 
Force or Weight	Newtons (N)	Scale  

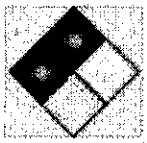
PS.1 - Scientific Investigation Fact Sheet

Derived Metric Units & Formulas

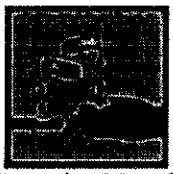
When I calculate...	I will use the formula...	And the units...
Solid Volume	Length x Width x Height	Cubic centimeter (cm^3)
Density	Mass ÷ Volume	Grams per milliliter (g/mL) or grams per cubic centimeter (g/cm^3)
Speed	Distance ÷ Time	Meters per second (m/s)
Work	Force x Distance	Joules (J)
Power	Work ÷ Time	Watts (W)

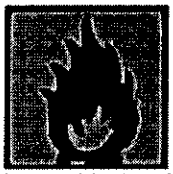
Laboratory Safety Symbols


Electrical Hazard


Chemistry Hazard Label


No Open Flames

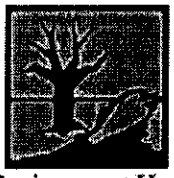

Corrosive Materials

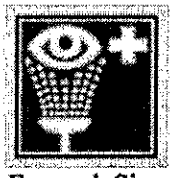

Flammable Symbol

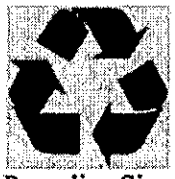

Fire Extinguisher


Toxic Chemical

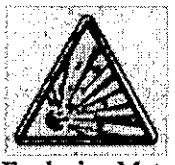

Non-potable water

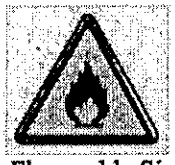

Environment Hazard

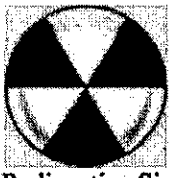

Eyewash Sign

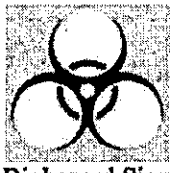

Recycling Sign


Toxic Materials Sign


Explosive Materials Sign


Flammable Sign


Radioactive Sign


Biohazard Sign

General Safety Rules:

1. Read & follow all directions; ask questions if there is anything you don't understand.
2. Do not perform experiments or handle equipment without permission/instructions
3. Be careful not to spill or break anything. If you do, alert your teacher immediately.
4. Keep your area clean & dispose of all waste materials according to your teacher's instructions.
5. Do not eat or bring food/drink into the laboratory. Wash hands after each experiment.
6. Use equipment as instructed and remain at your seat. Absolutely no horseplay!
7. Follow all safety instructions; keep gloves & goggles on until told to remove them.
8. Use inside voices and polite language with your lab group.

Life Science Fact Sheet 1

L.S. 2&3: Cell Theory & Organization

Development of Cell Theory:

- Robert Hooke: coined the term "cell" when viewing slices of cork with a microscope, recently invented by Zacharias Janssen.
- Anton van Leeuwenhoek: first to observe living cells.
- Matthias Schleiden, Theodore Schwan, & Rudolf Virchow researched & summarized the statements of cell theory (below).

Cell Theory:

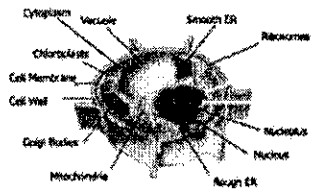
- All living things are composed of cells.
- Living cells come only from other living cells
- Cells are the smallest unit that can perform all of the processes of life: digestion, waste removal, environmental response, growth/repair, gas exchange, & reproduction

Cell Organelles:

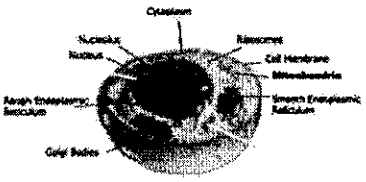
- Cell membrane: allows materials in or out of the cell.
  - The cell membrane is selectively permeable.
  - Osmosis is the passive transport of water across the membrane; diffusion is the passive transport of other material.
- Cytoplasm: jelly-like substance that holds all of the organelles.
- Nucleus: contains DNA and is the control center of the cell.
- Cell Wall: rigid protective structure around plant cells.
- Vacuole: stores food, water, and waste in the cell.
- Mitochondria: provides cells with energy from respiration.
- Endoplasmic Reticulum: transports materials in the cell.
- Ribosomes: assemble proteins for the cell.
- Golgi Bodies: package proteins for transport through the ER.
- Chloroplast: conducts photosynthesis to make food in plant cells.

Plant Cells: large vacuole, cell wall, chloroplast, rectangular shape.
Animal Cells: small vacuoles, round shape, no cell wall or chloroplast.

Plant Cell



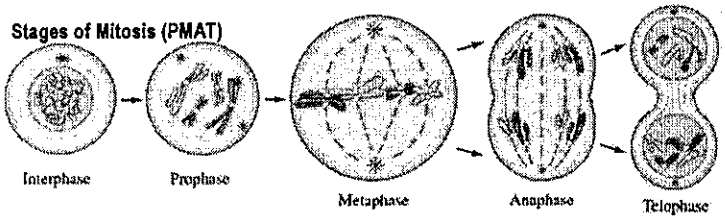
Animal Cell



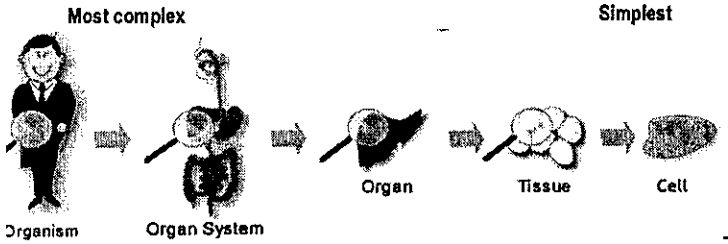
Cell Cycle: cells grow and make copies of DNA before cell division.

- Mitosis: produces two identical cells for growth and repair
- Meiosis: produces four sex cells with half the genetic material.

Stages of Mitosis (PMAT)



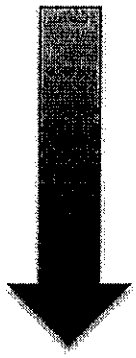
Cellular Organization: The structures of life are organized accordingly:



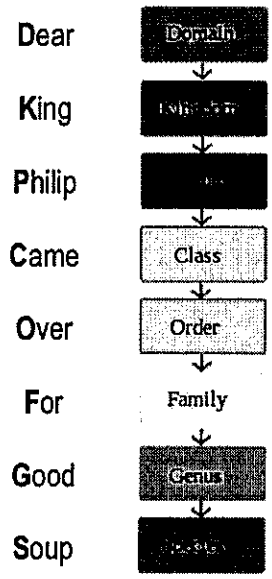
L.S. 4: Classification of Life

- Scientists **classify** living things according to similar **characteristics.**
- How scientists classifying living things changes as we learn more.
- **Carl Linnaeus** introduced the **taxonomic divisions** we use today:

Broadest Category
Most Living Things
Least in Common



Most Specific Category



3 Domains: Eukarya (Plants, Fungi, Protists, Animals), **Eubacteria** (Bacteria), **Archaea** (ancient bacteria that live in extreme environments)
6 Kingdoms: (Based on presence/absence of cellular structures, whether organisms is single or multi-cellular, & how it reproduces & gets food)

- **Archaea:** prokaryotic, unicellular, can be autotrophs or heterotrophs, have a lipid cell wall, reproduce asexually.
- **Bacteria:** prokaryotic, unicellular, can be autotrophs or heterotrophs, have a peptidoglycan cell wall, reproduce asexually.
- **Protista:** Eukaryotic & mostly unicellular, can have a pectin cell wall or no cell wall, can be autotrophs or heterotrophs, reproduce asexually.
- **Fungi:** eukaryotic, mostly multicellular, have chitin cell walls, are heterotrophs, can reproduce sexually or asexually.
- **Plants:** Eukaryotic, multicellular, autotrophs, have a cellulose cell wall, can reproduce sexually or asexually
- **Animals:** Eukaryotic, multicellular, have no cell wall, reproduce sexually.

Prokaryotic = have NO cell nucleus, **Eukaryotic** = have a cell nucleus, **Autotrophs** make their own food, **Heterotrophs** eat/absorb food from environment, **Unicellular** = made up of 1 cell, **Multicellular** = made up of many cells, **Sexual** = reproduce through meiosis, **Asexual** = reproduce through mitosis (binary fission).

Major Animal Phyla: cnidarians (jellyfish), **mollusks** (clams/snails/slugs), **annelids** (worms), **arthropods** (insects, shellfish), **echinoderms** (starfish), **chordates** (fish w/backbones, mammals, birds, reptiles, amphibians).

Major Plant Phyla: Mosses (non-vascular ground covering plants), **Ferns** (leafy, low-growing plants that bear spores), **Gymnosperms** (Cone-bearing plants, like pine trees), **Angiosperms** (Flowering plants/trees).

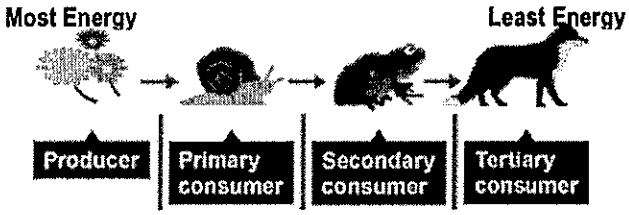
A **species** is a single type of organism that can reproduce among members of its own species.

- **Binomial Nomenclature:** two-part system of naming species using the **Genus** and **species** name. Example: Homo sapiens (humans)

Life Science Fact Sheet 2

L.S. 5&6: Life Cycles

- Energy is a basic need of all living things.
- Energy enters an ecosystem through the process of photosynthesis and is passed through the system as organisms eat one another.
- Producers, like plants, make their own food by photosynthesis. Producers make up the base of all food webs.
- The **amount of energy available** in each successive tropic level (producer, first-order consumer, second-order consumer, third-order consumer) **decreases.**



Photosynthesis is the necessary life process that transforms light energy into chemical energy (food).

- Plant's leaves are the main sites of photosynthesis in a plant.
- Chloroplasts inside plant cells use the green pigment, chlorophyll, to trap light energy for photosynthesis.

Photosynthesis Equation:

$$\underset{\text{Carbon dioxide}}{6CO_2} + \underset{\text{Water}}{6H_2O} \xrightarrow{\text{Light}} \underset{\text{Sugar}}{C_6H_{12}O_6} + \underset{\text{Oxygen}}{6O_2}$$

Reactants (starting materials) Products (ending materials)

Cellular Respiration is the process that releases the chemical energy stored in food to a usable form in the body.

- All living things, including plants, do respiration to release energy.
- Mitochondria inside cells are responsible for respiration.

Respiration Equation:

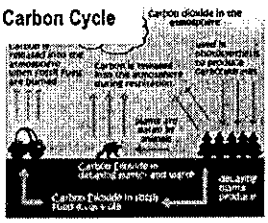
$$C_6H_{12}O_6 + 6O_2 \Rightarrow 6CO_2 + 6H_2O + ATP$$

Glucose Oxygen Carbon Dioxide Water Energy

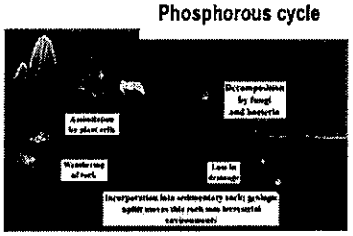
Reactants (starting materials) Products (ending materials)

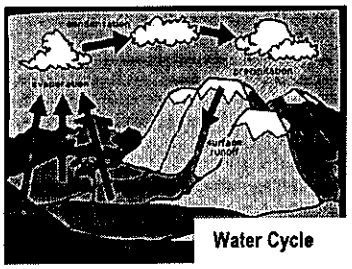
Nutrient Cycles: Many important elements & compounds cycle through the environment as a repetitive chain of events.

Carbon Cycle



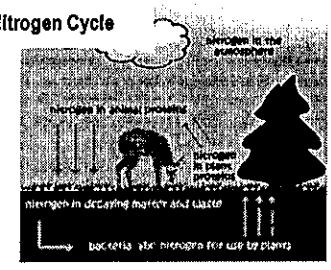
Phosphorous cycle





Water Cycle

Nitrogen Cycle



L.S. 7&8: Populations and Communities

Population: all members of the same species in an area.

- Competition for resources, mates, and territories.
- Cooperation with other members of a species to help meet each individual's basic needs.
- Social Hierarchy is established in some animals to ensure that all labor and resources are shared.
- Territories are established to make sure members of a population have an adequate habitat to provide basic resources.

Community: all the living things in an ecosystem.

- Niche: the role a living thing plays in the ecosystem.
- Producers: make their own food by photosynthesis.
- Consumers: obtain their food from other living things.
- Decomposers: break down dead organisms for energy.
- Symbiosis: a relationship between two different species.

Interaction	Species A	Species B
Commensalism	Receives benefit	Not affected
Mutualism	Receives benefit	Receives benefit
Parasitism	Receives benefit	Harmed

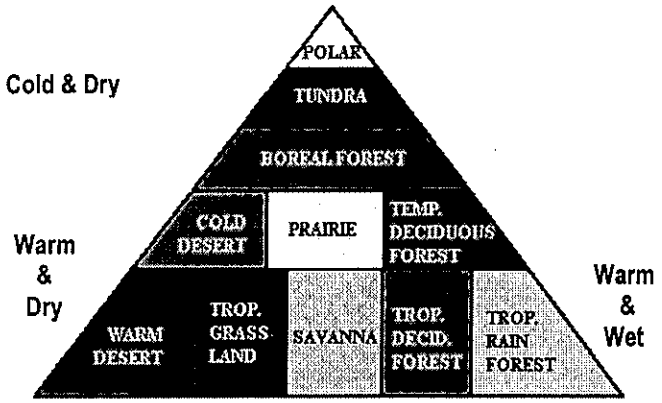
L.S. 10&11: Ecosystem Dynamics

- **Natural** and **man-made change** to ecosystems can affect individual organisms, populations, and communities over time.
- **Changes** that affect individual organisms can be **daily, seasonal, or long-term.**
  - Tropism: Plants respond to light (phototropism) or gravity (gravitropism) by growing toward or away from it.
  - Hibernation: animals respond to cold conditions with a period of lowered metabolism.
  - Dormancy: plants or animals may respond to adverse conditions (severe cold, wet, or drought) with a period of suspended metabolism.
- A variety of **environmental factors** may cause the **size of a population** to increase or decrease (weather/climate conditions, natural disasters, availability of resources).
- **Long-term changes** to the ecosystem may affect entire **communities.**
  - Eutrophication: addition of excess nutrients (nitrogen) to the ecosystem, causing over-growth of plants/ algae.
  - Global Climate Change: introduction of greenhouse gases warming the atmosphere and changing the climate within a biome, causing organisms to migrate or die.
  - Catastrophic events: major flooding, wildfires, earthquakes, etc. reduce the population of all organisms.
- **Human interaction** can directly **alter habitat** size, quality of available resources, and structure of habitat components. Such interactions can be positive or negative.
  - Positive examples: re-planting/re-populating vegetation & wildlife, restoring/reclaiming previously damaged ecosystems (mine sites, industrial waste sites).
  - Negative examples: clearing habitat for housing, industry, or agriculture; burning fossil fuels to produce greenhouse gases, over-hunting/fishing/harvesting, fertilizer run-off causing eutrophication.

Life Science Fact Sheet 3

L.S. 9: Ecosystems and Biomes

- **Ecosystems** are the living organisms and the physical environment within a specific area.
- **Biotic factors:** living parts of the ecosystem. (Animals, plants).
- **Abiotic factors:** nonliving parts of the ecosystem. (Soil, Water)
- **Biomes** are ecosystems with similar climate conditions.
  - **Marine Biomes**: Oceans, Coral Reefs, Estuaries.
  - **Freshwater Biomes**: Lakes, Rivers, Ponds, Wetlands.
  - **Terrestrial (land) Biomes**: Polar, Tundra, Boreal Forest, Desert, Prairie, Grassland, Temperate Forest, Rain Forest



Adaptations are specific structures, functions, & behaviors that help organisms survive in the biome in which they live.

- **Cold Adaptations**: thick fur, white color, small/stocky body.
- **Hot/Dry Adaptations**: thin body, thin fur; plants store water.
- **Tropical Adaptations**: Tall trees to reach light, leaves shed water, animals can climb trees.

L.S. 13: Evolution

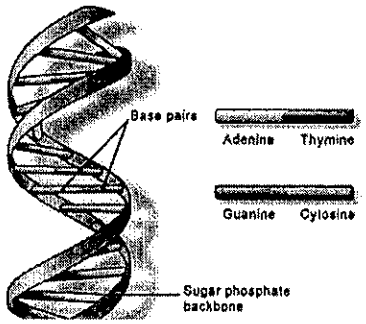
- **Charles Darwin**: First proposed theory of evolution with his book "On the Origin of Species" based on his research of finches & other organisms on the Galapagos Islands.
- **Evolution** is the changing/addition of species over time due to mutations, adaptations, and natural selection.
- **Mutations** are random, inheritable changes to DNA. Usually mutations are bad (cause disease/illness), but some are helpful for survival and are considered **adaptations**.
- **Natural Selection** is the survival and reproduction of individuals of a species that have traits (adaptations) that best enable them to survive in their environment.
- **Species** who lack the traits to help them survive new environmental conditions may become **extinct**.

Evidence of Evolution:

- **Fossil Record:** showing physical change in species over time
- **Radiometric Dating:** using radioactive carbon isotopes to figure out the age of fossils & place them on an evolutionary "timeline"
- **Genetic Information:** similarities in different species' DNA
- **Embryology:** similarities in different species' early development
- **Homologous Structures**: different species w/similar physical appearance (limbs, beaks, organs)
- **Vestigial Structures**: physical structures that are no longer used by a particular species (e.g. human tailbone, wings of flightless birds, pelvic spurs in snakes, "horse chestnuts")

L.S. 12: Genetics

- **DNA** is a molecule that stores the all the information about an organism in a chemical code.
- **Franklin, Watson**, and **Crick** discovered DNA structure.



- **DNA Structure:** Two Strands, Double Helix Shape
- **3 Parts of DNA:** Sugar, Phosphate & Nitrogenous Bases
- **Base Pairing:**
  - A pairs with T
  - G pairs with C

The way the bases are paired determines your unique "genetic code"

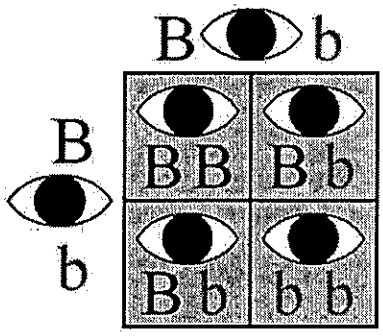
- **Chromosomes** are strands of tightly wound DNA. (23 in humans)
- **Genes** are sections of chromosomes that code for a single trait (characteristic).
  - **Heritable Traits**: Traits that are expressed by genes and can be passed on from parent to offspring (inherited).
  - **Acquired Traits**: Traits that you gain/learn through life experience and cannot be passed on from parent to offspring.

Gregor Mendel (Father of Genetics) is an Austrian monk that studied how pea plants pass traits from parents to offspring.

- **Alleles**: different forms of a gene that cause variation in traits.
- **Dominant Trait**: Traits that always show up in offspring, so long as they have inherited at least one copy of the allele.
- **Recessive Trait:** Traits that are covered up by dominant traits and are only expressed if an organism inherits two copies of the recessive allele.
- **Genotype**: the genetic make-up of an organism, or the actual alleles they have inherited
- **Phenotype:** the physical expression of genes, or the traits that are outwardly visible.

Punnett Squares are used to predict the possible combinations of inherited traits. A capitol letter stands for the dominant allele. A lower case letter stands for the recessive allele The crosses represent the **percentage chance** the offspring will inherit/display are particular trait.

Example:
B = brown eyes (dominant)
b = blue eyes (recessive)
For two Bb/brown eyed parents, the possible offspring are BB/brown (25%), Bb/brown (50%), and bb/blue (25%).



Genetic engineering is the changing of an organism's genetic code in order to produce a desired product. Some practical applications include:

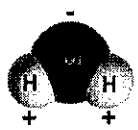
- Medicine: production of insulin, hormones, antibodies, & vaccines
- Agriculture: pesticide/insecticide resistant crops, pest resistance
- Industry: biofuel production, production of enzymes to produce chemicals (glucose, ammonia), bacteria to break down waste.

6th Grade Science Fact Sheet

SOL 6.2: Energy Sources

- There are two main forms of energy. **Potential Energy** is not in use. **Kinetic Energy** is in use, usually in the form of motion.
  - Moving wind & water have kinetic energy
  - Fossil fuels contain chemical potential energy, which is released when they are burned.
- **Energy Resources** are sources of potential or kinetic energy in our environment. They can be renewable or nonrenewable.
- **Nonrenewable Energy Resources** take a very long time to form and cannot easily be replenished.
- **Examples:** Fossil fuels (coal, petroleum, and natural gas) and nuclear power.
  - Fossil fuels are made up of stored solar energy from the ancient remains of dead animals and plants.
  - Fossil fuels contain large amounts of carbon and hydrogen.
- **Renewable Energy Resources** can be replenished over relatively short periods of time.
- **Examples:** Solar (Sun), Wind (Spins turbines), Hydropower (Falling water to turn turbines in a dam), Tidal power (In and out motion of the tides), Biofuels (Wood, Corn Ethanol, Manure, Garbage), Geothermal (Earth's Heat)
- **Secondary Resources:** Electricity, Gasoline, and Hydrogen are used to store, move, and deliver energy in a usable form.
- **Modern society** is dependent on fossil fuels for energy, but we are increasing our use of renewable resources as they run out.

SOL 6.5: Properties of Water



- The unique properties of water allow Earth to sustain life.
- Water molecules are polar, meaning they have a slightly negative and slightly positive side.
- Because water is polar...
  - Water is cohesive and sticks to other water molecules.
  - Water is adhesive and sticks to other materials.
  - Water is often called the universal solvent because a large number of substances will dissolve in water.
  - Water has a high surface tension.
  - Water has a high specific heat, meaning it can absorb large amounts of thermal energy, keeping areas near bodies of water milder in temperature by absorbing heat in the summer and releasing heat in the winter.
- Water is the only compound that exists in all three states (solid, liquid, and gas) on Earth.
- Solid water (ice) is less dense than liquid water, allowing it to float.
- Water can shape our environment by physical weathering (water eroding & and breaking down rocks) and chemical weathering (acidic rain reacting with rock to form carbon dioxide).
- Saltwater makes up 97% of Earth's water, >2% is frozen in the ice caps, and <1% is fresh and not frozen (usable to humans).
- Humans need fresh, clean water for agriculture (irrigation), power generation (hydroelectric & thermal power plants), health, and sanitation. Advances in water treatment have eliminated diseases.

SOL 6.3: Solar Energy

Though almost all energy on Earth comes from the Sun, the Earth receives only a very small portion of the Sun's energy.

- Incoming radiation is balanced with energy that leaves the atmosphere. (Some reflected, some absorbed by Earth)
- The Sun's energy is responsible for powering the motion of the atmosphere (wind), ocean currents, and the weather.
- Excess carbon dioxide (CO_2) & methane (CH4) gas can trap solar energy and create a greenhouse effect, causing Earth's atmosphere heat up & resulting in changes our climate.

Convection Currents:

- Earth's surface is heated unequally. (More towards the equator)
- When air or water is heated, the molecules move faster and farther apart, reducing their density and causing them to rise.
- When air or water is cooled, the molecules move slower and closer together, increasing the density and causing them to sink.
- This cycling rising and falling is called a convection current, and is the main way the sun's heat is distributed through the atmosphere and oceans from the equator to the polar regions.

Cloud Formation:

1) Bodies of water absorb energy, causing the water to evaporate.
2) Warm water vapor rises and cools in the upper atmosphere.
4) Cool water vapor condenses to form tiny water droplets as clouds.
   - Three main types of clouds are cumulus ("puffy"), stratus ("flat"), and cirrus ("wispy"). Adding "nimbo" means rain.
   - Thunderstorms form where moist air over land is heated.
   - Hurricanes form over warm water near the equator.

SOL 6.6: Earth's Atmosphere

Layers of the Atmosphere

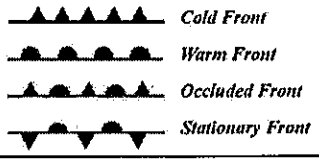
Thermosphere (Thermos):
- Lowest Air Pressure
- Satellites orbit here.

Mesosphere (Mary's):
- Meteors burn up here.

Stratosphere (Stole):
- Ozone (O_3) layer here. Helps shield us from UV radiation.

Troposphere (Trudy):
- Highest Air Pressure
- All weather here
- Temperature decreases as altitude increases here

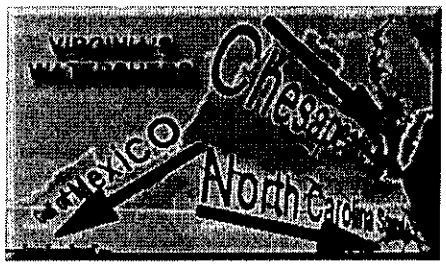
- Air is a **mixture** of **nitrogen** (78%), **oxygen** (21%), water, carbon dioxide, & argon
- **Natural** (Forest fires and volcanic eruptions) and **human processes** (pollution) affect Earth's atmosphere.
- Weather is determined by **temperature** (heat, measured with a thermometer), **air pressure** (force of air being pulled down by gravity, measured with a barometer), and **humidity** (moisture, measured with a hygrometer).
- Differences in air pressure (H to L) cause air to move in **fronts**.



Cold: cold air replaces warm.
Warm: warm air replaces cold.
Occluded: warm air "stuck" between two cold fronts.
Stationary: cold & warm air mix.

SOL 6.7: Watersheds

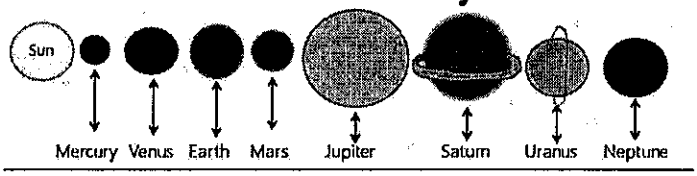
- The **health of an ecosystem** is directly related to **water quality.**
- **Water quality** can be measured in terms of pH (acidity), temperature (heat), salinity (salt), dissolved oxygen (aeration), turbidity (sediment), and the number and diversity of macro-invertebrate organisms (small insects living in water).
- A **watershed** is the land that water flows across on its way to a stream, lake, wetland, or other body of water. Areas of higher elevation separate watersheds.



The three main **watersheds in Virginia** are the **Chesapeake Bay** (Northeast), **North Carolina Sound** (Southeast), & **Gulf of Mexico** (Southwest)

- River systems are made up of **tributaries**, which are smaller streams that flow into larger rivers. Rivers have wide, flat areas called **flood plains**, where water spills out at times of high flow.
- **Wetlands** are transition zones between dry land and bodies of water. Wetlands prevent flooding, reduce erosion, filter sediment/pollution, & provide wildlife habitat.
- An **estuary** is a type of wetland formed where a river system flows into the ocean, providing a mix of freshwater & salt water. The **Chesapeake Bay** is the largest estuary in the U.S.

SOL 6.8: The Solar System



My Very Educated Mother Just Served Us Nachos

- **Inner Rocky Planets (small):** Mercury, Venus, Earth, Mars
  - Few moons (Earth/Mars) or no moons (Mercury/Venus)
  - No rings orbiting the planets.
  - **Earth** can sustain life because has an **atmosphere** and **magnetic field** that protect it from harmful solar radiation and plenty of liquid **water.**
- **Asteroid Belt:** large rocks found between Mars and Jupiter.
- **Outer Gas Giant Planets (large):** Jupiter, Saturn, Uranus, Neptune. All have many moons and rings orbiting the planets.
- **Dwarf Planets** (Pluto) have not yet cleared their orbit of debris.
- **Meteors:** rocks that burn up in Earth's atmosphere.
- **Comets:** Chunks of ice and rock that orbit the Sun. (wispy tail)

Gravity is a force that keeps the planets in motion around the Sun.

- Planets **revolve** (orbit) around the Sun and **rotate** (spin) on their axis. Earth's orbit around the Sun takes **365.25 days.** (1 year) Earth's rotation on its axis takes **24 hours** (1 day)
- **Seasons** are caused by **Earth's tilt** (23.5°) on its axis as it orbits the Sun. The hemisphere leaning **towards** the sun experiences **summer.** The hemisphere leaning **away** experiences **winter.**

Copernicus & Galileo proved the Sun is the center of the solar system, disproving **Aristotle & Ptolemy's** theory that Earth was the center.

SOL 6.9: Public Policy & The Environment

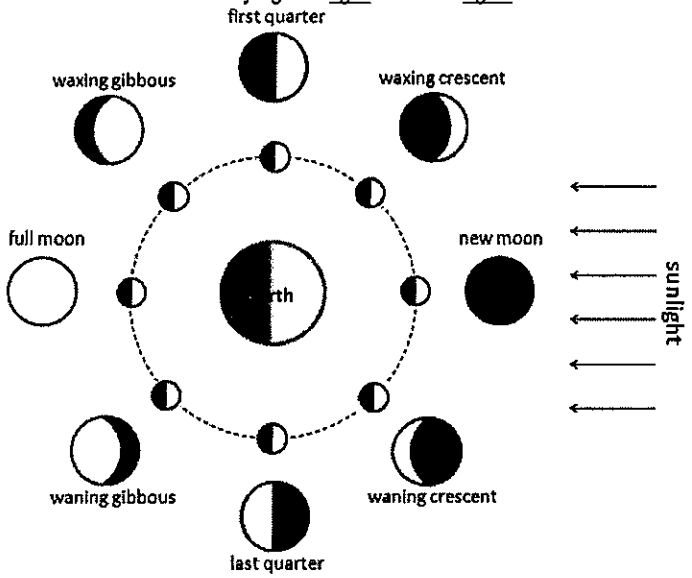
- **People**, as well as other living organism, are **dependent upon clean water, clean air,** and a **healthy environment.**
- **Human activities** can alter the environment & accelerate or decelerate natural processes. Ex: Increased erosion from logging/plowing, decreased erosion from planting trees.
- **Modern industrial society** is dependent upon energy. **Fossil fuels** are the major sources of energy in industrialized nations and **should be managed** to minimize adverse impacts (water pollution from extraction, air pollution from their use/burning).
- **Renewable resources** should be managed so that they produce continuously. **Sustainable development** makes decisions about long-term use of land and natural resources for maximum benefit for the longest time with the least environmental damage.
- **Conservation** of resources and environmental protection begin with **individual acts of stewardship.**
  - Reducing, reusing, & recycling resources when able.
  - Limiting energy use by conserving electricity (updating to more efficient appliances, turning off when not in use).
  - Conserving water resources (saving gray water for gardening, turning of faucets when brushing teeth, etc.)
  - Reducing the use of fossil fuels for transportation (using public transport, carpooling, walking, riding bikes)
- **Local, state, & federal governments** have significant roles in managing and protecting air, water, plant, & wildlife.
  - Limiting how much hunting and fishing can be done, and where, to prevent species endangerment/extinction
  - Monitoring types and sources of pollution & enforcing bans
  - Preserving wildlife habitat & natural resources through national/state parks & forests.

Pollution prevention & management are less costly than cleanup!

SOL 6.8: The Solar System (continued)

The **phases of the moon** are caused by its position between the Earth and Sun as it completes its orbit around Earth.

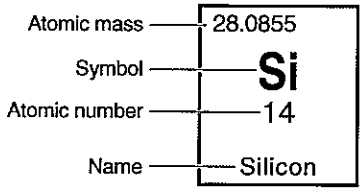
- **Waxing** means gaining light, **waning** means losing light.
- **Gibbous** is more than half lit, **crescent** is less than half lit.
- The moon always gains light from the right.



- **Tides** are the result of gravitational pull of the moon and sun on the surface waters of Earth. A **spring** tide occurs when the sun and moon are in line. A **neap** tide occurs when the sun and moon are at right angles to each other.
- A **solar eclipse** occurs when the moon is between Sun and Earth.
- A **lunar eclipse** occurs when the Earth is between Moon & Sun.

Periodic Table of the Elements
For Assessments Based on the 2010 Chemistry Standards of Learning

Periodic Table of the Elements



Period	Group 1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.00794 H 1 Hydrogen																		4.00260 He 2 Helium
2	6.941 Li 3 Lithium	9.01218 Be 4 Beryllium					Transition Elements							10.81 B 5 Boron	12.0111 C 6 Carbon	14.0067 N 7 Nitrogen	15.9994 O 8 Oxygen	18.998403 F 9 Fluorine	20.179 Ne 10 Neon
3	22.98977 Na 11 Sodium	24.305 Mg 12 Magnesium												26.98154 Al 13 Aluminum	28.0855 Si 14 Silicon	30.97376 P 15 Phosphorus	32.06 S 16 Sulfur	35.453 Cl 17 Chlorine	39.948 Ar 18 Argon
4	39.0983 K 19 Potassium	40.08 Ca 20 Calcium	44.9559 Sc 21 Scandium	47.88 Ti 22 Titanium	50.9415 V 23 Vanadium	51.996 Cr 24 Chromium	54.9380 Mn 25 Manganese	55.847 Fe 26 Iron	58.9332 Co 27 Cobalt	58.69 Ni 28 Nickel	63.546 Cu 29 Copper	65.39 Zn 30 Zinc	69.72 Ga 31 Gallium	72.59 Ge 32 Germanium	74.9216 As 33 Arsenic	78.96 Se 34 Selenium	79.904 Br 35 Bromine	83.80 Kr 36 Krypton	
5	85.4678 Rb 37 Rubidium	87.62 Sr 38 Strontium	88.9059 Y 39 Yttrium	91.224 Zr 40 Zirconium	92.9064 Nb 41 Niobium	95.94 Mo 42 Molybdenum	(98) Tc 43 Technetium	101.07 Ru 44 Ruthenium	102.906 Rh 45 Rhodium	106.42 Pd 46 Palladium	107.868 Ag 47 Silver	112.41 Cd 48 Cadmium	114.82 In 49 Indium	118.71 Sn 50 Tin	121.75 Sb 51 Antimony	127.60 Te 52 Tellurium	126.905 I 53 Iodine	131.29 Xe 54 Xenon	
6	132.905 Cs 55 Cesium	137.33 Ba 56 Barium	138.906 La 57 Lanthanum	178.49 Hf 72 Hafnium	180.948 Ta 73 Tantalum	183.85 W 74 Tungsten	186.207 Re 75 Rhenium	190.2 Os 76 Osmium	192.22 Ir 77 Iridium	195.08 Pt 78 Platinum	196.967 Au 79 Gold	200.59 Hg 80 Mercury	204.383 Tl 81 Thallium	207.2 Pb 82 Lead	208.980 Bi 83 Bismuth	(209) Po 84 Polonium	(210) At 85 Astatine	(222) Rn 86 Radon	
7	(223) Fr 87 Francium	226.025 Ra 88 Radium	227.028 Ac 89 Actinium	(261) Rf 104 Rutherfordium	(262) Db 105 Dubnium	(263) Sg 106 Seaborgium	(262) Bh 107 Bohrium	(265) Hs 108 Hassium	(266?) Mt 109 Meitnerium	(269?) 110									

Mass numbers in parentheses are those of the most stable or most common isotope.

Metals ◄ ► Nonmetals

Lanthanoid Series	140.12 Ce 58 Cerium	140.908 Pr 59 Praseodymium	144.24 Nd 60 Neodymium	(145) Pm 61 Promethium	150.36 Sm 62 Samarium	151.96 Eu 63 Europium	157.25 Gd 64 Gadolinium	158.925 Tb 65 Terbium	162.50 Dy 66 Dysprosium	164.930 Ho 67 Holmium	167.26 Er 68 Erbium	168.934 Tm 69 Thulium	173.04 Yb 70 Ytterbium	174.967 Lu 71 Lutetium
Actinoid Series	232.038 Th 90 Thorium	231.036 Pa 91 Protactinium	238.029 U 92 Uranium	237.048 Np 93 Neptunium	(244) Pu 94 Plutonium	(243) Am 95 Americium	(247) Cm 96 Curium	(247) Bk 97 Berkelium	(251) Cf 98 Californium	(252) Es 99 Einsteinium	(257) Fm 100 Fermium	(258) Md 101 Mendelevium	(259) No 102 Nobelium	(260) Lr 103 Lawrencium

Revised May 2011

Scientific Investigation and Inquiry Skills Vocabulary

1. Define the following terms in your own words:

Obervation_____

Inference_____

Hypothesis_____

Experiment_____

Control_____

Constant_____

Independent Varibale_____

Dependent Varibale_____

Conclusion_____

Analyze Data_____

Give an example of an inference_____

_____

2. Identify the Variables

If you increase the number of cigarettes you smoke, then you will increase your risk for lung cancer.

Independent variable_____

Dependent variable_____

Students of different ages were given a jigsaw puzzle to put together. They were timed to see how long it took to finish the puzzle.

Independent variable_____

Dependent variable_____

I think there is a connection between how long you run and how fast your heart beats (heart rate). I will be performing an experiment where a person will run for a 1 minute and I will check their heart rate. Then they will run for 2 minutes and I will check their heart rate. I will do this up to 6 minutes and see if the is a connection.

Independent variable_____

Dependent variable_____

I want to see if different colors of light help plants grow better. I am going to take four plants (all the sane type) and set them up underneath different lights. One will be a white light, one will be red, one will be blue, and one will be green. Everyday, I will water them the same amount at the same time. I will also record how high each plant grows for two weeks and then look at my results.

Independent variable_____

Dependent variable_____

Constants/Control_____

3. Measurement: Complete the following

What is SI? _____.

_____

SI is based on the _____ system.

Why do Scientist use SI units? _____

_____

List 3 ways scientist communicate:

1._____

2. _____

3. _____

Measurement	Tool	Unit
	Graduated cylinder	
Mass		
		Celsius
Length		

4. Scientific Method: List the steps of the scientific method in order.

1._____

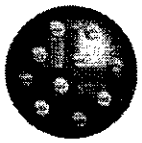
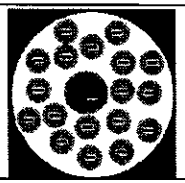
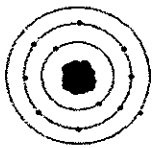
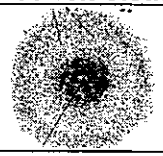
2. _____

3. _____

4. _____

5. _____

6._____

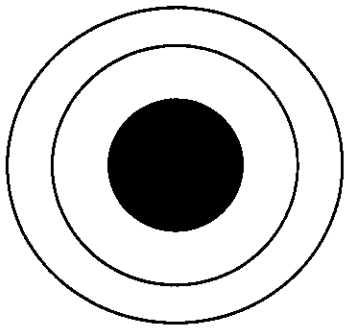
Atomic Theory	
Scientist	Identify the scientist and describe their model or contribution to the understanding of the atom.
1. Democritus 	**1897** *Description:*
2. _____ 	**1920s** *Description:*
3. _____ 	**ANCIENT GREECE** *Description:*
4. _____ 	**1913** *Description:*
5. _____ 	**1808** *Description:*
6. **Electron Cloud** 	**1911** *Description:*

State Dalton's Atomic Theory:

***** If you have access to the Internet Jlab is an excellent review site. Don't forget to review your 7th grade reviews packet. Take care and be safe during the break.**

Atomic Basics Name _____

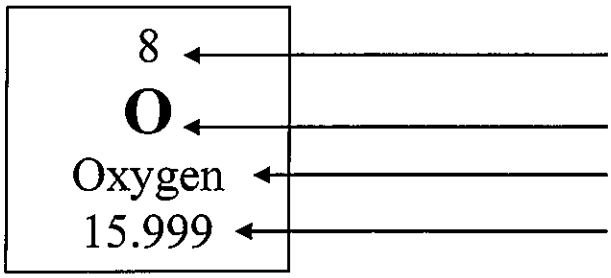
Part A: Atomic Structure



1. Draw five protons in the nucleus of the atom. Label them with their charge.
2. Draw six neutrons in the nucleus of the atom.
3. Draw two electrons in the first energy level and label them with their charge.
4. Draw three electrons in the second energy level and label them with their charge.
5. What element is represented by the diagram? _____

Part B: Atomic Calculations

6. Label the information provided in the periodic table.



7. What does the atomic number represent?

_____ or _____

8. What does the atomic mass represent?

_____ + _____

9. How would you figure the number of protons or electrons in an atom?

10. How would you figure the number of neutrons in an atom?

11. Use your knowledge of atomic calculations to complete the chart.

Element	Atomic Number	Atomic Mass	Protons	Neutrons	Electrons
Li	3	7			
P	15	31			
Cl		35	17		
Ni	28			31	
K		39			19
Ag	47			61	
H		1	1		
Si				14	14
W			74	110	
Ne				10	10

Name: _____

Period: _____

Periods and Groups; Valence Electrons; Masses

Periods and Groups

Elements that have the same number of outermost electrons have similar properties, so we put them in ***groups***. On the periodic table groups = columns (up and down). You will use mostly groups 1A – 18 A. Hydrogen is in the same group as Lithium.

Elements that have electrons in the same electron levels are in the same period (row) on the Periodic Table. Periods go left and right. Helium is in the same period as Hydrogen.

Periods	Groups 1A	2A									18A
							13A	14A	15A	16A	17A	
1	1 H											2 He
2	3 Li	4 Be					5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg	Transition metals—number of valence electrons varies				13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca					31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr

Thinking like the game "Battleship", you can find an element by its period and group.

What element is in Period 2 and Group 16A?
Period 2 is row 2; Group 16A is Column 16A. The element is oxygen.

What element is in Group 13A and Period 3?

What element is in Group 2A and Period 2?

What group and period is Chlorine in?

Group: _____ Period: _____

What about Magnesium?

Group: _____ Period: _____

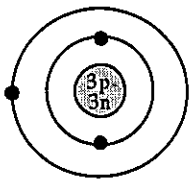
Valence Electrons

Valence Electrons are the outermost electrons in an atom. Each group (column) has the same number of valence electrons. Valence electrons are the electrons that are involved in chemical bonding.

hydrogen 1

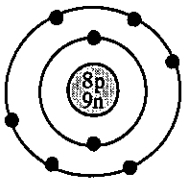
1 valence electron

lithium 6



1 valence electron

oxygen 17



6 valence electrons

Hydrogen and Lithium are both in Group 1A—both have 1 valence electrons.

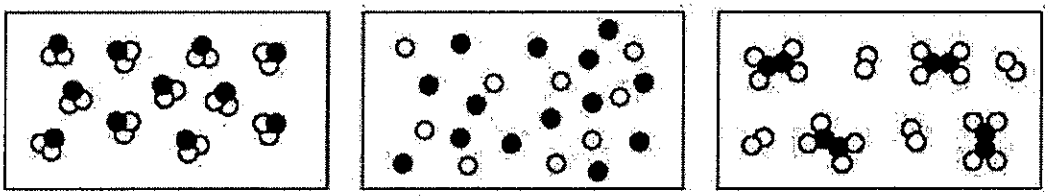
Oxygen is in Group 16A and has 6 valence electrons. How many valence electrons will Sulfur have?

How about Selenium?

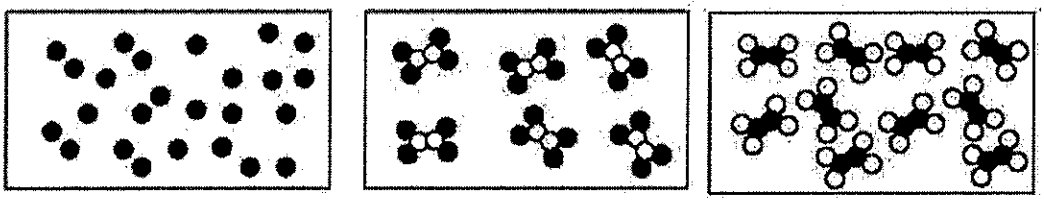
Octet Rule – Atom are more stable that have a full shell of electrons. For most atoms (except H and He) this number is 8 (octet = 8). Atoms want to have 8 valence electrons. "If I 8, I full." Only Group 18A have a full octet (8 valence electrons) naturally. All other elements will lose, gain, or share to reach 8 electrons.

One of These Things Is Not Like the Other

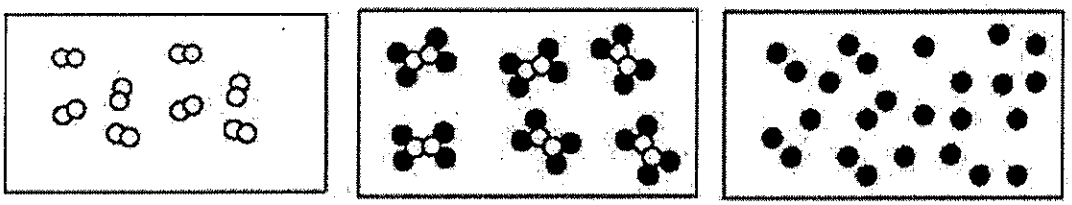
Directions: Circle the picture in each row that does not belong and provide a reason to explain why you chose your answer.



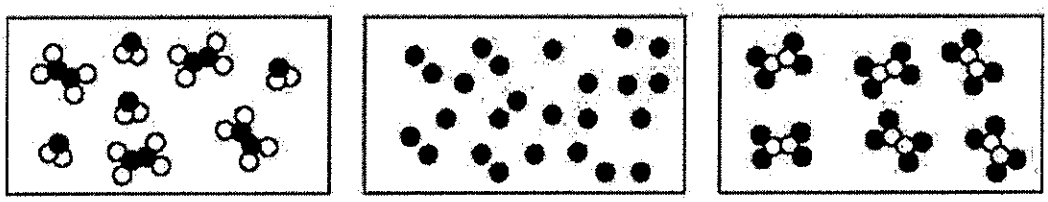
1. Why did you choose this picture?



2. Why did you choose this picture?



3. Why did you choose this picture?



4. Why did you choose this picture?

Name: _____

Properties of Matter Review

Part I: Define each of the following words.

1. Physical Property: _____
   _____
   _____
2. Chemical Property: _____
   _____
   _____

Part II: Physical or Chemical Property? Fill in the chart using the vocabulary words or phrases provided. Each word is used once. Define the word when done!

Combustibility	Density	Brittleness	Acidity	Ductility
Texture	Basicity	Reactivity	Malleability	Odor

Chemical Property	Definition
	• A substance's ability to burn.

Physical Property	Definition
	• Does the substance have a smell?

Part III: Circle the answer in the parentheses that makes each statement correct.

1. (Physical/Chemical) properties describe matter.
2. (Physical/Chemical) properties of a substance can be easily observed.
3. A student can use their five senses to determine the (physical/chemical) properties of a substance.
4. (Physical/Chemical) properties usually describe how a substance reacts.
5. (Physical/Chemical) properties are not as easy to observe.

Part IV: Determine if each example is a physical property (PP) or a chemical property (CP).

_____1. The color of the ball is red.
_____2. Water is a liquid.
_____3. Oxygen is odorless and colorless.
_____4. Copper can react with oxygen and turn green.
_____5. The density of water is 1.0 g/mL.
_____6. Diamonds are a very hard substance.
_____7. Sodium can react with other elements very easily.
_____8. The boiling point of water is 100°C.
_____9. Hydrogen can burst into flames.
_____10. Silver can react with oxygen and turn dark gray.

Name_____Date_____Core_____

Notes on Acids and Bases (pH)

---

pH - = Potential of Hydrogen

Acids	Bases
Battery Acid	Hand Soap
Lemon Juice	Baking Soda
Soda	Bleach

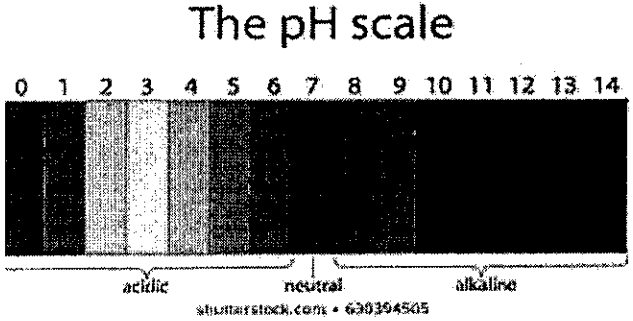
Acids

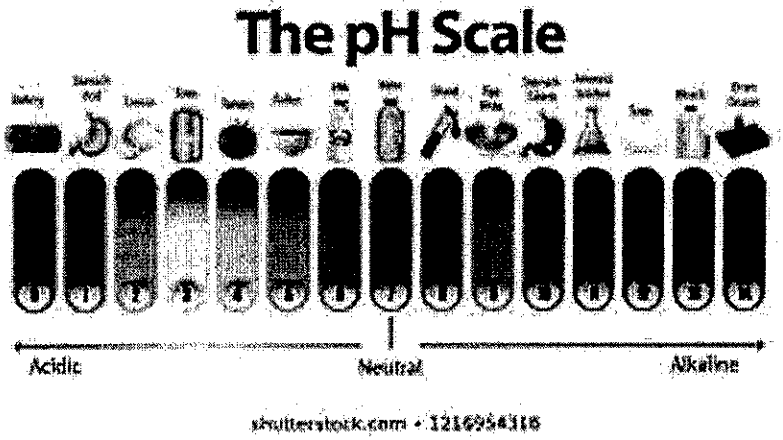
- A solution that has an excess of H^+ ions.
- From the Latin word acidus, which means "sharp" or "sour"
- Characteristics
  - Taste sour
  - React strongly with metals
  - Dangerous and can burn your skin
  - Turns blue litmus indicator red
  - Increase H^+ ion concentration in solution

Bases

- A solution that has an excess of OH^- ions.
- Another word for base is alkali or alkaline
- Characteristics of bases
  - Bitter taste
  - Slippery feel
  - Strong bases are very dangerous and can burn your skin.
  - Turns red litmus indicator blue
  - Increase OH^- ion concentration in solution

<u>Neutralization</u> – is when a acid and base are mixed. This reaction produces salt and water.





Name_____Date_____ Assignment#_____

Student pH Notes (Acids and Bases)

PS.2 Properties

1.	
Shape	Color
Solubility	Odor
Melting Point	Density
Boiling Point	

2.	
Acidity	Basicity
Combustibility	Reactivity

Directions: Use the note page to complete your notes.

Acids	Bases
A solution that has an excess of _____ions	A solution that has an excess of _____ions.
From the Latin work acidus, which means "_____ or _____"	Another word for base is _____ or _____
<u>Characteristics</u> 1. Taste _____ 2. _____with metals and carbonates 3. pH < _____	<u>Characteristics</u> 1. Taste _____ 2. Feels _____ 3. pH >_____
Litmus Paper (blue) Turns_____litmus paper _____	Litmus Paper (red) Turns_____litmus paper _____

Questions???

What does pH mean? _____

What happens when you mix an acid and a base? _____

What products are formed when you mix an acid and a base?

_____

What is neutral pH and substance that has it? _____

1.

What is a neutralization reaction?

2.

What are the products of a neutralization reaction?

3.

List characteristics of acids.

4.

List 3 characteristics of bases.

5.

If a substance has a pH of 3 what is it? (acid or base) Explain your answer

6.

What is the range of the pH scale?

7.

When a base dissolves in water it releases?

Name

8th Grade: Science: X= omit

SOL PS.1 - Scientific Investigation

1. The general process used by scientists to answer questions is called?

2. What steps are followed in this process?

3. What phrase can you use to remember the steps of the scientific method?

4. All scientific knowledge, including theories and laws, are based on?

5. Complete the statement describing the difference between a scientific law and a scientific theory:

   a. A _____ is a well-tested general explanation for repeated observations.

   b. A _____ is a statement that describes a repeated pattern in nature.

6. An opinion or error which might affect the results of a research project or experiment, is called?

7. How can you avoid bias in an experiment?

8. Name each component of a controlled experiment, described below.

   a. The variable the scientist changes, the "cause" of any observed or measured change:

   b. The variable that changes as a result of what the scientist did, or the "effect":

   c. Other factors that might affect the experiment, which are kept the same by the scientist:

9. What is the name for a group or trial in an experiment which does not receive treatment (the independent variable is not changed)?

10. Name each variable for the following hypothesis: *"If I water my plants more frequently than once per week, they will grow taller."*

    a. Independent variable:

    b. Dependent variable:

    c. Constants:

    d. Control group:

11. What is the name for the measurement system used by scientists all over the world?

12. Name the quantity described by each statement, identify the appropriate SI unit, and list tools used to measure it.

    a. The amount of matter in an object:

b. The force of gravity on an object:

c. The amount of space an object takes up:

d. The distance between two points.

e. The average kinetic energy of the particles of a substance.

f. The amount of matter contained in a given volume.
Density, g/mL or cubic centimeter, graduated cylinder or ruler and balance.

13. Define each metric prefix:

a. kilo (k) -

b. hecto (h) -

c. deka (da) -

d. deci (d) -

e. centi (c) -

f. milli (m) -

g. micro (μ) -

h. nano (n) -

14. How can you remember the metric prefixes from largest to smallest?

15. List all equivalent measurements for 3.2 grams.

a. kg

b. hg

c. dag

d. g

e. dg

f. cg

g. mg

16. Complete each statement describing the proper setup of a data table:

a. The values of the independent variable are listed on the _____ column.

b. The values of the dependent variable for each experimental trial are listed in the _____ columns.

c. The average values for the dependent variable are listed in the _____ column.

17. List the proper axes on which to graph your variables:

a. independent variable:

b. dependent variable:

18. How can you remember the proper way to construct a graph from a data table?

19. Identify the proper type of graph for each type of data:

a. Relationship between variables (ex: change in plant height over time):

b. Categories of data (ex: population of various species in a national park):

c. Tally occurrence of events or repeated data (ex: number of students whose grades fall between various values):

d. Show percentages or parts of a whole:

20. Name the descriptive statistic that is described by each statement of how to calculate:

a. Add all values and divide by the total number of values:

b. List values in numerical order and find the middle number or average of the two middle:

c. The most frequently occurring value:

d. Subtract the smallest value from the largest:

21. Calculate the descriptive statistics for the following data: *10, 12, 9, 7, 8, 10, 11, 10, 12, 16*

a. Mean:

b. Median:

c. Mode:

d. Range:

22. A number that does not fit the data is called?

_____

*Which value does not fit the data above?

23. Something that is constructed or created to describe or explain an object or process that cannot be directly observed is called?

24. List some examples:

25. In a scale model of the solar system, one cm = 1,00,000 km. If the actual distance from Earth to the Sun is 150,000,000 km, how many centimeters apart should they be in the replica?

26. Write the number 150,000 in proper scientific notation.

27. Identify each lab safety symbol pictured below.

a. b. c. d. e. f. g. h.

a.

b.

c.

d.

e.

f.

g.

h.

28. What are some safety procedures you should follow while heating a test-tube of unknown liquid?

SOL PS.2 – Classifying Matter

1. Anything that has mass and takes up space is called?

2. All matter is made up of tiny particles called?

3. A pure substance made up of only one type of atom is called an?

4. Two or more elements **chemically** combined in a fixed ratio form a pure substance called a?

5. Two or more substances **physically** combined in NO fixed ratio form a?

6. List an example of each:

   a. Element:

   b. Compound:

   c. Mixture:

7. What are the four phases of matter that can be observed in nature?

8. Matter with no shape or volume?

9. Matter with volume and no shape?

10. Matter with shape and volume?

11. What is the name for the matter found in the sun and other starts that acts as a superheated ionized gas?

12. What element is found in all organic compounds?

13. Compounds that generally do not contain carbon are –

14. Two exceptions to this rule are –
Carbon dioxide, Carbon monoxide

15. Identify each substance as an acid, base, or neutral based on its properties.

   a. pH < 7

   b. pH of exactly 7

   c. pH > 7

   d. Tastes Bitter

   e. Tastes Sour

   f. Turns litmus paper red→

   g. Turns litmus paper blue→

   h. Formula starts with H/releases H^+ ions in water

   i. Formula ends with a OH/releases OH^- ions in water

16. What is formed when an acid reacts with a base?

17. Characteristics that can be observed or measured without changing an object into a new substance are called -

18. Characteristics that that can only be observed by causing substance to change into a new substance are called -

19. Some examples of physical properties include:

20. List some examples of chemical properties:

SOL PS.3 – Atomic Structure

1. Which scientist developed the first working model of that atom as a solid sphere?

2. Which scientist discovered electrons and thought they were scattered throughout atoms like plums in pudding?

3. Which scientist discovered that atoms have a nucleus?

4. Which scientist stated the electrons circled the nucleus of the atom in fixed orbits with different energies?

5. Which scientist proposed the most accurate 3-D model of the atom in which electrons are loosely grouped around the nucleus in energy levels or "clouds"?
Schrodinger

6. What is one name for this model?
Electron cloud model, Quantum mechanical model

7. What phrase can you use to remember the atomic theory scientists in order?

8. What is the dense central region of the atom called?

9. What is the positively charged particle in the nucleus?

10. What is the particle with no charge in the nucleus?

11. What is the negatively charged particle found in energy levels (shells) outside of the nucleus?

12. What are particles that make up the protons and neutrons called?

SOL PS.4 – The Periodic Table

1. What makes every element on the Periodic Table unique?

2. There are 118 known elements on the Periodic Table. The first 92 are found in nature. Where are the rest produced?

3. What determines the arrangement and identity of the elements on the Periodic Table?

4. What are the 18 columns on the Periodic Table called?

5. What are the 7 rows on the Periodic Table called?

6. Elements in the same family have similar properties. What else do they normally have in common that has a major effect on chemical bonding?

7. How are all of the elements on the right side of the staircase plus Hydrogen classified?

8. How are all of the elements on the left side of the staircase plus Aluminum classified?

9. How are all of the elements on the staircase except Aluminum classified?

10. What type of bond is formed when two nonmetals share electrons?

11. What type of bond is formed when a metal transfers electrons to a nonmetal?

12. What is an atom that gains or loses electrons called?

13. What is an atom that gains or loses neutrons called?

14. What tells you the number of atoms of each type in a chemical compound?

15. Answer the questions below using the periodic table.

a. How many protons does Aluminum have?

b. *Aluminum has an atomic number of*

c. *Aluminum has an atomic mass of*

d. How many neutrons does Aluminum have?

e. How many electrons does Aluminum have?

SOL PS.5 – Changes in Matter

1. What are changes in size, shape, or phase called?

2. What are changes that produce new substances called?

3. What law states the total amount of matter remains the same before and after a chemical reaction?

4. Which law states that energy only changes forms during a reaction and is never created or destroyed?

5. What is a reaction that absorbs energy called?

6. What is a reaction that releases energy called?

7. How can you speed up or slow down an chemical reaction?

Name: _____

Cell Study Guide

1. Gary was designing an experiment for his science fair project on how much water grows the tallest plant. He will be using different amounts of water to determine which plant will grow the tallest. In designing his experiment to receive accurate results, which variable will be **constant?**
   a. Amount of water
   b. Plant height
   c. Color of pot
   d. Type of plant

2. How does a bacterial cell (**prokaryotic** cell) differ from a plant or animal cell (**eukaryotic** cell)?
   a. It has no organelles
   b. It is larger
   c. It has no cytoplasm
   d. It does not have a nucleus

3. List the 3 parts of the **cell theory**
   a. _____
   b. _____
   c. _____

4. Scientist Redi and Pasteur disproved **Spontaneous generation.** What is Spontaneous generation?
   _____
   _____

5. In an experiment, the factor being changed on purpose is called the -
   a. Constant
   b. Dependent variable
   c. Independent variable
   d. Experimental error

6. What are the 3 stages of the **cell cycle**? What happens in each stage?

a. _____

_____

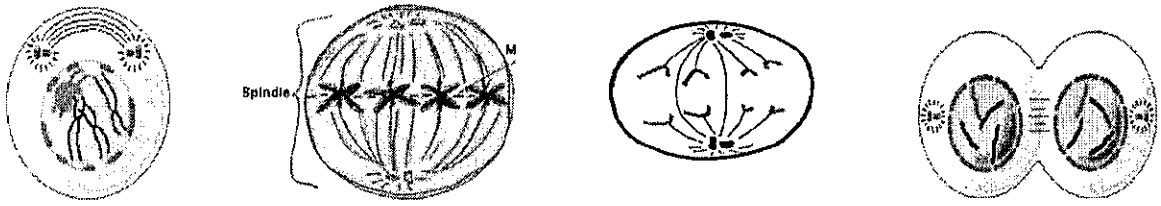
b. _____

_____

c. _____

_____

7. Label each stage of **Mitosis**. Also list what happens during each stage.



8. When energy is required to move certain molecules across the cell membrane it is called -

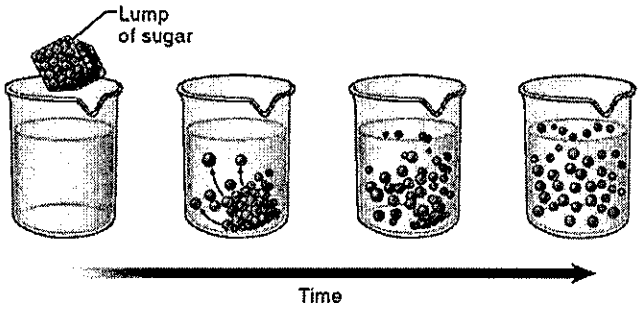
a. Active transport
b. Passive transport
c. Photosynthesis
d. Metabolism

9. Which term refers to the movement of <u>water</u> molecules through a selectively permeable membrane?

a. Passive transport
b. Active transport
c. Osmosis
d. Engulfing

10. What process is shown in the picture?

a. Active transport
b. Diffusion
c. Respiration
d. Osmosis



11. Photosynthesis takes place in the _____.
12. Write the chemical formula for Photosynthesis:

13. Respiration takes place in the _____.
14. Write the chemical formula for Respiration:

15. Unicellular organisms have _____ cell.

16. Multicellular organisms have _____ cell(s).

17. (Circle one) Autotrophs/Heterotrophs make their own food.

18. (Circle one) Autotrophs/Heterotrophs cannot make their own food.

Use the following word bank to complete the next two slides.

Organelle Word Bank

Cell Wall	Cell Membrane	Cytoplasm	Mitochondria
Chloroplast	Vacuoles	Nucleus	Chromatin
Ribosomes	Endoplasmic Reticulum	Golgi Bodies	Lysosomes

Organelle	Function
	It regulates and controls cell activities
	Jelly-like substance in the cell
	Passageways that carry materials around the cell
	It controls what can come into and out of the cell
	It stores food, water and chemicals in the cell
	Produces proteins for the cell
	Produces most of the energy for the cell
	Receives materials from ER and moves them around the cell
	It shapes and protects the plant cell
	Green food making structures within plant cells
	Contains chemicals that break down food particles and worn-out cells
	Complex of DNA, forms chromosomes

Weather Symbols

Direction: Describe each term and draw an illustration.

Term	Description	Illustration
High Pressure		
Low Pressure		
Cold Front		
Warm Front		
Stationary Front		

Weather Events

Direction: Describe each term and draw an illustration.

Term	Description	Impact to Ecosystem
Flood		
Hurricane		
Earthquake		
Tsunami		
Meteor		

Term	Description	Impact to Ecosystem
Hurricane		
Blizzard		
Drought		
Tornado		
Volcano		
Wildfire		