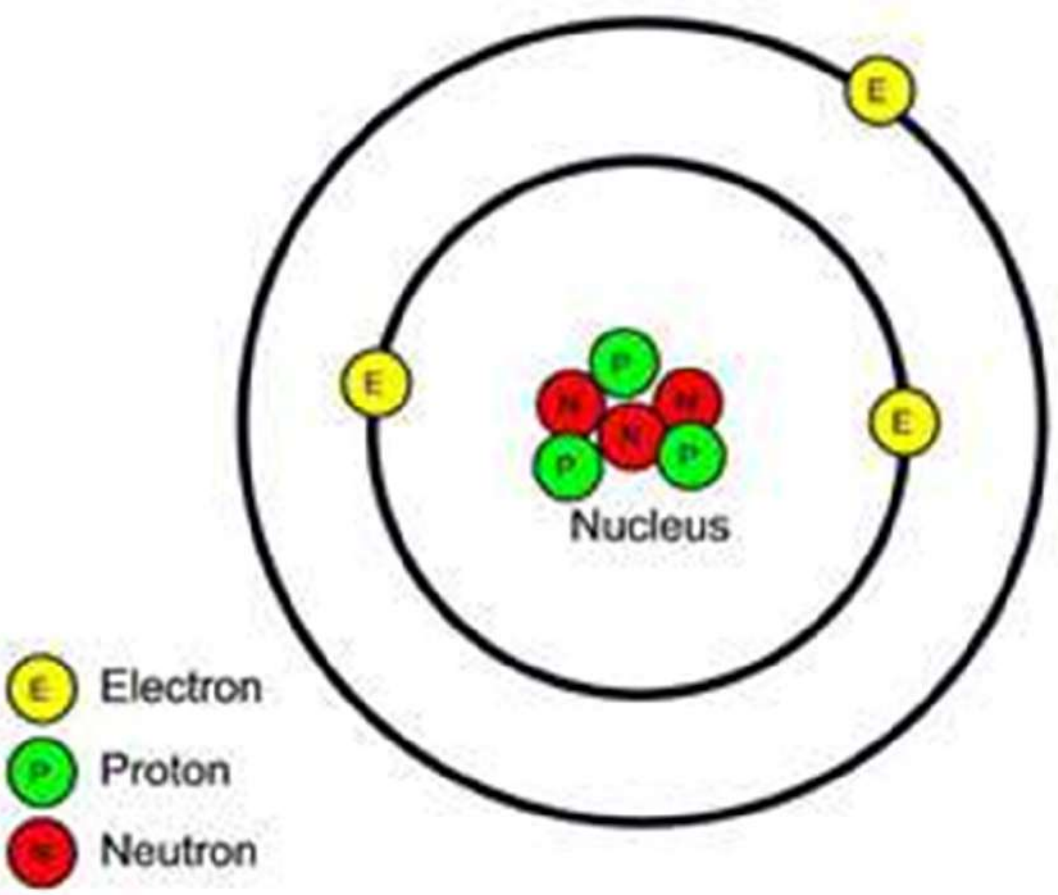
STAAR Science Study Guide

Matter and Energy

describe the structure of atoms, including the masses, electrical charges, and locations, of protons and neutrons in the nucleus and electrons in the electron cloud



Electron – No Mass & -1 charge

Proton – Mass of 1 & +1 charge

Neutron – Mass of 1 & no charge

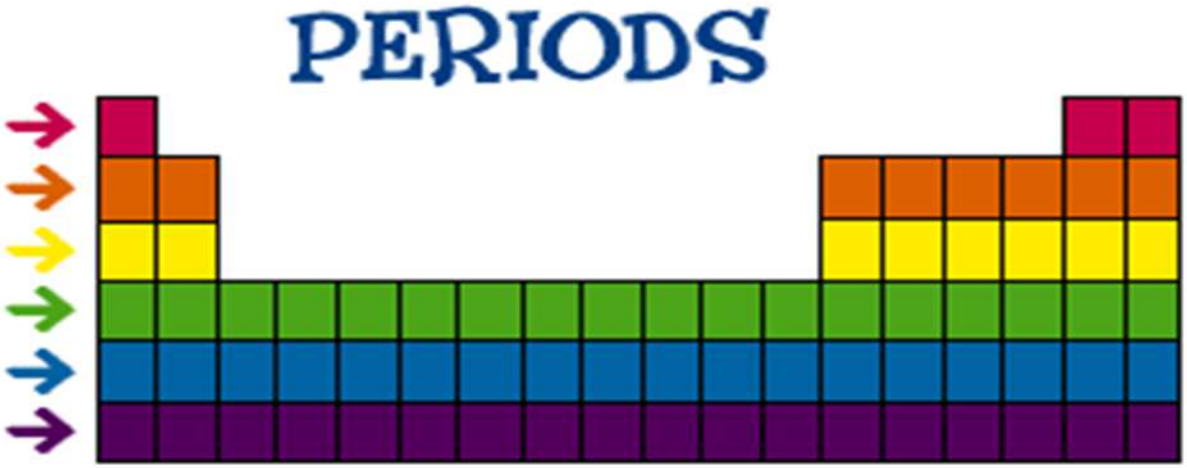
identify that protons determine an element's identity and valence electrons determine its chemical properties, including reactivity;

- Each type of atom has a specific number of Protons and the number of Protons determines the Atomic Number.
- Valence electrons are electrons in the outermost energy level and atoms what a full valence shell

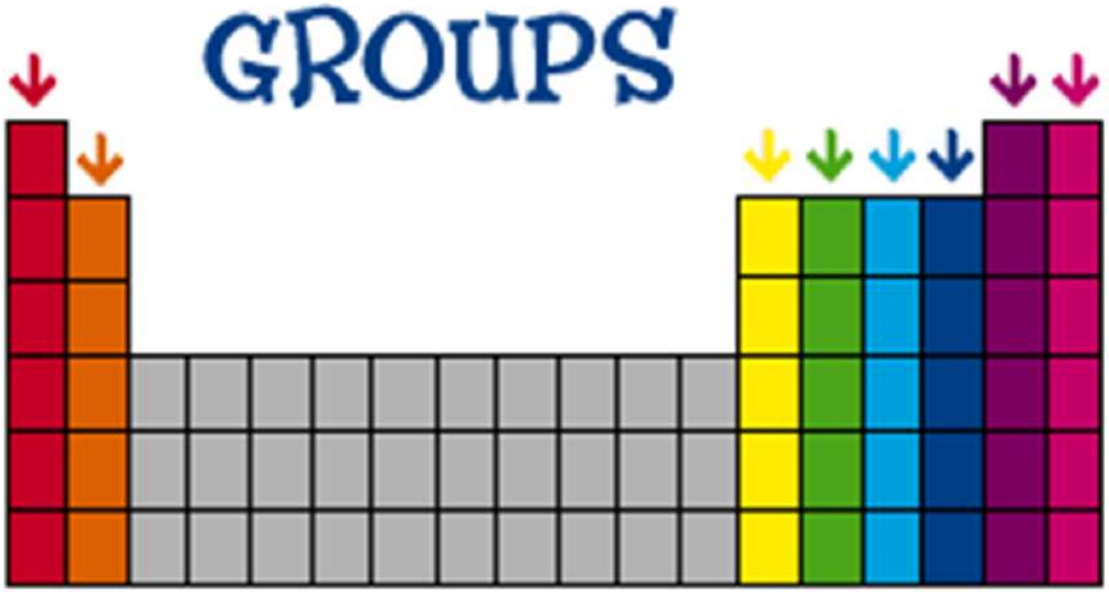
- A – Atomic Number =
- P – Protons =
- E – Electrons

- M – Mass Number –
- A – Atomic Number =
- N - Neutrons

interpret the arrangement of the Periodic Table, including groups and periods, to explain how properties are used to classify elements;

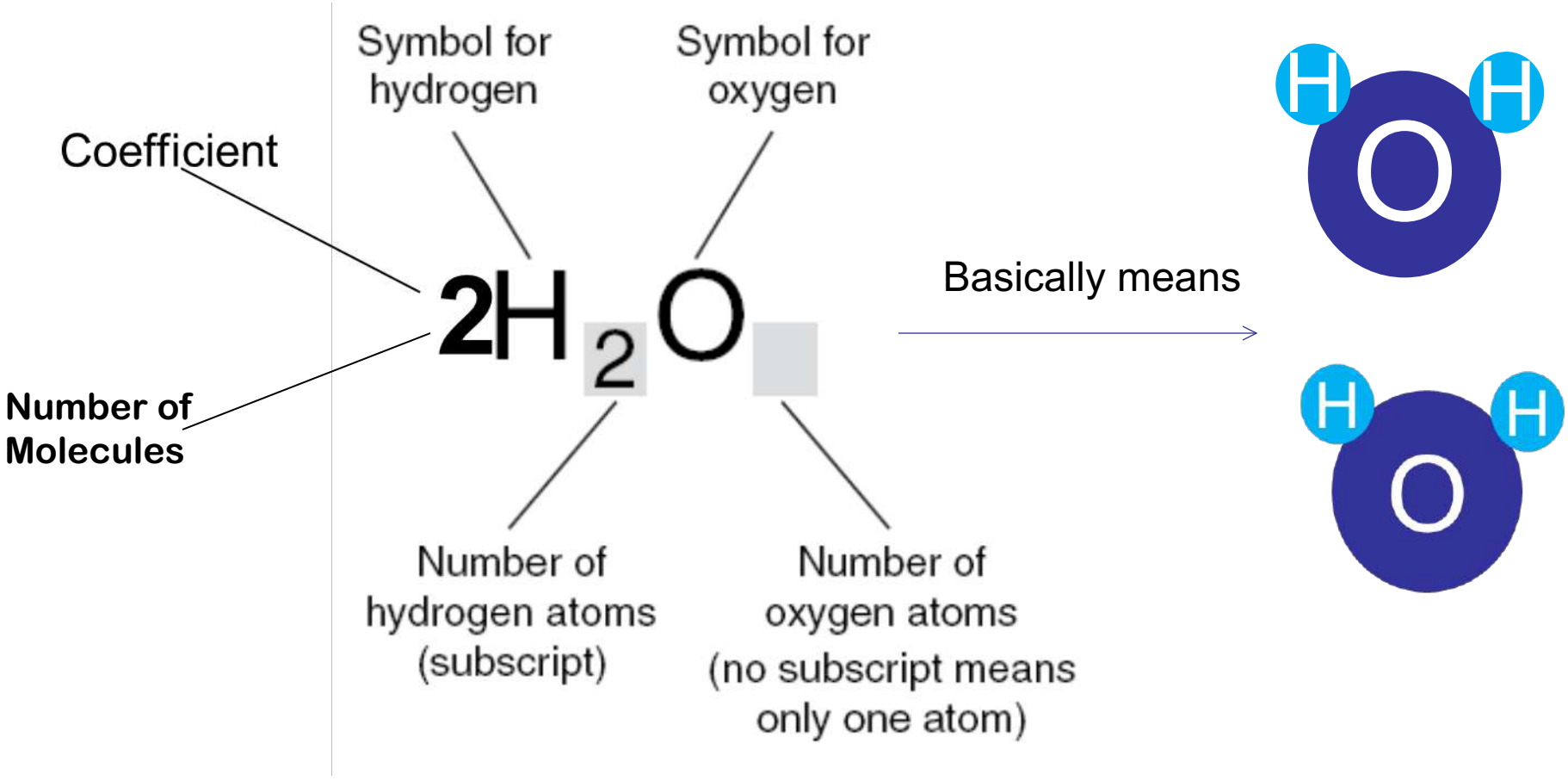


- Periods have a gradual change in chemical properties



- Groups or families have similar chemical properties

recognize that chemical formulas are used to identify substances and determine the number of atoms of each element in chemical formulas containing subscripts;



investigate how evidence of chemical reactions indicate that new substances with different properties are formed;

Evidence of a Chemical Change

- Production of a GAS
- Production of LIGHT
- Production of SOUND
- Production of a PRECIPITATE
- COLOR Change
- TEMPERATURE Change
- pH Change

recognize whether a chemical equation containing coefficients is balanced or not and how that relates to the law of conservation of mass.

$$CH_4 + O_2 \rightarrow CO_2 + H_2O$$

NOT BALANCED

Reactant Side

- C – 1 atom
- H – 4 atoms
- O – 2 atoms

Product Side

- C – 1 atom
- H – 2 atoms
- O – 3 atoms

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

BALANCED

Reactant Side

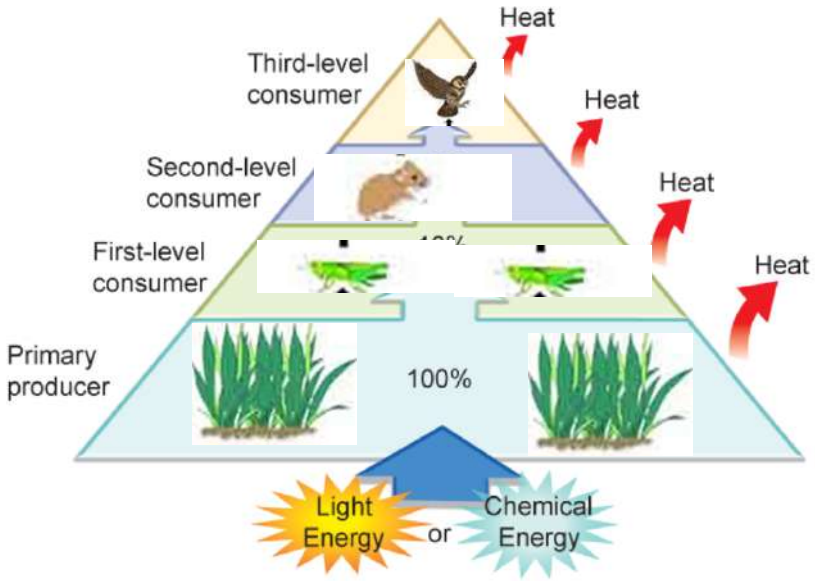
- C – 1 atom
- H – 4 atoms
- O – 4 atoms

Product Side

- C – 1 atom
- H – 4 atoms
- O – 4 atoms

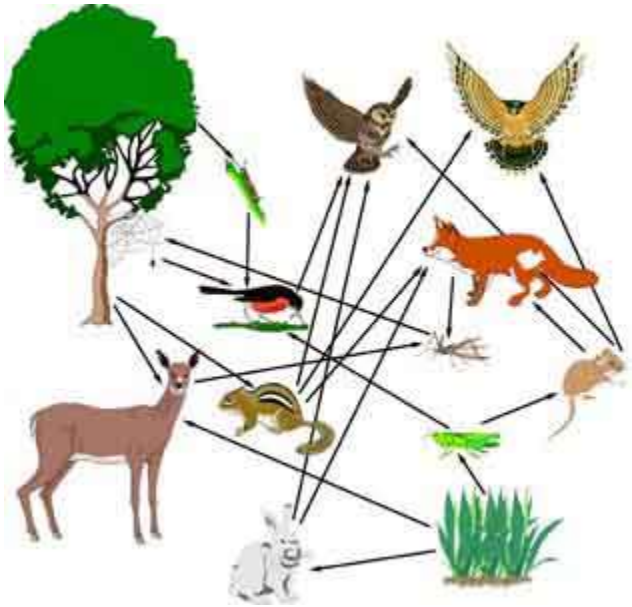
diagram the flow of energy through living systems, including food chains, food webs, and energy pyramids.

Food Pyramid – 10% of energy
Is passed on to each level



Food Chain

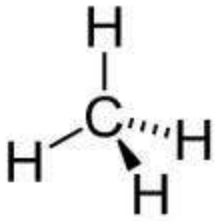
Food Web



identify that organic compounds contain carbon and other elements such as hydrogen, oxygen, phosphorus, nitrogen, or sulfur;

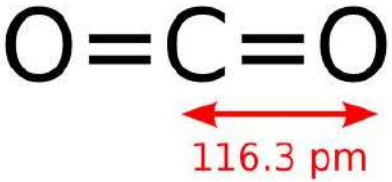
Organic

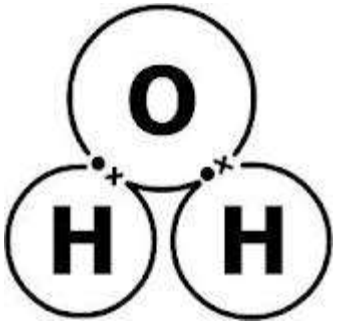
- contains atoms of carbon bonded to one another
- C2H12O6
- Made by living things
- Sugars



Inorganic

- Does not contain carbon bonded together
- CO2
- Not made by living things
- Minerals





distinguish between physical and chemical changes in matter in the digestive system.

Physical Change - change in appearance or location of a substance (SAME SUBSTANCE)

- Mechanical Digestion – mostly happens in the mouth
- Teeth crush, grind, tear, and rip food into smaller pieces
- Swallowing food
- Bile in the stomach breaks fat into smaller droplets of fat
- Peristalsis – pushing/squeezing of food through the digestive system

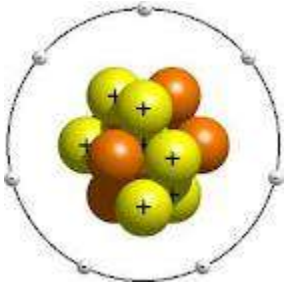
Chemical Change - change in identity of a substance (NEW/DIFFERENT SUBSTANCE)

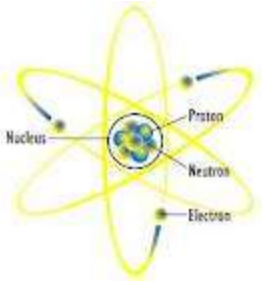
- Chemical Digestion – mostly happens in the stomach
- Any energy transfer (absorption or release of energy)
- Saliva breaks down carbohydrates into sugar
- Stomach acid breaks down protein into useable substances
- Small intestine secretes enzymes to break down lipids (fats) into useable substances

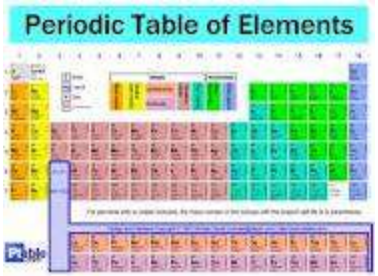
differentiate between elements and compounds on the most basic level.

Element

- Elements contain one or more of the **same** type of atom!

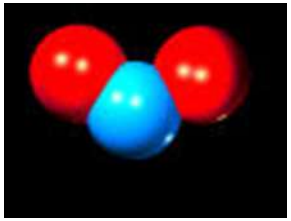


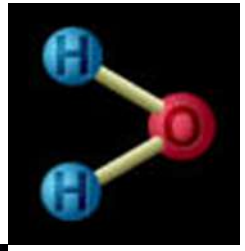


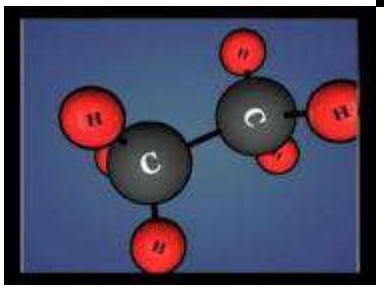


Compounds

- Compounds contain type of atom!







compare metals, nonmetals, and metalloids using physical properties such as luster, conductivity, or malleability;

Metal	Metalloid	Nonmetal
Shiny metallic appearance – has luster	Some have luster some do not	Dull lacking luster
Highly conductive	Some are conductive	Poor conductor
Bendable and malleable	Brittle	Brittle and fragile when solid

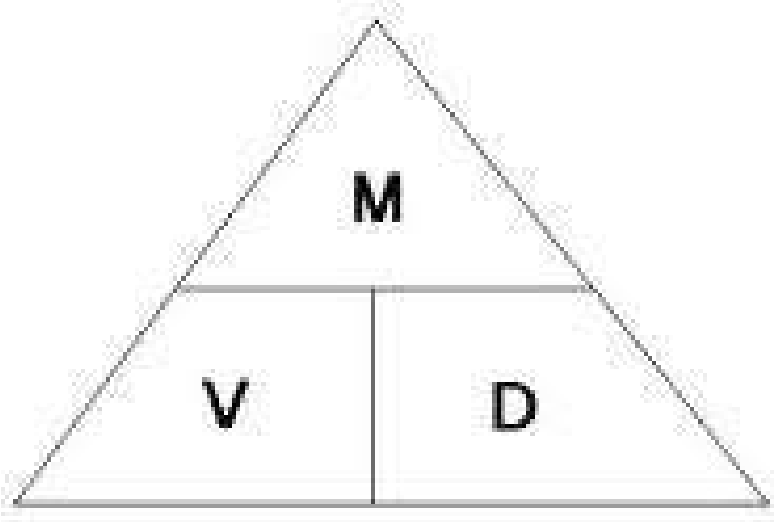
calculate density to identify an unknown substance.

Density = Mass ÷ Volume

D=M/V

M=V x D

V = M/D

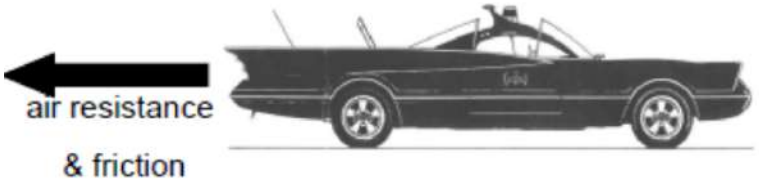


Force, Motion, and Energy

demonstrate and calculate how unbalanced forces change the speed or direction of an object's motion;

- Balanced forces cause motion to stay the same

- Unbalance forces cause objects motion to change



investigate and describe applications of Newton's law of inertia, law of force and acceleration, and law of action-reaction such as in vehicle restraints, sports activities, amusement park rides, Earth's tectonic activities, and rocket launches.

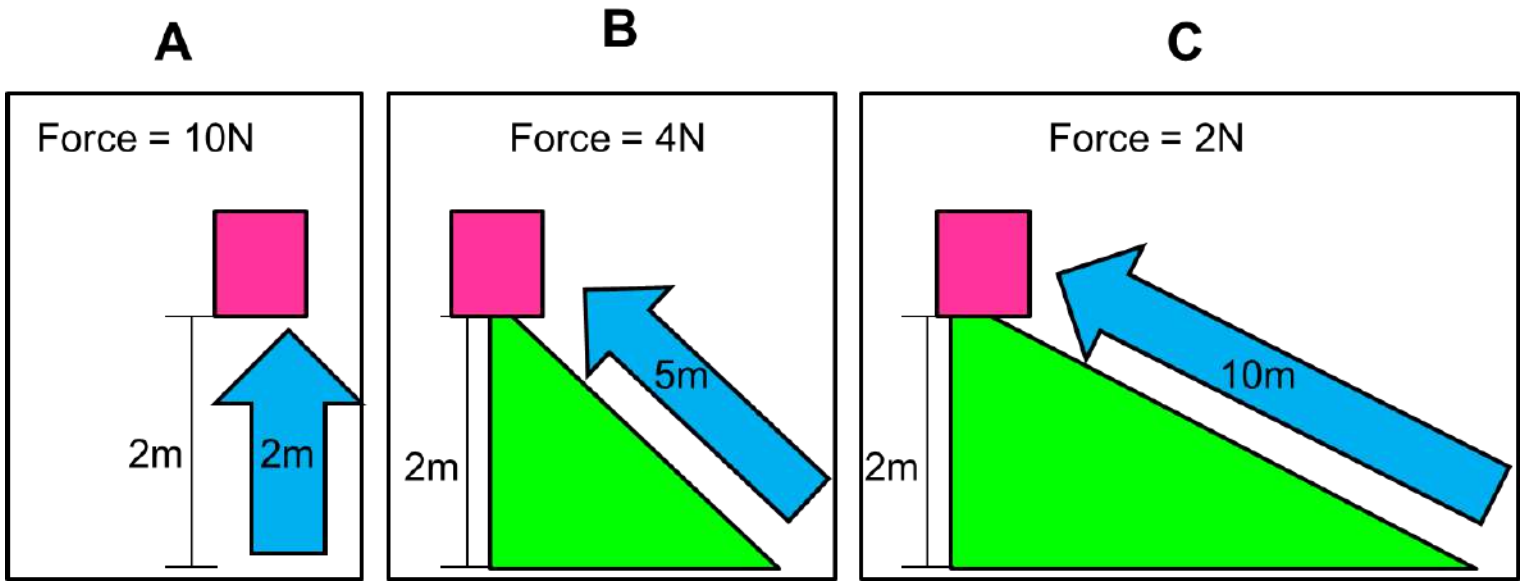
- **Newton's first law** of motion states that an object at rest will remain at rest unless acted upon by a nonzero net force. An object moving at a constant velocity will continue moving at a constant velocity unless acted upon by a nonzero net force. Also called *the law of inertia.*
- **Newton's second law** of motion states that an object's acceleration depends on its mass and on the net force acting on it. Also called *the law of force and acceleration.*
- **Newton's third law** of motion states that if one object exerts a force on another object, then the second object exerts a force of equal strength in the opposite direction on the first object. This is the law of action-reaction.

differentiate between speed, velocity, and acceleration;

- Speed – distance ÷ time (how fast something is going)
- Velocity – displacement ÷ time (how fast something is going and its direction)
- Acceleration – how an objects motion is changing (speeding up, slowing down, or changing direction)

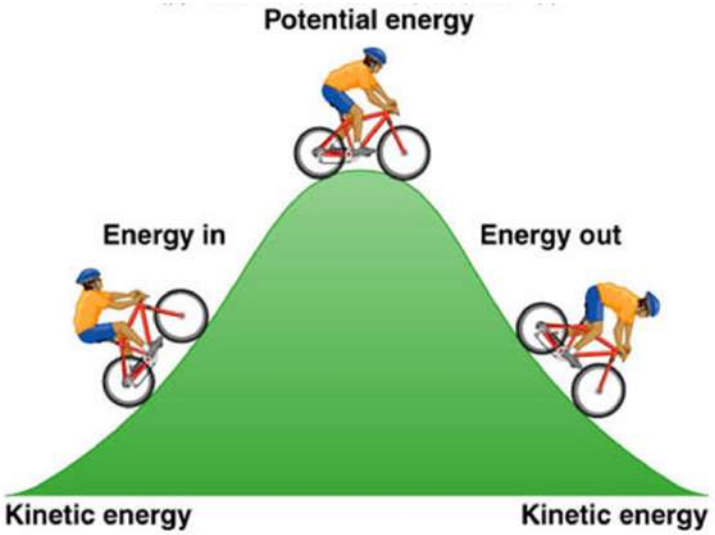
contrast situations where work is done with different amounts of force to situations where no work is done such as moving a box with a ramp and without a ramp, or standing still.

- **Work = Force x Distance or W = F x D**
- The pink box is lifted to the same position in three different ways, since the box started and ended at the same position, the **same amount of work** is done in each scenario.



compare and contrast potential and kinetic energy;

- Potential energy is stored energy
- Kinetic Energy is the energy of motion
- The rider has kinetic energy and it is transferred to potential energy as he goes up the hill
- As he comes down hill the potential energy is transferred into kinetic energy



calculate average speed using distance and time measurements;

- Speed = distance ÷ time
- Its on the formula chart

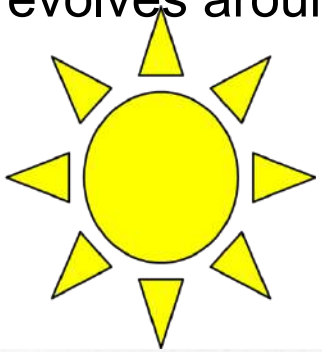
measure and graph changes in motion.

demonstrate energy transformations such as energy in a flashlight battery changes from chemical energy to electrical energy to light energy.

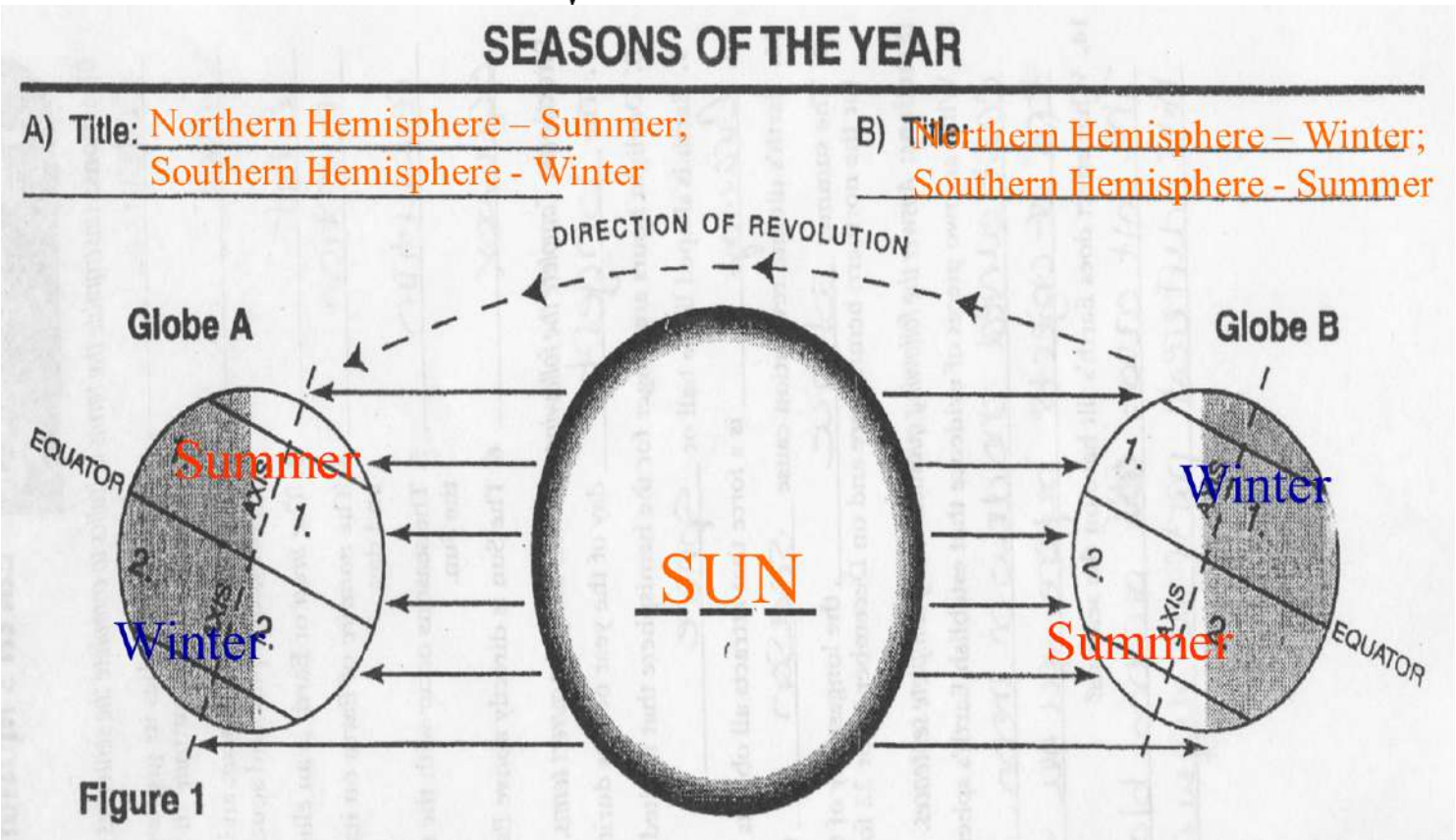
- Energy can not be created or destroyed it can only change form.
- One type of energy can change into another type. Often some energy is lost in the form of heat.

Earth and Space

model and illustrate how the tilted Earth rotates on its axis, causing day and night, and revolves around the Sun causing changes in seasons;



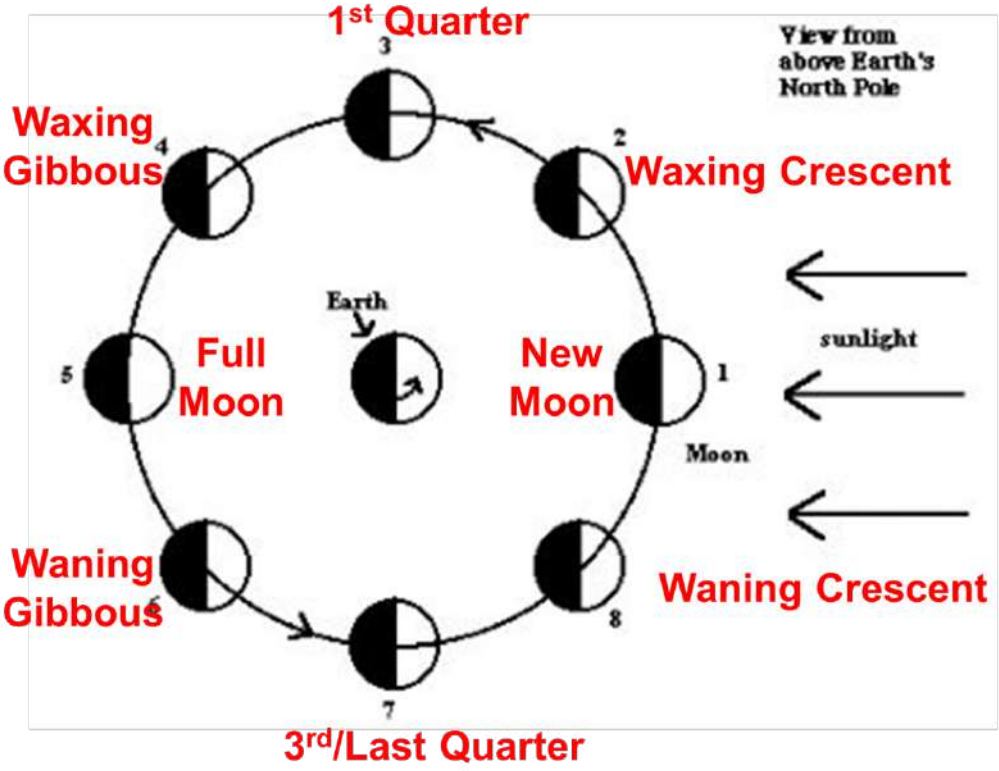
As Earth rotates on it's axis every 24 hours, the side of Earth facing the sun is in day the side facing away is in night



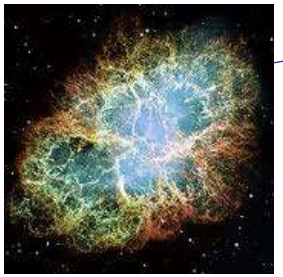
Earth's tilt and its revolution around the sun cause the seasons

demonstrate and predict the sequence of events in the lunar cycle;

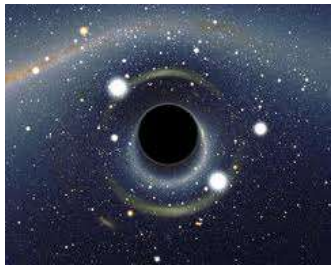
- It takes the moon about 28 days to revolve around the Sun
- It take 14 days to go half way around
- It takes about 7 days to go a quarter of the way around

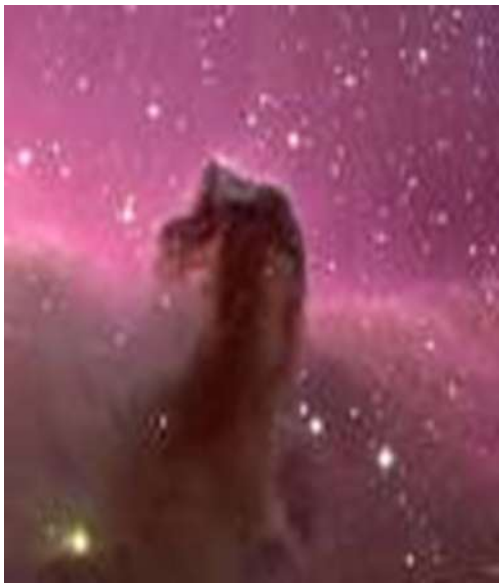


describe components of the universe, including stars, nebulae, and galaxies, and use models such as the Hertzsprung-Russell diagram for classification;

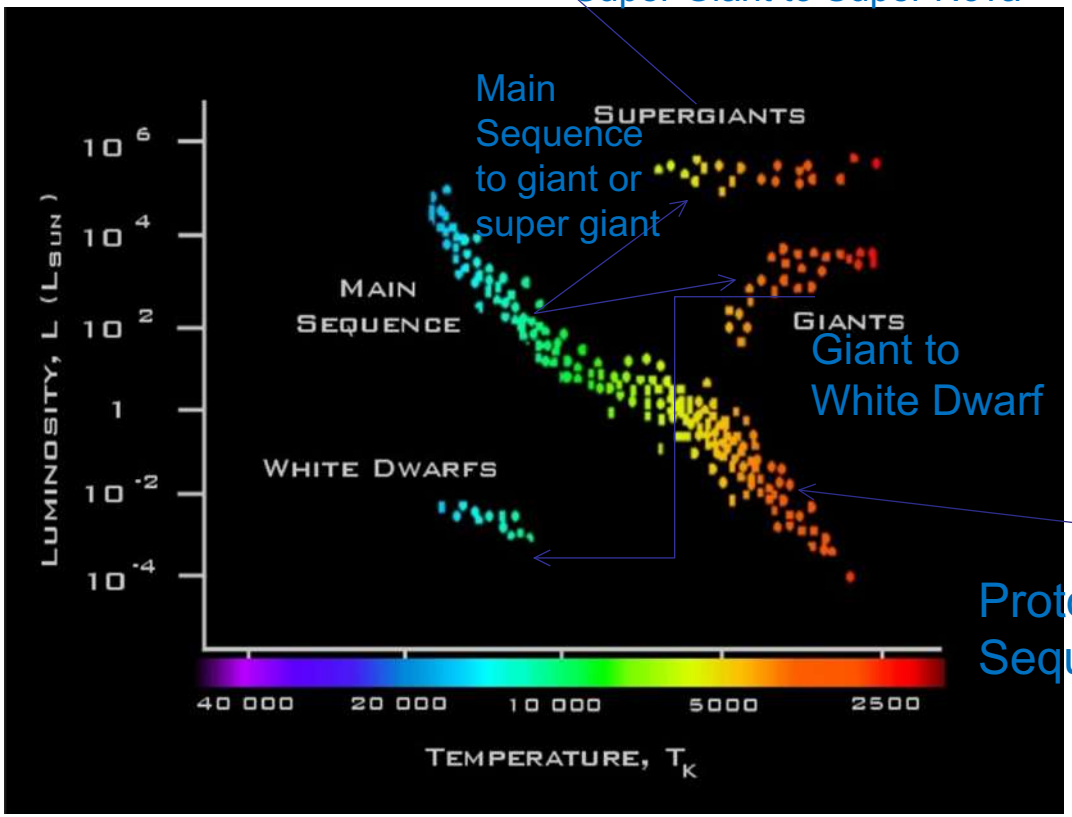


Super Nova to Black hole or forms a new nebula





Super Giant to Super Nova

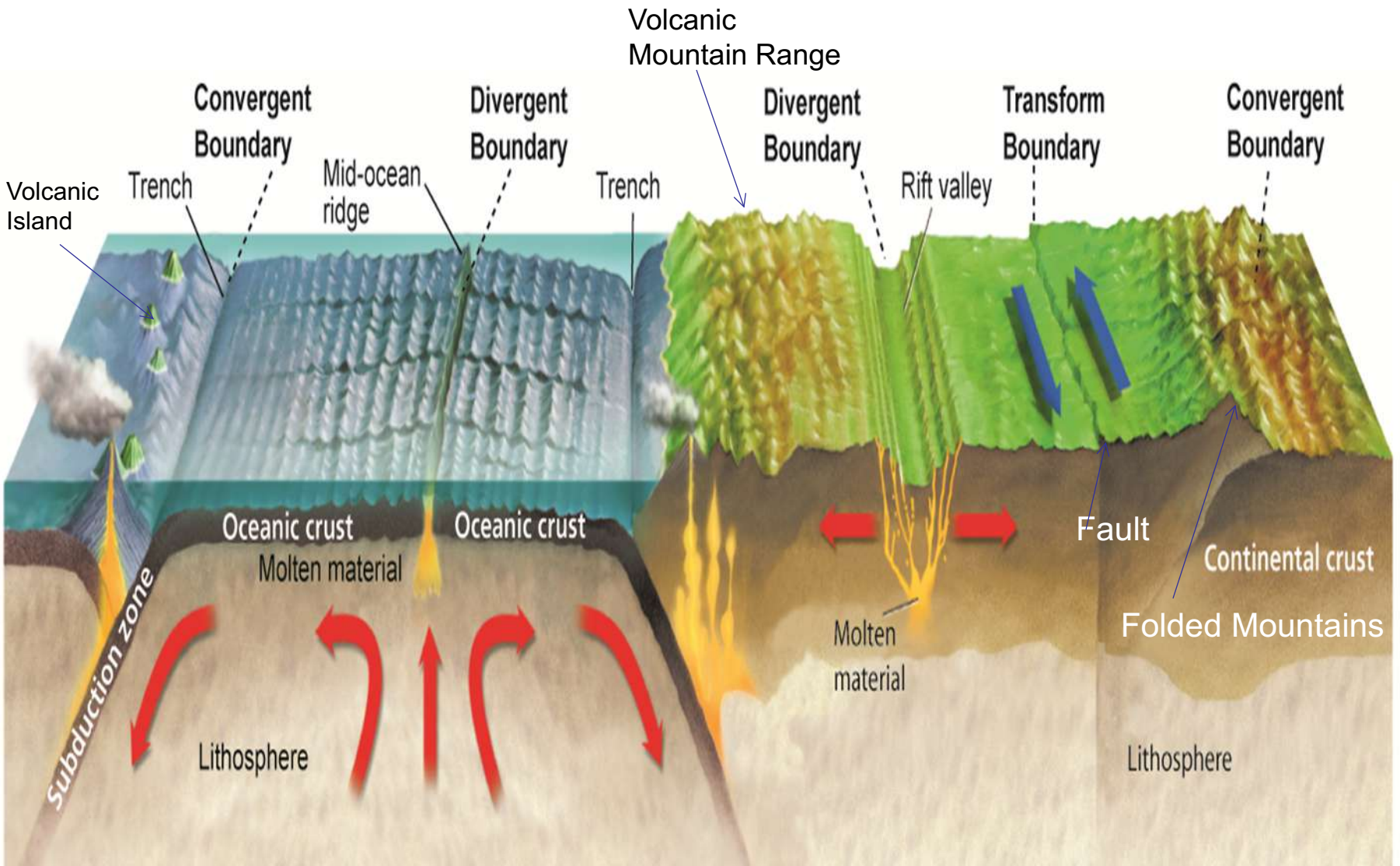


Protostar to Main Sequence

Nebula – gas and dust and star nursery

Protostar – star that is forming in a nebula

relate plate tectonics to the formation of crustal features

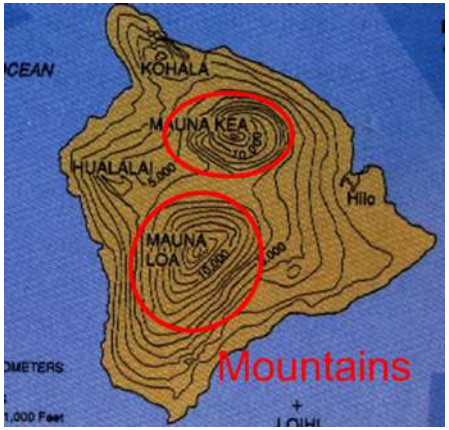


interpret topographic maps and satellite views to identify land and erosional features and predict how these features may be reshaped by weathering.

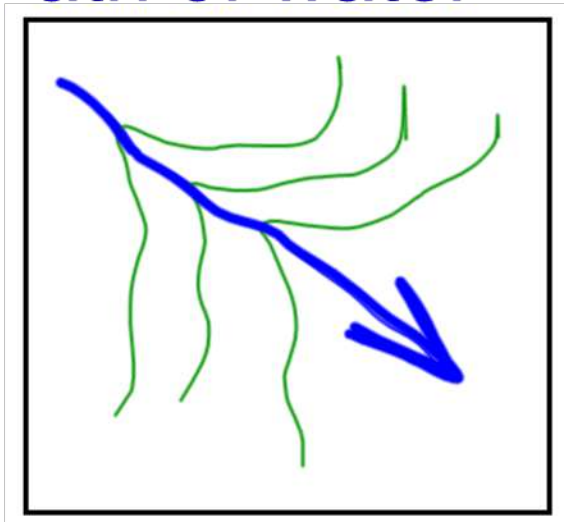
Closed loops usually indicate a hill or mountain

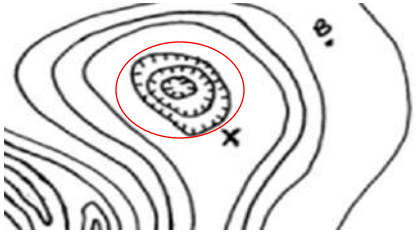
Sharp pointed V's indicate streams or a valley and always point uphill

Tick marks in closed circles represent depressions like sink holes or volcanoes

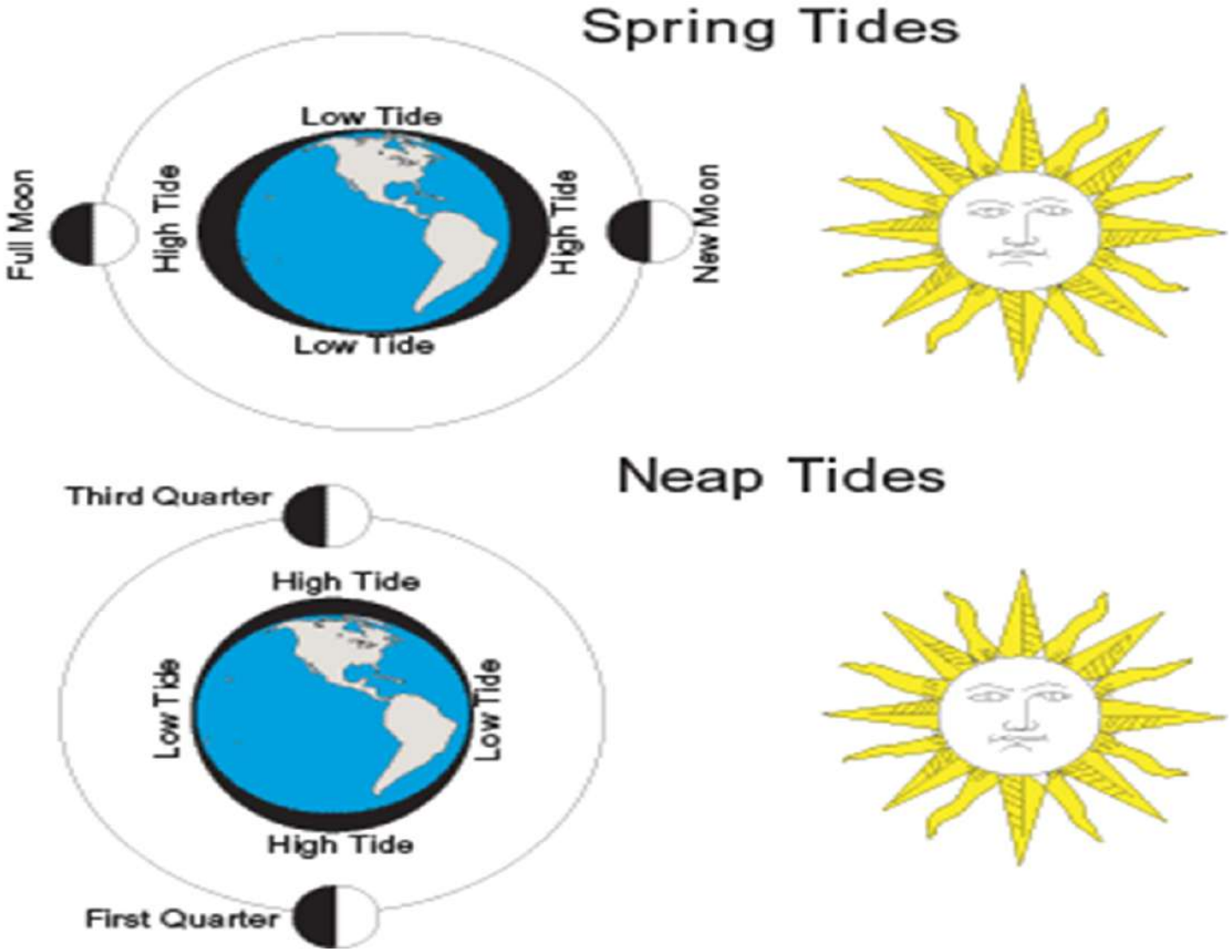


Path of water



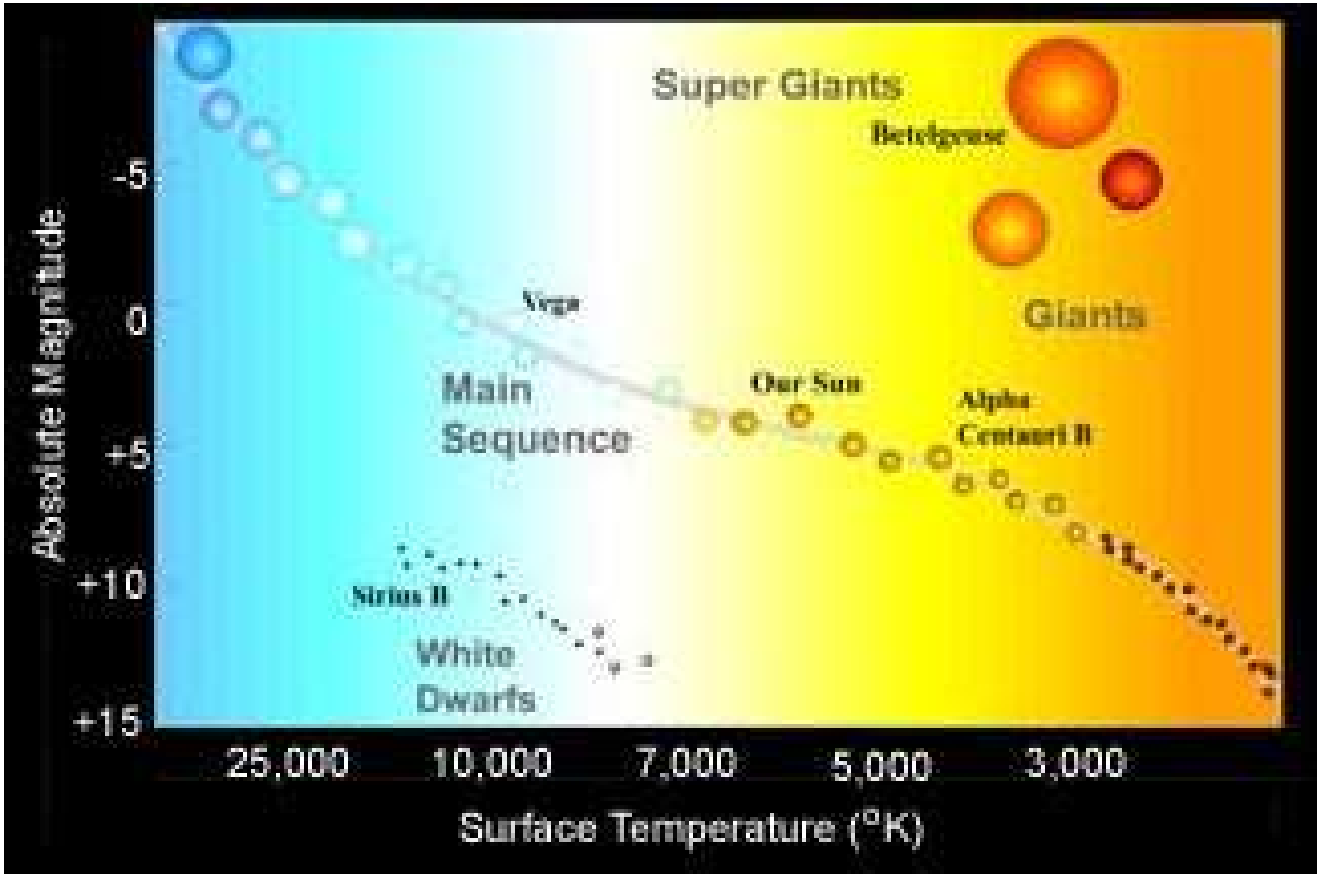


relate the position of the Moon and Sun to their effect on ocean tides.



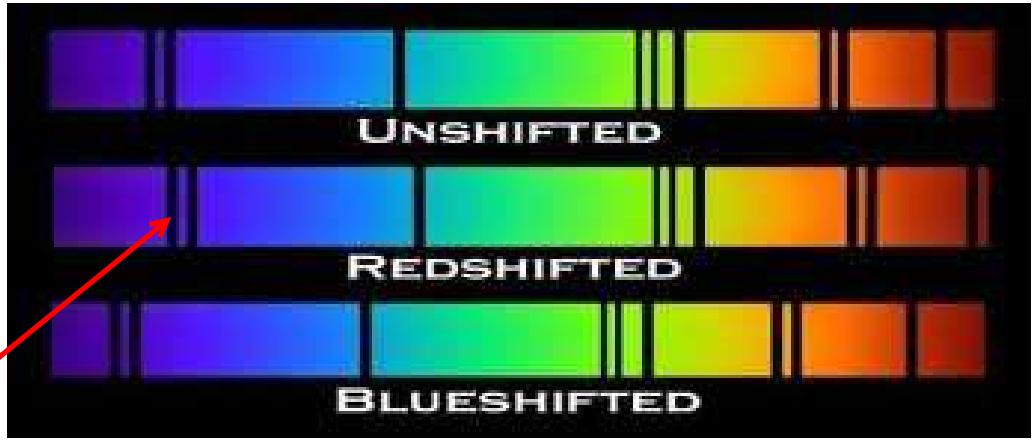
recognize that the Sun is a medium-sized star near the edge of a disc-shaped galaxy of stars and that the Sun is many thousands of times closer to Earth than any other star;

- Look at where the sun is on the HR Diagram



explore how different wavelengths of the electromagnetic spectrum such as light and radio waves are used to gain information about distances and properties of components in the universe; and

- Red Shift – a shift towards the red spectrum of light – object is moving away
- Blue Shift – Shift towards the blue spectrum of light – object is getting closer



- Spectral lines show what a star is made of.

model and describe how light years are used to measure distances and sizes in the universe.

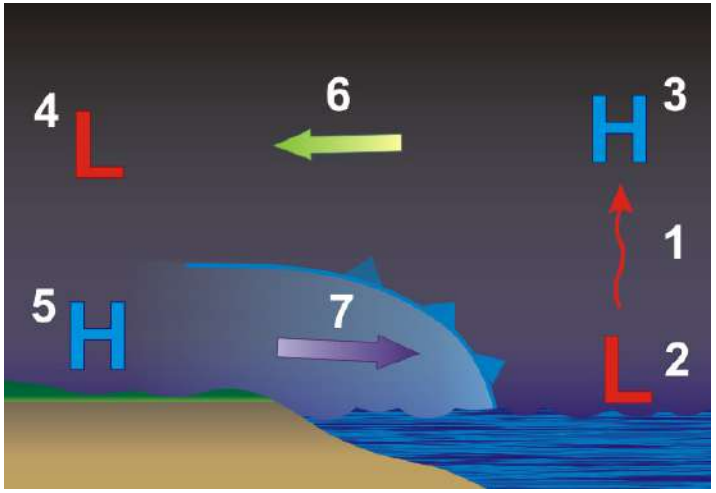
- A light year is **5,865,696,000,000 miles** (9,460,800,000,000 kilometers). That's a long way!
- Equal to the distance light travels in a single year.
- If we look through a telescope at a star 100 light years away, we see the light that was released from it 100 years ago!!!!

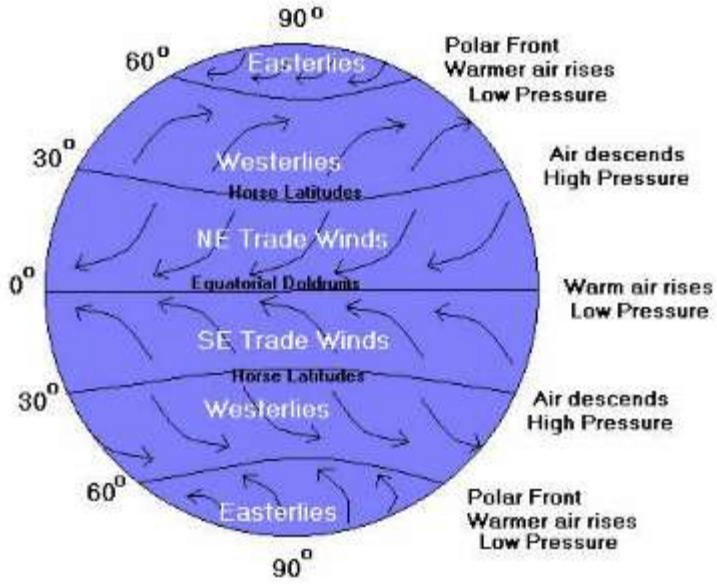
describe the historical development of evidence that supports plate tectonic theory;

- Alfred Wagner proposed Theory of Continental Drift in 1912.
  - The continent once formed a large landmass called Pangaea that broke apart and “Drifted” to their current location
- Henry Hess proposed Theory of Seafloor Spreading in 1958
  - The crust in parts of the Earth’s oceans is splitting apart allowing magma to rise to the surface forming new crust and pushing the ocean floor apart.
- Theory of Plate Tectonics
  - The Earth’s crust is broken into several large tectonic plates that are in constant motion due to convection currents in the Earth’s mantle

recognize that the Sun provides the energy that drives convection within the atmosphere and oceans, producing winds and ocean currents;

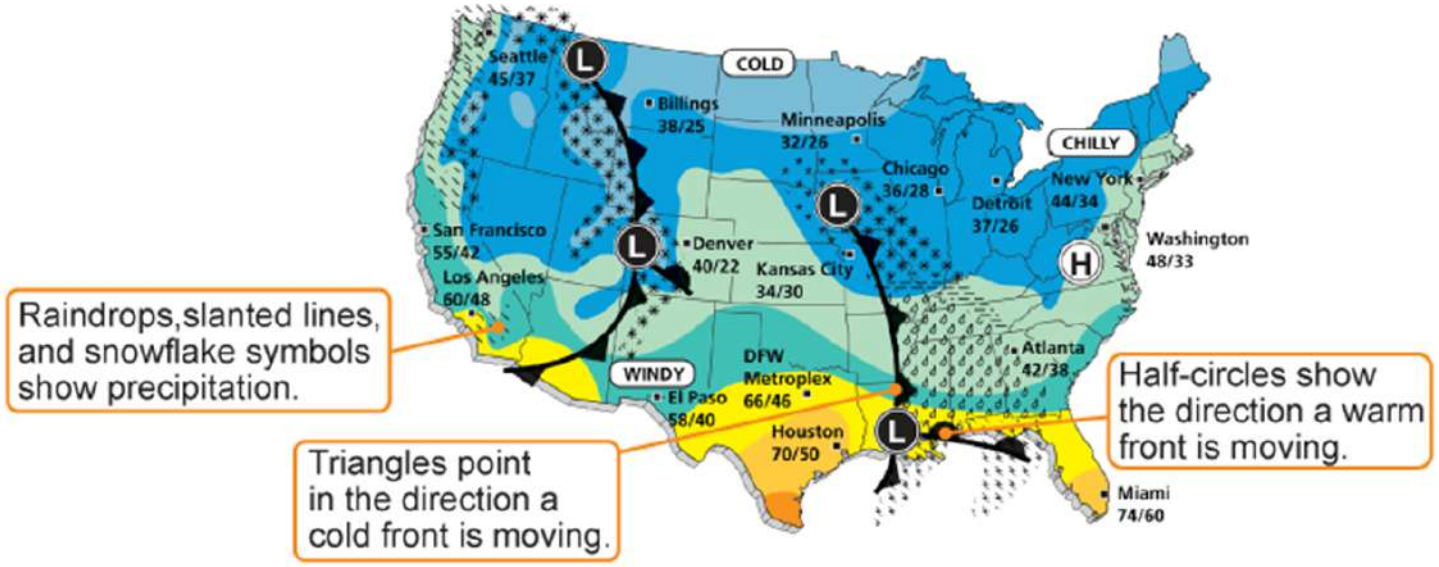
- At night, the land temperature falls to below that of the ocean and becomes less dense. Therefore it begins to rise (1, above right). The rising air creates a weak low pressure area due to a decrease in air mass at the surface (2). As the air cools, it begins to collect resulting in an increase in pressure, creating a "high" (3). These differences in pressures over the water, both at the surface and aloft are greater than the differences in pressures over land at the same elevations over land (4 and 5). Therefore, as the atmosphere seeks to reestablish the equal pressure both onshore and offshore, two high pressure to low pressure airflows develop; the onshore flow aloft (6) and surface offshore, called the land breeze (7).





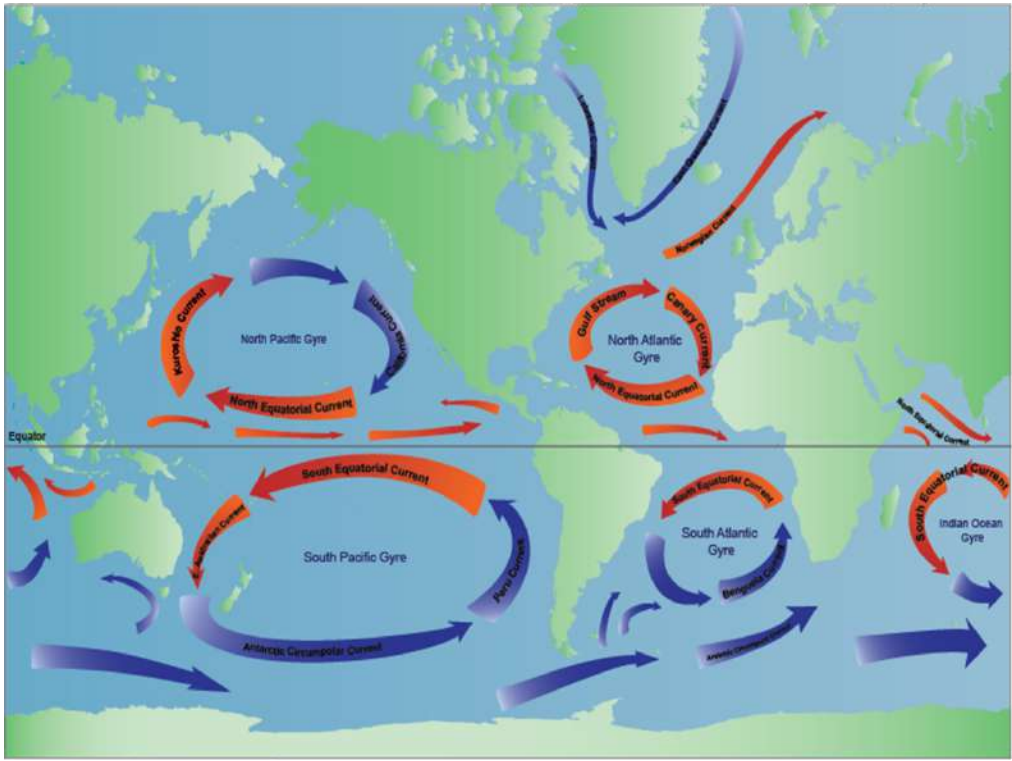
identify how global patterns of atmospheric movement influence local weather using weather maps that show high and low pressures and fronts;

- A **low-pressure area,** or cyclone, forms when air spirals into a weather system. A low pressure area brings stormy weather into a region.
- A **high-pressure area,** or anticyclone, forms when air spirals outward from the center of a weather system. A high pressure area brings fair weather into a region.
- Air flows from high to low pressure.



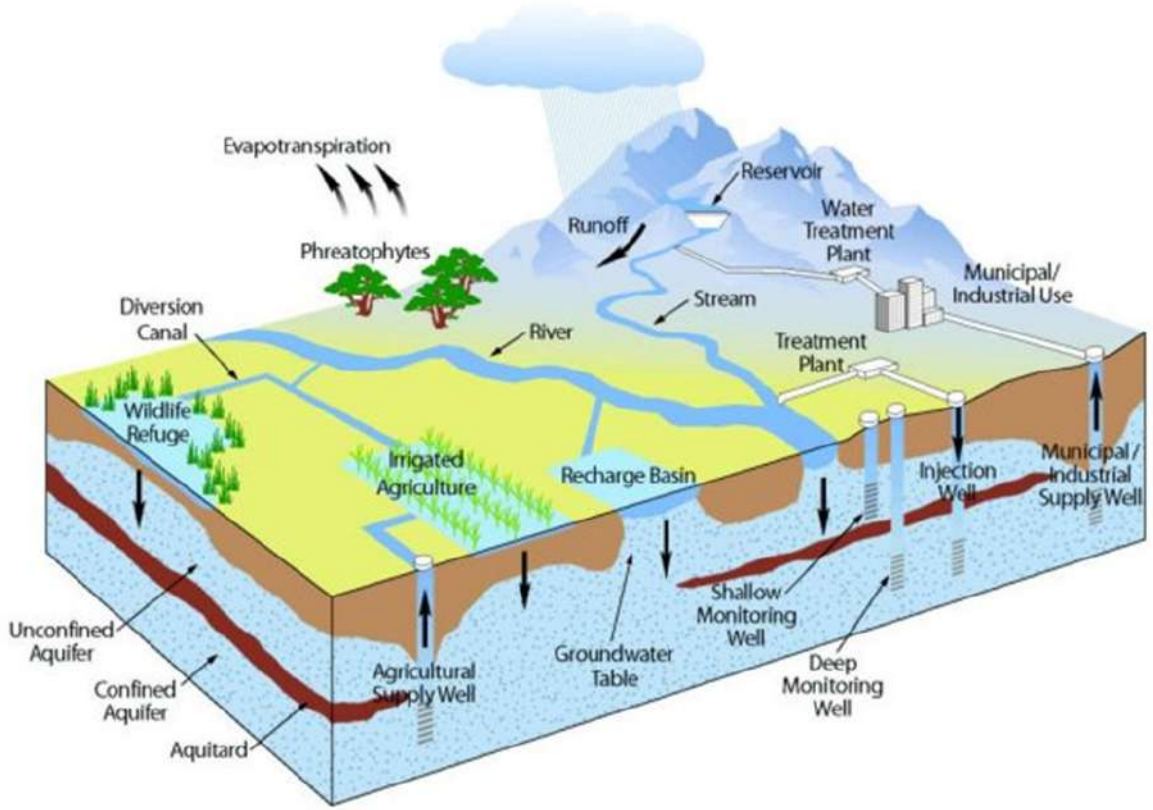
identify the role of the oceans in the formation of weather systems such as hurricanes.

- Ocean currents move warm water from the equator to poles and cold water from the poles to the equator.
- This brings warmer air up North.



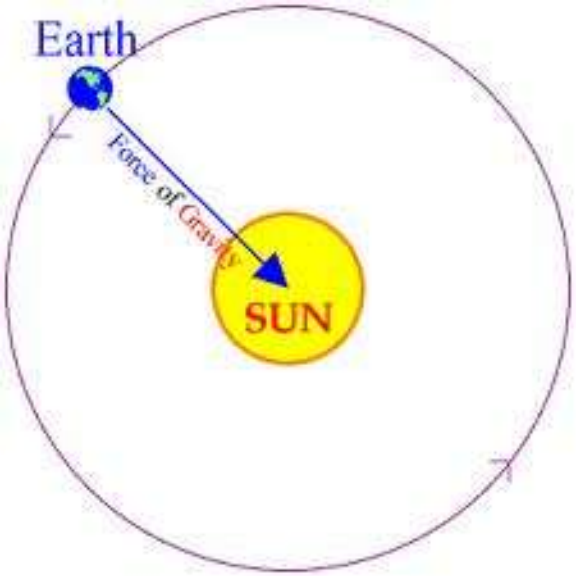
model the effects of human activity on groundwater and surface water in a watershed.

- Pollution from industry, homes, and agriculture can enter streams, lakes, and groundwater causing pollution.



understand that gravity is the force that governs the motion of our solar system.

- Gravity is a force that attracts objects to each other. The greater the mass of an object the greater its force of gravity.
- Gravity from the sun holds the planets in it orbit.



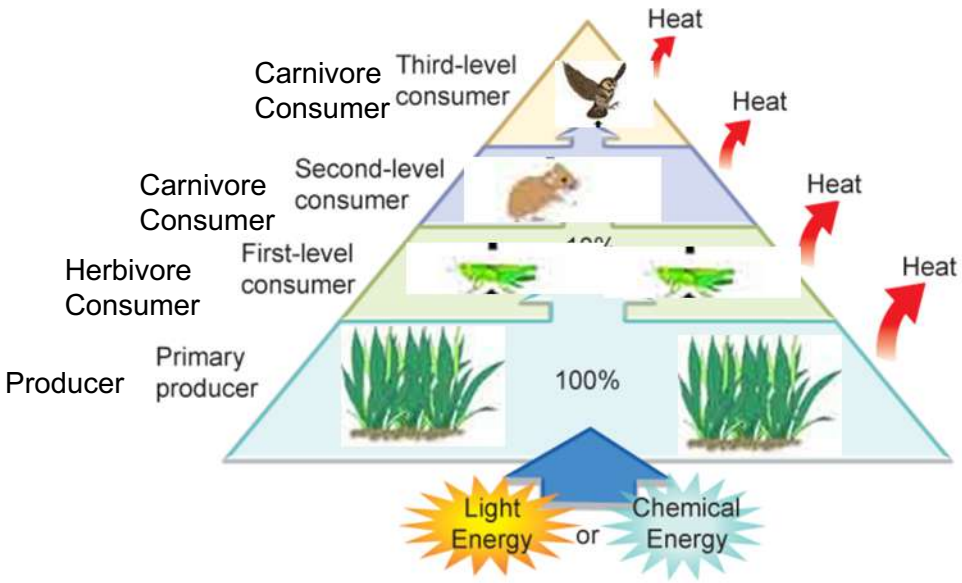
Organisms and Environments

describe producer/consumer, predator/prey, and parasite/host relationships as they occur in food webs within marine, freshwater, and terrestrial ecosystems;

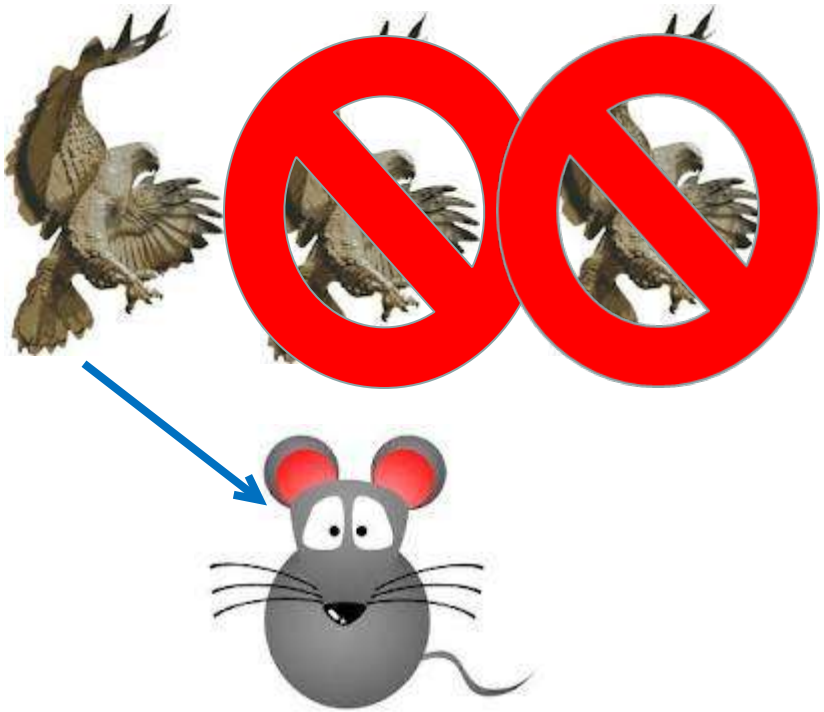
Parasite

Host

Predator **Prey**



investigate how organisms and populations in an ecosystem depend on and may compete for biotic and abiotic factors such as quantity of light, water, range of temperatures, or soil composition;

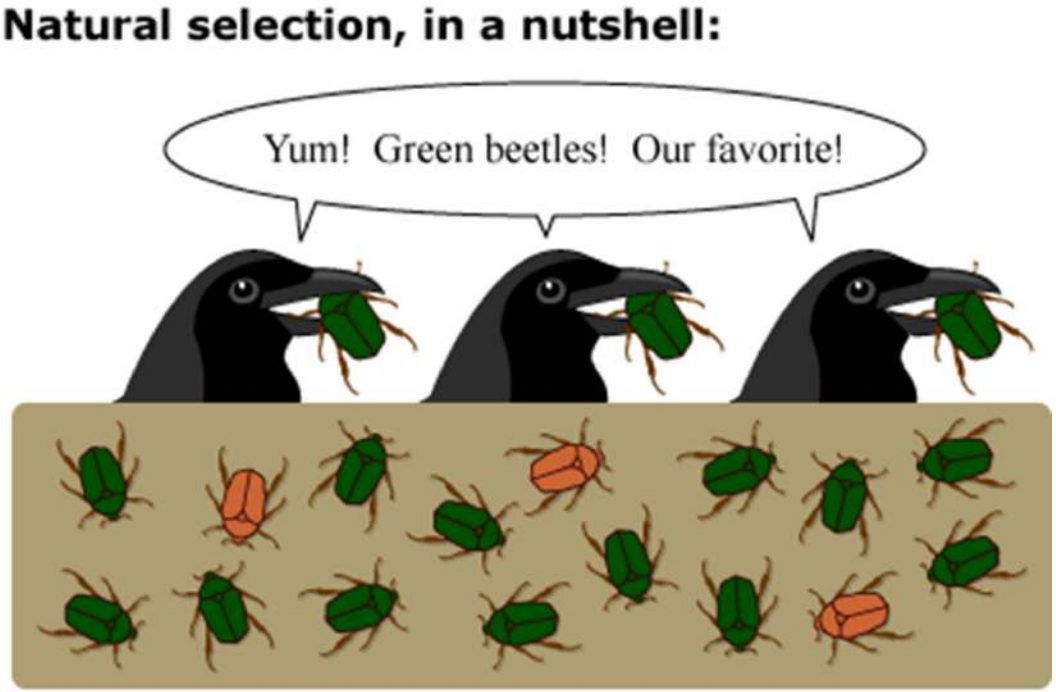


Three hawks want food. Only the ones best equipped to catch mice survive

The plants that grow faster are more likely to receive the light they need and survive

explore how short- and long-term environmental changes affect organisms and traits in subsequent populations;

- Organisms with traits that help them survive are more likely to live long enough to pass on traits to their offspring.

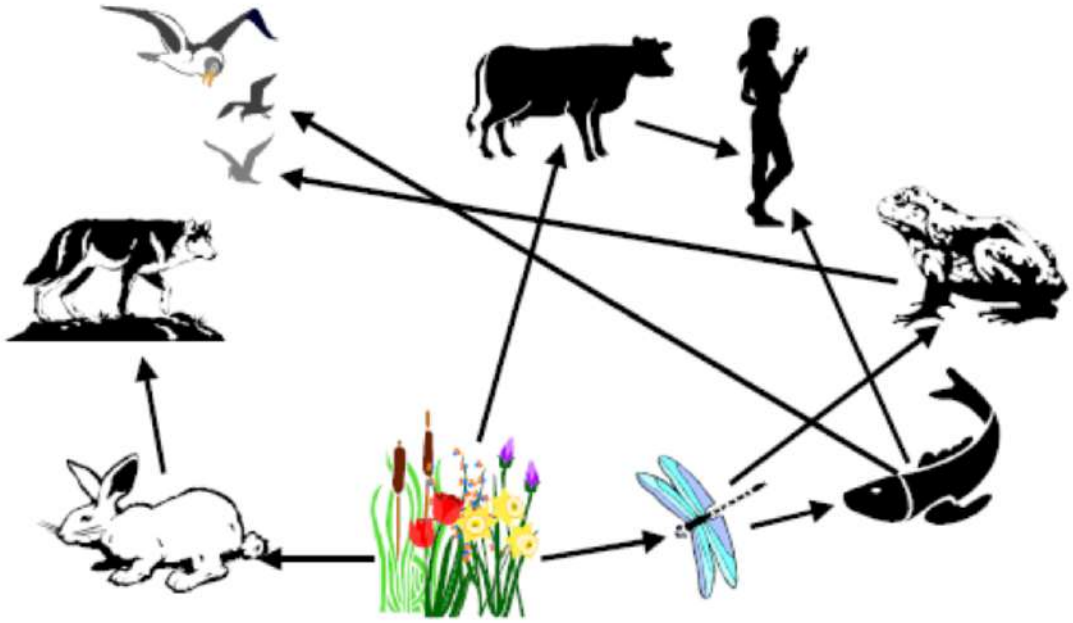


recognize human dependence on ocean systems and explain how human activities such as runoff, artificial reefs, or use of resources have modified these systems.

- Humans use resources from the ocean for food and medicine as well as in many products we use everyday.
- Pollution on land flows through groundwater, rivers and streams and reaches the ocean causing a decrease in the available resources we can get from the ocean.

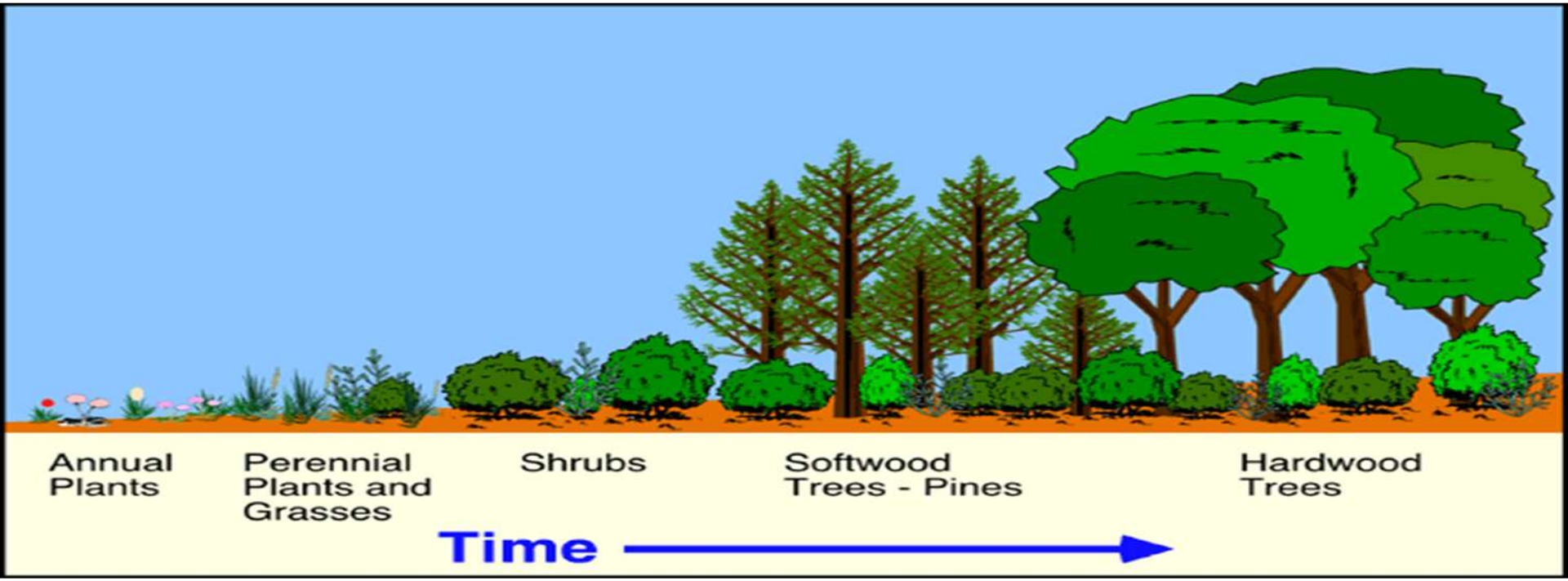
describe how biodiversity contributes to the sustainability of an ecosystem;

- Biodiversity means the richness and variety of life
- An ecosystem with a high level of biodiversity is more resistant to environmental change.
- The more links in a food web the more biodiversity and the more stable the ecosystem

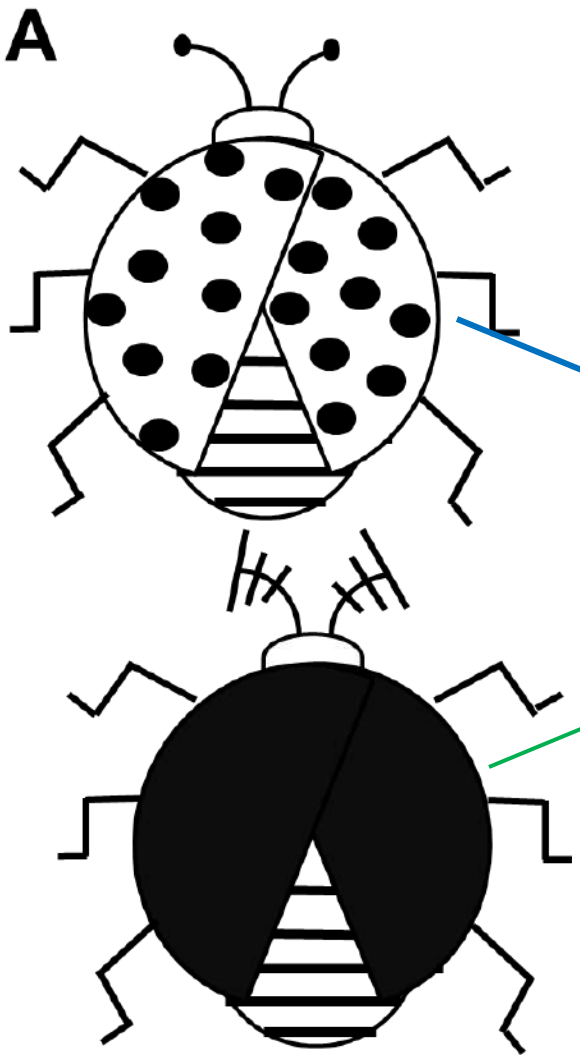


observe, record, and describe the role of ecological succession such as in a microhabitat of a garden with weeds.

- Succession - gradual replacement of populations in an area (**how barren land changes into a forest if left alone**)
- Primary Succession -Begins in a place **without any soil, or ROCK.** (After a volcanic eruption)
- Secondary Succession - Begins in a place that already has SOIL and was once the home of living organisms



examine organisms or their structures such as insects or leaves and use dichotomous keys for identification;



1. a. If the lady bug has feather like antennas….go to 2
   b. If the lady bug has knob antennas…..go to 4

2. a. Spotted wings present……***Ladea ashley***
   b. Solid wings present……..go to 3

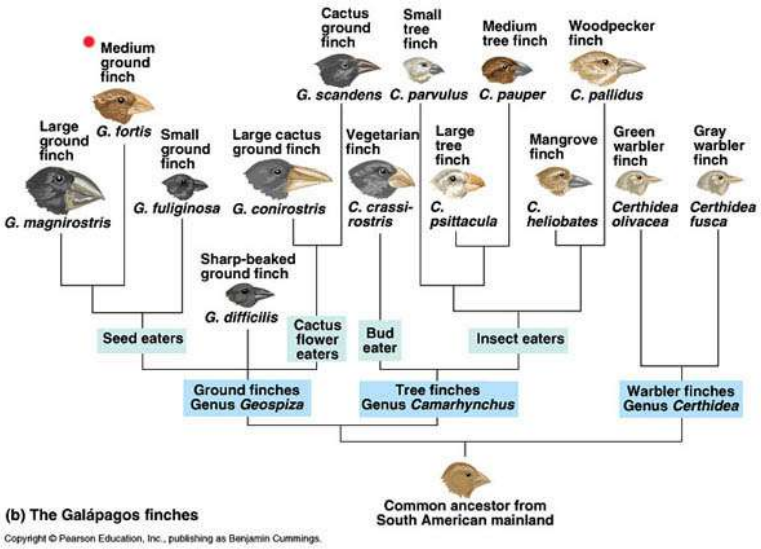
3. a. Has six legs……..***Ladea kaley***
   b. Has 4 legs……..***Ladea jessica***

4. a. Solid abdomen present….***Ladea elena***
   b. Stripes on abdomen……go to 5

5. a. Spotted wings……***Ladea rachel***
   b. Solid wings……..….***Ladea allison***

identify some changes in genetic traits that have occurred over several generations through natural selection and selective breeding such as the Galapagos Medium Ground Finch (*Geospiza fortis*) or domestic animals.

- From one common ancestor we have the variety of finches found on the Galapagos islands



- Over several generations the color of the pepper moth turned from white to black due to a change in the enviornment

identify the main functions of the systems of the human organism, including the circulatory, respiratory, skeletal, muscular, digestive, excretory, reproductive, integumentary, nervous, and endocrine systems;

Respiratory System • Inhales/breathes in oxygen – O_2 • Gets rid of waste/carbon dioxide – CO_2	**Digestive System** • Breaks down food • Absorbs nutrients/energy • Gets rid of waste (feces, methane gas)	**Excretory System** • Gets rid of waste (sweat, urine, feces, carbon dioxide)	**Nervous System** • Sends and receives messages • Controls thinking and senses • Regulates homeostasis
Muscular System • Aids in movement • Gives body shape • Aids in digestion, circulation, and respiration	**Circulatory System** • Transports material around the body • Fights infection	**Immune/Lymphatic System** • Fights infection • Expels foreign invaders by fever or vomit	**Urinary System** • Balances fluid levels • Filters/cleans the blood • Gets rid of waste (urine)
Integumentary System • Regulates temperature • Provides protection against infection, injury, UV Radiation • Gets rid of waste (sweat)	**Reproductive System** • Survival of species • Produce offspring	**Skeletal System** • Protects vital organs • Aids in movement • Supports • Produces red blood cells • Stores minerals	**Endocrine System** • Secrets hormones to regulate body growth an function • Fight or flight response •

differentiate between structure and function in plant and animal cell organelles, including cell membrane, cell wall, nucleus, cytoplasm, mitochondrion, chloroplast, and vacuole;

Organelle	Structure – physical properties, like shape and location	Function – job or role an organelle does for the cell	Found in what kind of cells?
Cell Wall	Rigid/stiff; surrounds plant cells	provides support, protection	Plant cells only
Cell Membrane	surrounds the cytoplasm	Allows certain things to enter and exit the cell	Both plant and animal cells
Cytoplasm	gel-like liquid that fills the cell	Provides suspension to organelles so they move around easier	Both plant and animal cells
Nucleus	houses chromosomes / DNA – the genetic code (heredity)	Control center	Both plant and animal cells
Mitochondrion (mitochondria-plural)	double membrane organelle with inner folds	Powerhouse of the cell; it releases energy (ATP)	Both plant and animal cells
Vacuole	much larger in plant cells than animal cells	Storage site of mainly water, but can store nutrients and waste	Plant cellss have a large vacuole, animal cells have several small vacuoles
Lysosome	small circular organelle that contains enzymes	Digest old cells parts; Rids the cell of waste	Both plant and animal cells
Chloroplast	Green; contains stacks of disc called thylackoids that contain chlorophyll	Site of photosynthesis; captures sunlight, then transform it into chemical energy/glucose	Plant cells only
Flagellum 	Long, tail - like structure	Aids in movement	Some animal cells and bacteria (unicellular organisms)
Cillia 	tiny hair -like projections	Aids in movement	Some animal cells and bacteria (unicellular organisms)

recognize that according to cell theory all organisms are composed of cells and cells carry on similar functions such as extracting energy from food to sustain life.

Cell Theory

- Cells are the basic building blocks of life.
- All organisms are made of 1 or more cells.
- Cells come from pre-existing cells.

compare the results of uniform or diverse offspring from sexual reproduction or asexual reproduction;

Asexual Reproduction

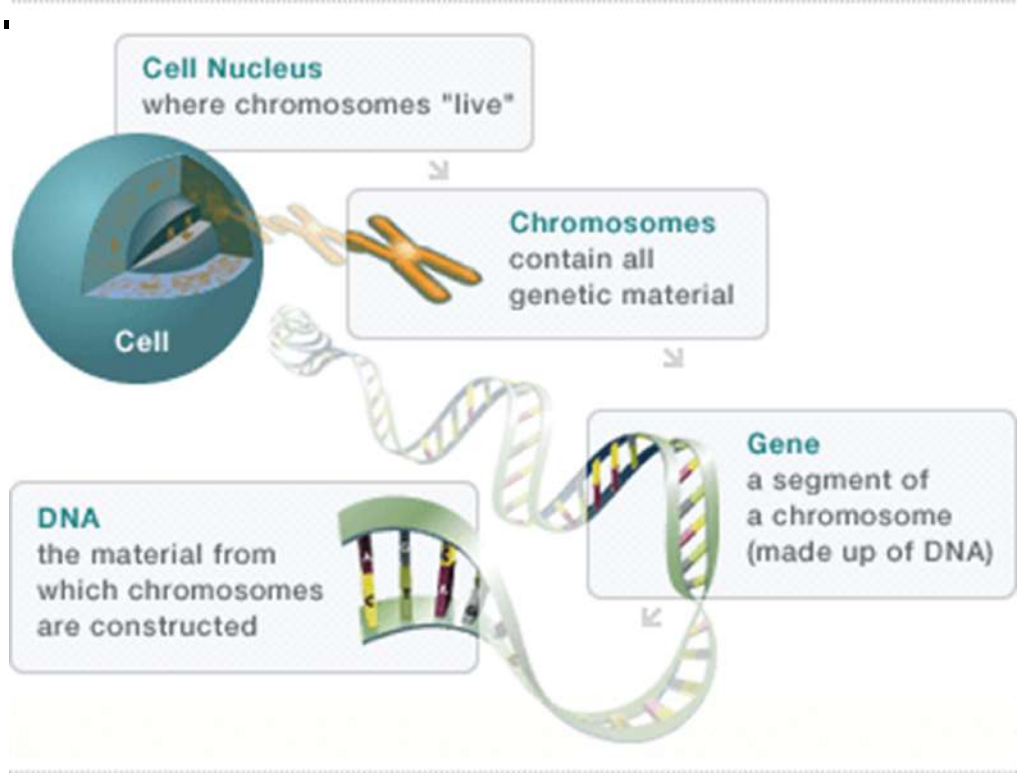
- In asexual reproduction there is only one parent.
- The offspring have exactly the same traits– they are clones.

Sexual Reproduction

- In sexual reproduction there are always two parents.
- The offspring, or children, share traits from both their parents.
- Traits are the distinguishing characteristics formed from the genetic information of individuals

recognize that inherited traits of individuals are governed in the genetic material found in the genes within chromosomes in the nucleus.

- Traits are inherited through genes located on the DNA that makes up a chromosome and is located in the nucleus of all the cells of the body.



identify the basic characteristics of organisms, including prokaryotic or eukaryotic, unicellular or multicellular, autotrophic or heterotrophic, and mode of reproduction, that further classify them in the currently recognized Kingdoms.

DOMAIN	Bacteria	Archaea	Eukarya			
KINGDOM	Bacteria	Archaea	Protists	Fungi	Plants	Animals
CELL TYPE	Prokaryotic	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic
NUMBER OF CELLS	Unicellular	Unicellular	Most unicellular, some multicellular	Most multicellular, some unicellular	Multicellular	Multicellular
FOOD SOURCE	Autotroph or heterotroph	Autotroph or heterotroph	Autotroph or heterotroph	Heterotroph	Autotroph	Heterotroph
REPRO-DUCTION	Asexual	Asexual	Most asexual	Asexual and sexual	Asexual and sexual	Most sexual, some asexual