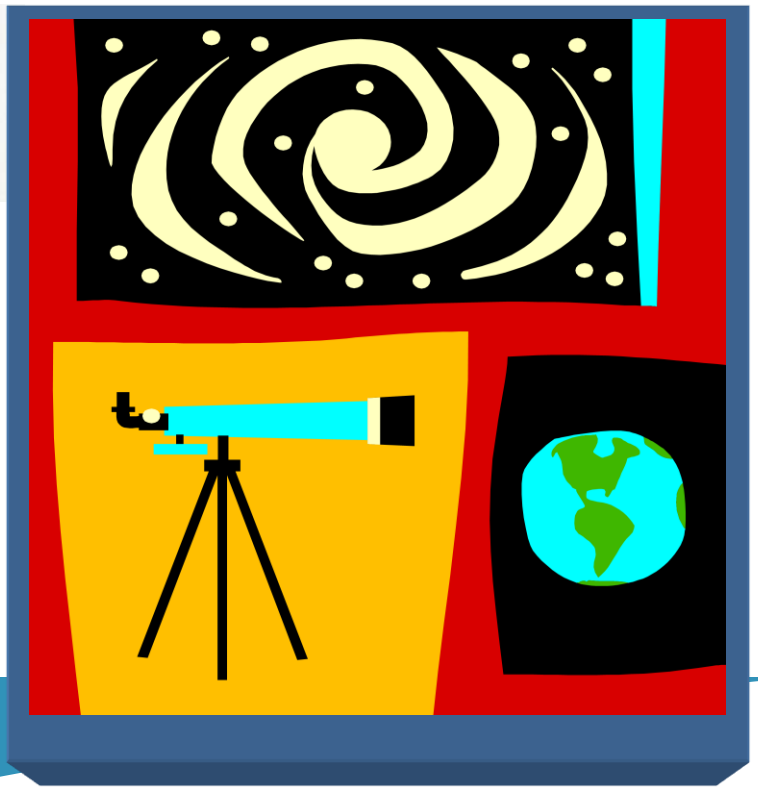
SCIENCE



NGSSS SCIENCE SUPPLEMENTAL RESOURCES

STUDENT PACKET

GRADE 8
14: STUDY GUIDE AND ASSESSMENT

OFFICE OF ACADEMICS AND TRANSFORMATION

text]

2015 – 2016

TABLE OF CONTENTS

Big Ideas and Background Information

BIG IDEA 1: THE PRACTICE OF SCIENCE

A. Scientific inquiry is a multifaceted activity; The processes of science include the formulation of scientifically investigable questions, construction of investigations into those questions, the collection of appropriate data, the evaluation of the meaning of those data, and the communication of this evaluation.
B. The processes of science frequently do not correspond to the traditional portrayal of "the scientific method."
C. Scientific argumentation is a necessary part of scientific inquiry and plays an important role in the generation and validation of scientific knowledge.
D. Scientific knowledge is based on observation and inference; it is important to recognize that these are very different things. Not only does science require creativity in its methods and processes, but also in its questions and explanations.

Science is not just a list of facts and laws. Science is always in motion. One of the principles of scientific study is that knowledge is available to all people and any scientific study is open to criticism or testing by other scientists.

No scientific knowledge provides the whole "truth." Instead, knowledge is tested and added to what scientists have learned in the past. This is why the efforts of scientists that made observations hundreds and even thousands of years ago are still very important. When a scientist makes a discovery, it is usually termed that he or she is "standing on the shoulders of giants." This means that the scientist could not have made this discovery without using the knowledge gained by many scientists in the past.

Another way that past scientific knowledge is important is because it allows new scientists to look at older studies and knowledge with fresh perspective. Many scientific discoveries are made by scientists who study older scientific theories and then offer new ideas.

http://depositphotos.com

Replication – by others

http://www.education.com

Scientists use controlled experiments to test ideas and hypotheses. A controlled experiment seeks to keep all factors, or variables, the same except for the factor that is being tested. All the parts of the experiment that must stay constant are called constant variables. If constant variables are allowed to change, the results of the experiment may not be valid.

The test variable/independent variable is the factor that the scientist changes in order to test the hypothesis. For example, if a scientist wants to test whether a certain type of fuel releases less air pollution in a car, the fuel type is the independent variable. To test this, the scientist needs to control the other variables, such as the type of car, the amount of fuel used, etc.

The outcome variable/dependent variable is the factor that is measured by the scientist. In the example above, the amount of air pollution released by the cars using different fuels is the dependent variable.

http://www.explorable.com

BIG IDEA 2: THE CHARACTERISTICS OF SCIENTIFIC KNOWLEDGE

A. Scientific knowledge is based on empirical evidence, and is appropriate for understanding the natural world, but it provides only a limited understanding of the supernatural, aesthetic, or other ways of knowing, such as art, philosophy, or religion.
B. Scientific knowledge is durable and robust, but open to change.
C. Because science is based on empirical evidence it strives for objectivity, but as it is a human endeavor the processes, methods, and knowledge of science include subjectivity, as well as creativity and discovery.

It is important for all scientists to keep honest records of their investigations and to report their findings. Scientists must provide all of the data they collected, even if it does not support their hypothesis.

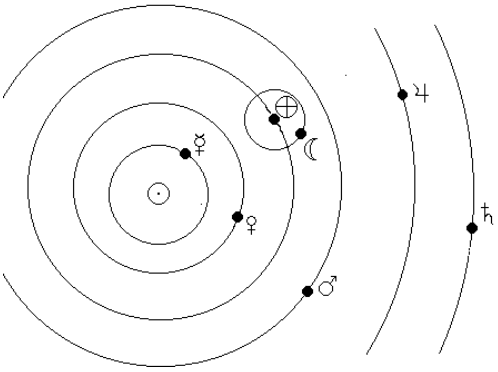
It is also important for other scientists to review the investigation and make criticisms. For this reason, a scientific investigation is not considered valid until it has been published in a reputable science magazine. At that point, other scientists can determine if the investigation was conducted correctly and if the data was interpreted in a fair way. Other scientists may also conduct the investigation for themselves to see if they get similar results.

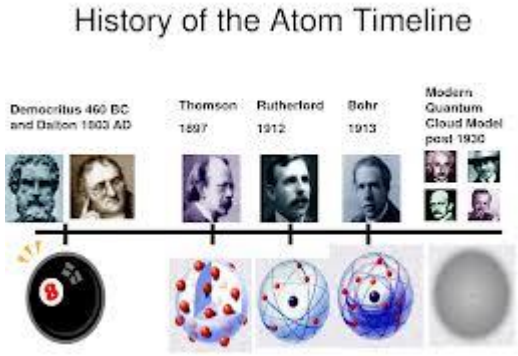
Scientists who do not keep good records or are not honest about data are not conducting good science. Their results cannot be trusted, and may create confusion or errors.

BIG IDEA 3: THE ROLE OF THEORIES, LAWS, HYPOTHESES, AND MODELS

The terms that describe examples of scientific knowledge, for example; "theory," "law," "hypothesis," and "model" have very specific meanings and functions within science.

Heliocentric Solar System Model



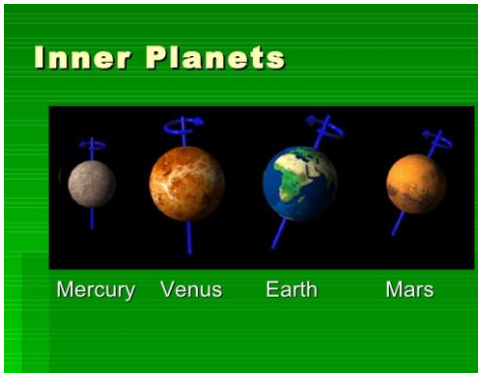


BIG IDEA 4: SCIENCE AND SOCIETY

As tomorrow's citizens, students should be able to identify issues about which society could provide input, formulate scientifically investigable questions about those issues, construct investigations of their questions, collect and evaluate data from their investigations, and develop scientific recommendations based upon their findings.

BIG IDEA 5: EARTH IN SPACE AND TIME

The origin and eventual fate of the Universe still remains one of the greatest questions in science. Gravity and energy influence the formation of galaxies, including our own Milky Way Galaxy, stars, the planetary systems, and Earth. Humankind's need to explore continues to lead to the development of knowledge and understanding of the nature of the Universe.



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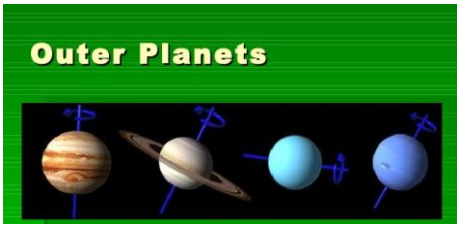
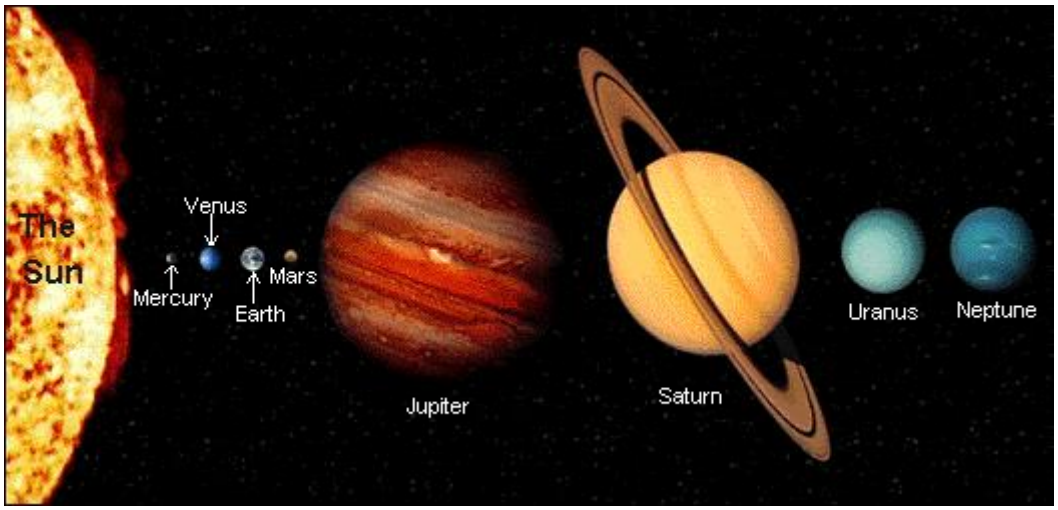


Jupiter Saturn Uranus Neptune
(Images NOT to SCALE)

The solar system is made up of all the objects that orbit our Sun. The Sun is easily the largest object in the solar system.

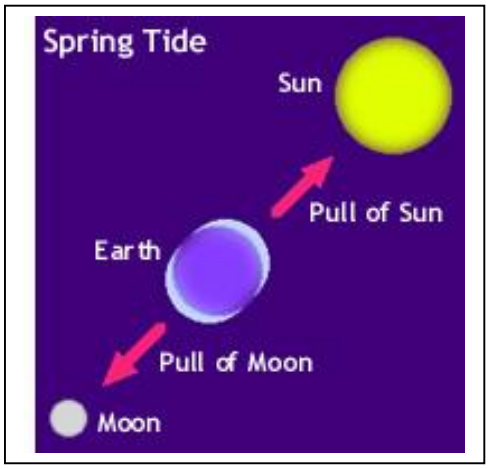
To the right is an image that shows the relative sizes of the planets and the Sun.



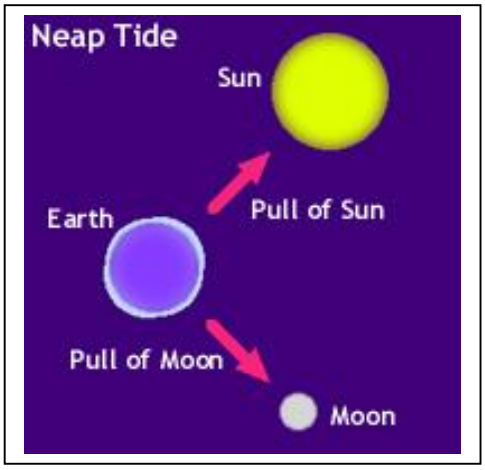
Relative sizes of the planets and the sun – Distances NOT to scale

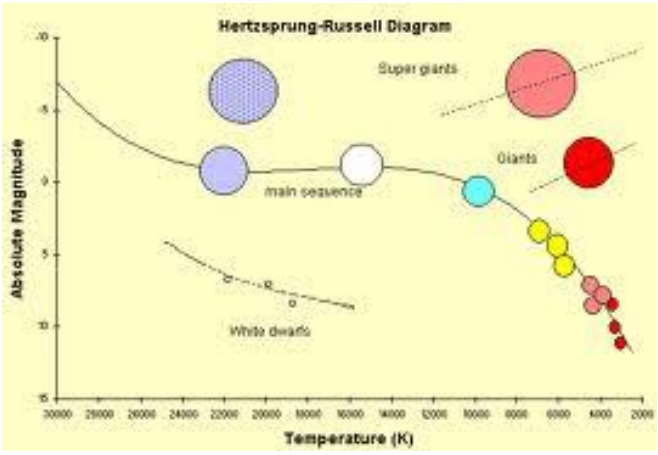
The moons of each planet are much smaller than the planets themselves. Almost all moons are thought to come from the same material as the planets they orbit. Remember that most of the inner planets in our solar system are small and rocky, while most of the outer planets are very large and are made of gases.

Earth-Sun-Moon Interactions: Moon Phases and Tides



Moon Phases





http://www.kcvs.ca

http://www.museumscience.org/oceans/motion/tides.html

All stars in our universe are basically made of hydrogen that is fusing to become helium. However, stars can be different sizes, colors, temperatures, and ages. They often have different characteristics because of these differences. The color of a star varies from red to blue, as the star becomes hotter. Our sun is a very average star in most respects. It is slightly above average in size. The smallest stars may be as small as 1/12th the size of our sun and the largest may be thousands of times as massive.

APPARENT MAGNITUDE (BRIGHTNESS)

LUMINOSITY (ABSOLUTE BRIGHTNESS)

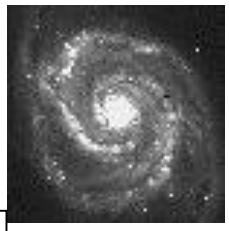
http://www.astrodidyouknow.blogspot.com

As stars age, they burns through their hydrogen fuel and eventually collapse into smaller forms called a White Dwarfs. If the star is more massive, it may explode into a supernova before collapsing into a neutron star. However, if a star is very massive, it may instead for a black hole after collapsing. Many things can affect how a star appears from Earth. A star that looks smaller than another star may actually be larger, but farther away.

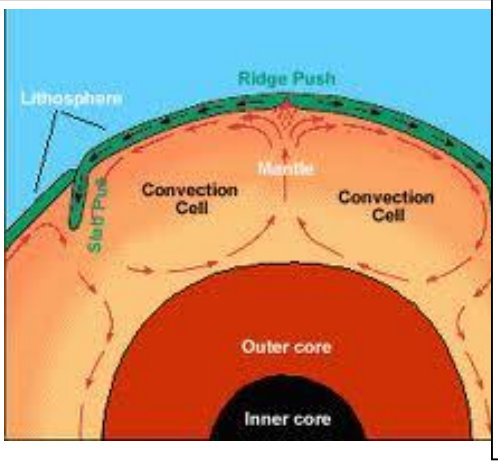
The Sun is the center of our solar system. Our solar system is one of billions, or even trillions, of stars in our Milky Way galaxy. A galaxy is a collection of stars that move as a group together. The universe is filled with millions of galaxies. These galaxies are held together by gravity. Galaxies generally come in either spiral or elliptical form, although many galaxies are also irregularly shaped. Elliptical galaxies are generally very young, and become spiral-shaped as they get older. Many spiral galaxies also develop “arms” or bars of stars that extend from the center of the galaxy. Most of the stars in a galaxy are located in the center of the galaxy. Our sun is located along the edge of the Milky Way Galaxy.

Elliptical Galaxy

Spiral Galaxy

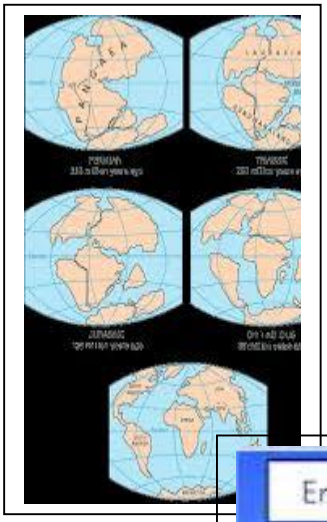


BIG IDEA 6: EARTH STRUCTURES



http://www.freewebs.com

Over geologic time, internal and external sources of energy have continuously altered the eatures of Earth by means of both constructive and destructive forces. All life, including human civilization, is dependent on Earth's internal and external energy and material resources.

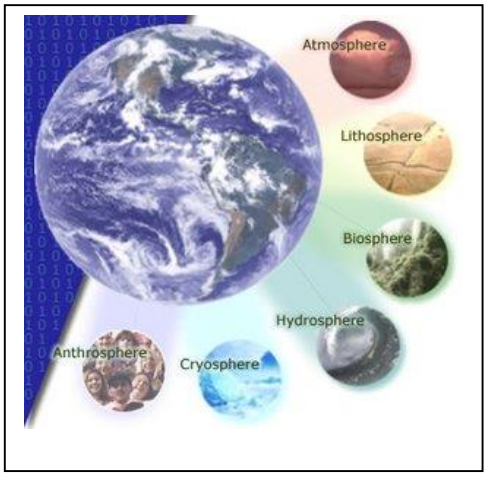


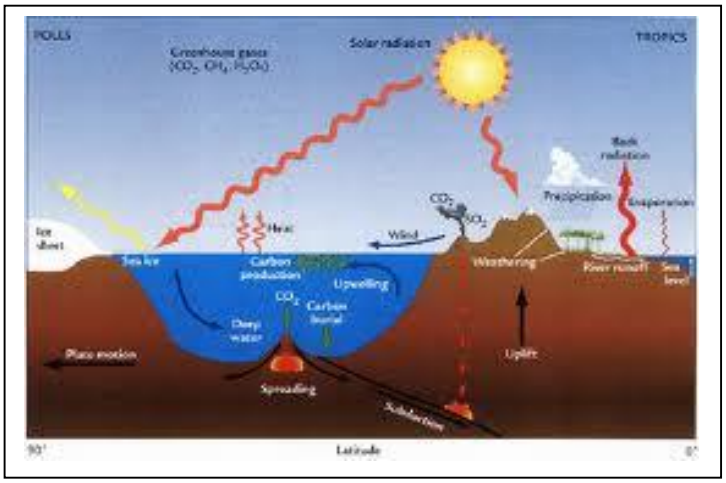
Earth's biosphere affects the lithosphere in many ways. The main way that organisms affect the lithosphere is through the relationship that plants have with the soil. Plants hold soil together with their roots. They also cycle nutrients through the soil. Plants create organic carbon by fixing carbon dioxide in the air and converting it to food and organic material. This material is used by many organisms, such as insects and worms, which live in the soil. Almost all organisms contribute organic material to the soil when they die and decompose.

When you look at Earth's surface, you should recognize the role that erosion and deposition play in changing its shape. Erosion is the wearing down of soil and rock. Deposition occurs when material accumulates in another location. Most erosion and deposition is done by water or wind. Wind is responsible for shaping some of Earth's surface, but wind tends to act more slowly and less dramatically. Water can move materials quickly because it typically has a stronger force and can dissolve minerals and soil. Water can also change state to take on the form of rain, snow, and ice that changes the landscape. For example, large ice glaciers have moved across the continents, like enormous bulldozers, creating flat lands and large lakes.

BIG IDEA 7: EARTH SYSTEMS AND PATTERNS

The scientific theory of the evolution of Earth states that changes in our planet are driven by the flow of energy and the cycling of matter through dynamic interactions among the atmosphere, hydrosphere, cryosphere, geosphere, and biosphere, and the resources used to sustain human civilization on Earth.



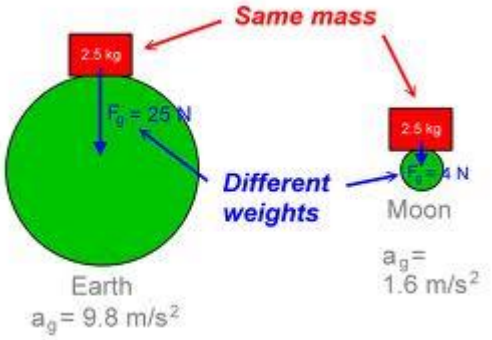


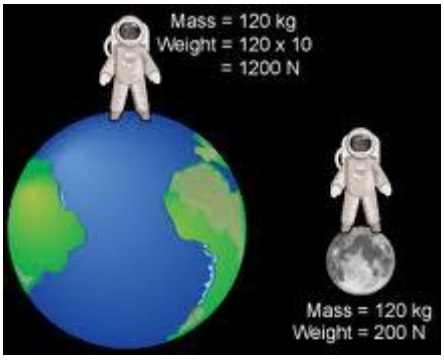
BIG IDEA 8: PROPERTIES OF MATTER

A. All objects and substances in the world are made of matter. Matter has two fundamental properties: matter takes up space and matter has mass which gives it inertia.

B. Objects and substances can be classified by their physical and chemical properties. Mass is the amount of matter (or "stuff") in an object. Weight, on the other hand, is the measure of force of attraction (gravitational force) between an object and Earth.

By grades 6-8, students are expected to understand the distinction between mass and weight, and use them appropriately.

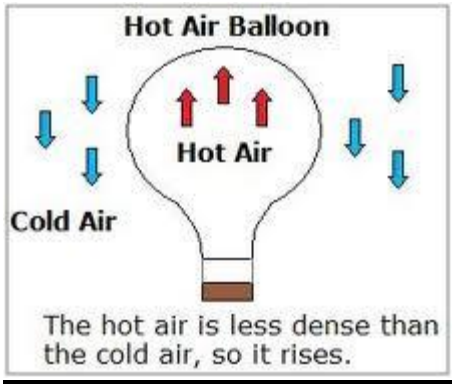


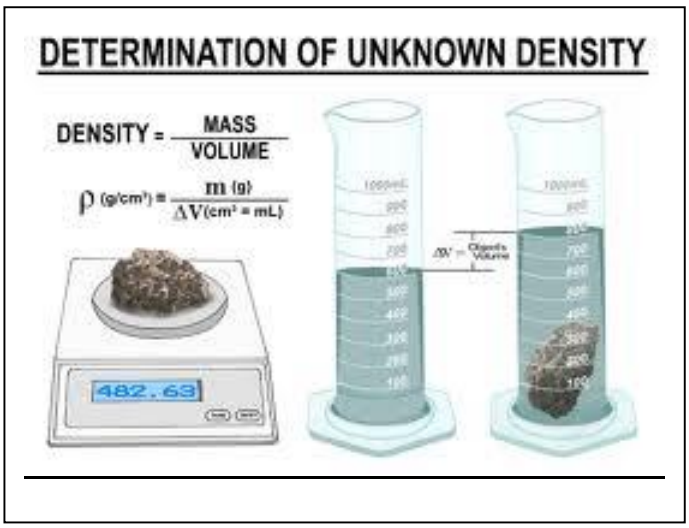


Substances can differ from each other in a variety of observable ways. You may be able to observe differences in color, size, shape, or texture merely by looking at two objects. Other differences may need to be measured. For example, the mass of an object is the measurement of how much material an object has. You would measure the mass of an object with a balance scale that gives the measurement in grams. The weight of an object can also be measured by a scale, but while the mass of an object remains the same no matter the location of the object, the weight of an object is a measure of the pull of gravity on the object, and can change depending on the location. Weight is usually measured in Newtons, since it is a measure of the force of gravity. Objects are also commonly defined by weight in terms of pounds.

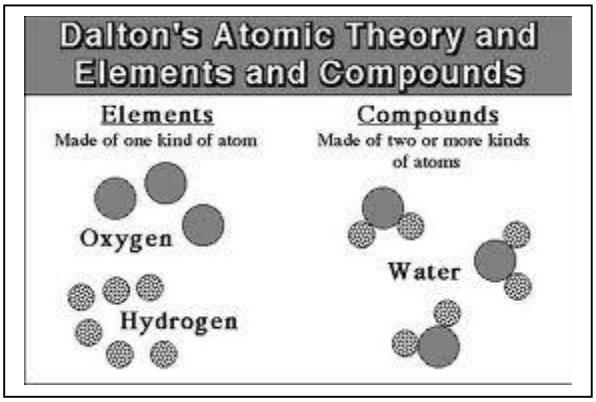
Some characteristic physical properties of substances that allow them to be compared and classified are density; thermal or electrical conductivity; solubility; magnetic properties; melting and boiling points. **No matter the amount of the sample substance, the properties remain the same**

The volume of an object is a measure of how much space it takes up. Volume is measured in units of liters for liquids and cubic centimeters for solids. An object's density is a measurement of its mass divided by its volume. Therefore, a dense object will take up less volume than another object that is less dense but has the same mass. For example, iron is denser than wood, so a gram of iron will be smaller, or take up less volume, than a gram of wood.





BIG IDEA 9: CHANGES IN MATTER

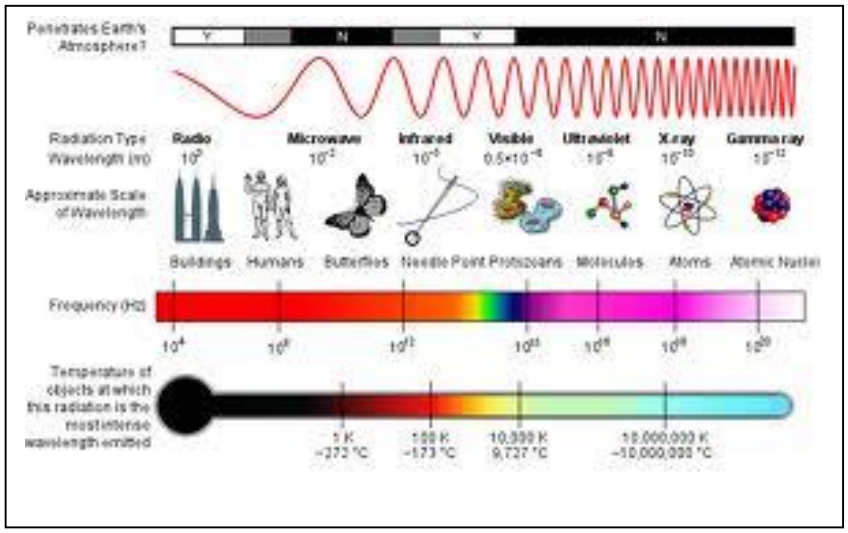


A. Matter can undergo a variety of changes.
B. When matter is changed physically, generally no changes occur in the structure of the atoms or molecules composing the matter.
C. When matter changes chemically, a rearrangement of bonds between the atoms occurs. This results in new substances with new properties.

Clarification for Grades 6-8: The target understanding for students in the middle grades should begin to transition the focus to: C. When matter changes chemically, a rearrangement of bonds between the atoms occurs. This results in new substances with new properties.

BIG IDEA 10: FORMS OF ENERGY

A. Energy is involved in all physical processes and is a unifying concept in many areas of science.
B. Energy exists in many forms and has the ability to do work or cause a change.



Electromagnetic Spectrum

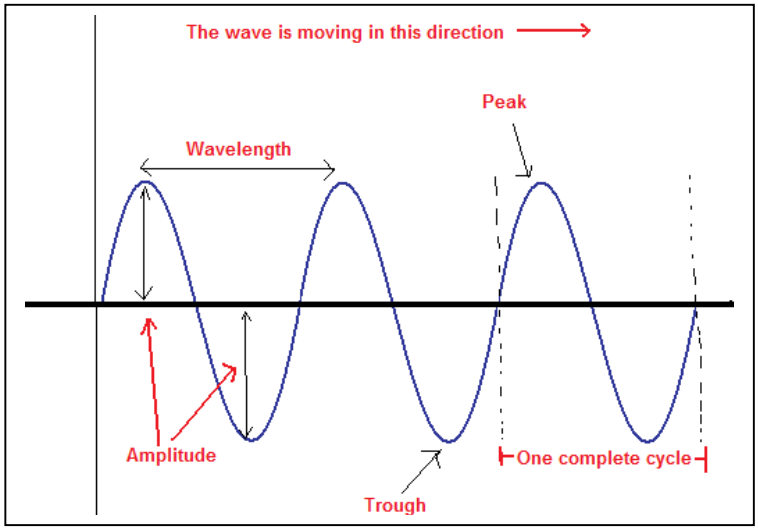
Energy can exist as potential energy or kinetic energy. Kinetic energy is the energy of motion, while potential energy is energy due to an object's position that can be released at some future point. You can imagine kinetic energy as a ball rolling down a hill. In that example, the ball's energy is released through its motion. However, if the ball sits at the top of the hill, it has potential energy. The potential energy is due to the position of the ball and the force that gravity exerts on it.

Potential energy can be calculated based on the amount of work that can be done by the object. To calculate this, you need to know the mass of the object and the distance it moves. Other sources of potential energy include potential chemical energy and potential electrical energy. An object exposed to pressure, such as a stretched rubber band or a diving board, also has potential energy.

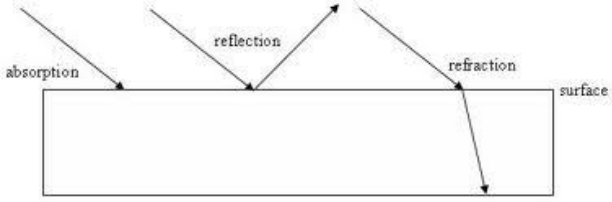
You can remember different types of energy by thinking of their key words, which are designated in parenthesis: electrical energy (wires), mechanical energy (machines), nuclear energy (nuclei of atoms), and chemical energy (burn).

Make sure you are familiar with the structure and properties of waves.

Visualize the wave as shown above moving through a medium represented by the black horizontal line. The period from one peak to the next makes up one complete wavelength, or cycle. The number of cycles a wave moves through in a given unit of time is its frequency. The amplitude of a wave is the distance from the undisturbed medium (shown by the black line) on the top, or bottom of the wave.



Remember that waves represent the movement of many types of energy. This energy may move through a medium, for example, sound waves move through the air or water or earthquake waves move through the earth. Waves may also move energy without a medium, for example light moves through empty space. The amplitudes, frequency, and wavelengths all affect the properties of the wave. For example, light energy appears as different colors depending on the wavelength of the light waves. These properties can also change when a wave moves between different mediums.

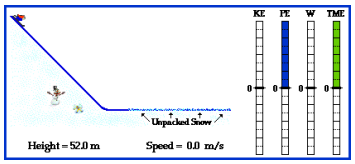


http://www.acecrc.sipex.aq

BIG IDEA 11: ENERGY TRANSFER AND TRANSFORMATIONS

A. Waves involve a transfer of energy without a transfer of matter.
B. Water and sound waves transfer energy through a material.
C. Light waves can travel through a vacuum and through matter.
D. The Law of Conservation of Energy: Energy is conserved as it transfers from one object to another and from one form to another.

Energy can be transferred from potential energy to kinetic energy and from kinetic energy to potential energy.



http://www.physicsclassroom.com/mmedia/energy/se.cfm

Energy is neither created nor destroyed in energy transformations; rather it moves from one form to another, ex. in a flashlight: chemical energy transfers to electrical energy then light energy

Try to visualize energy transformations that are occurring in any given scenario. For example, coal is burned at an electric power plant and transformed into electricity that travels to a house and is converted into sound and light energy by a television that is plugged into the electrical outlet.

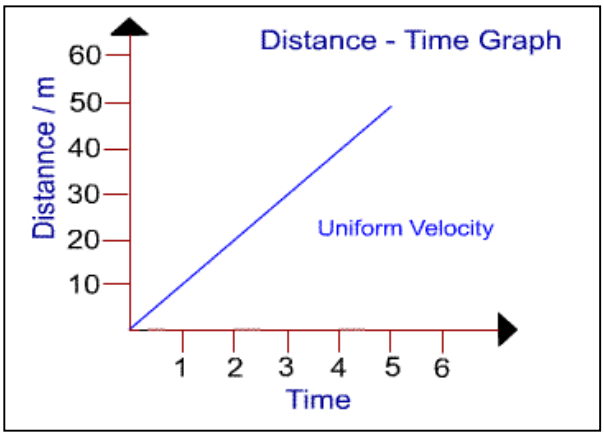
You know that energy conversions are never completely efficient. When you feel the running engine of an automobile, you feel the heat energy being released as waste instead of being transformed into the motion of the car.

Heat flows from warm to cool

http://www.ftexploring.com/energy/heatflow.htm

BIG IDEA 12: MOTION OF OBJECTS

A. Motion is a key characteristic of all matter that can be observed, described, and measured.
B. The motion of objects can be changed by forces.



BIG IDEA 13: FORCES AND CHANGES IN MOTION

A. It takes energy to change the motion of objects.
B. Energy change is understood in terms of forces--pushes or pulls.
C. Some forces act through physical contact, while others act at a distance.

Clarification for grades 6-8: The target understanding for students in grades 6-8 should begin to transition the focus to a more specific definition of forces and changes in motion. Net forces create a change in motion. A change in momentum occurs when a net force is applied to an object over a time interval.

A force is something that causes a change in motion of an object. Forces can either be contact forces, which require contact between two objects, or field forces, which do not require contact. Examples of contact forces include a hammer hitting a nail or an explosion. Examples of field forces include gravity or magnetic forces. If you are faced with a question that asks you about force acting on an object, try to visualize what is occurring. You may wish to draw a diagram of the objects and forces involved. Include descriptions of the forces and results involved in your diagram.

When determining the affect of one or more forces on an object, you should diagram the direction and relative size of the force to help you determine the result of the force or forces. For example:

Forces Acting at a Distance

http://www.physicsclassroom.com

http://www.leiasphysicsblog.blogspot.com

A. Your brother is applying force to a bicycle (pedals).

bicycle→

B. You apply additional force to the bicycle (push it back) as your brother is applying force to his bicycle.

you→bicycle→

The bicycle moves forward with the net force (add the forces) that you and your brother are applying to the bicycle. The bicycle moves faster than when he was applying the force alone.

C. You apply an equal but opposite force as your brother applies force (pedals).

bicycle→← you

D. You apply a greater opposite force as your brother applies force (pedals).

you⟶←bicycle

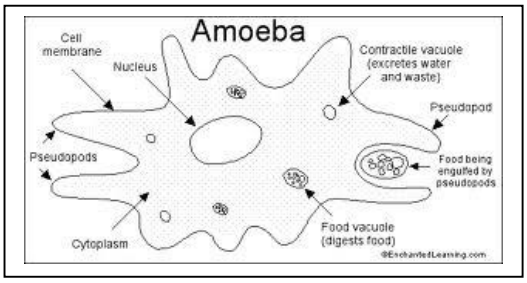
When you add the forces together (his small positive force and your greater negative force) they equal a negative number. The bicycle moves backward.

<u>BIG IDEA 14: ORGANIZATION AND DEVELOPMENT OF LIVING ORGANISMS</u>

A. All living things share certain characteristics.
B. The scientific theory of cells, also called cell theory, is a fundamental organizing principle of life on Earth.
C. Life can be organized in a functional and structural hierarchy.
D. Life is maintained by various physiological functions essential for growth, reproduction, and homeostasis.

All matter is made of atoms. Living things are matter and, therefore, made of atoms. All living things are made of cells. The scientific theory of cells (cell theory) states that:

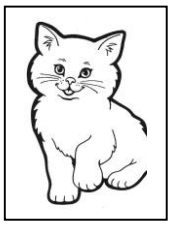
1. **all organisms are composed of cells (single-celled or multicellular),**
2. **all cells come from preexisting cells,**
3. **cells are the basic unit of life**



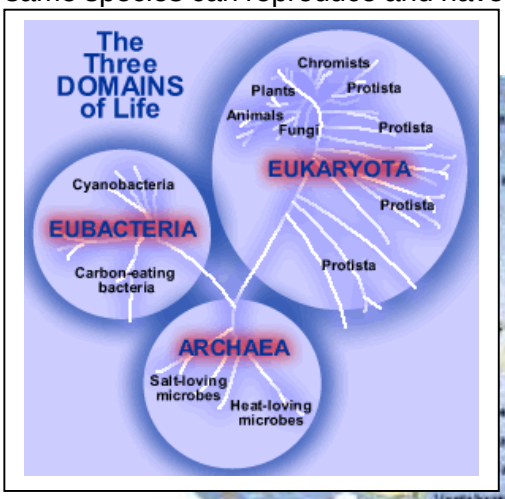
An organism can be as simple as a cell or complex as involving the following organization:

Simple organism: atoms to molecules to cells (ex., amoeba, paramecium, bacteria, etc.)

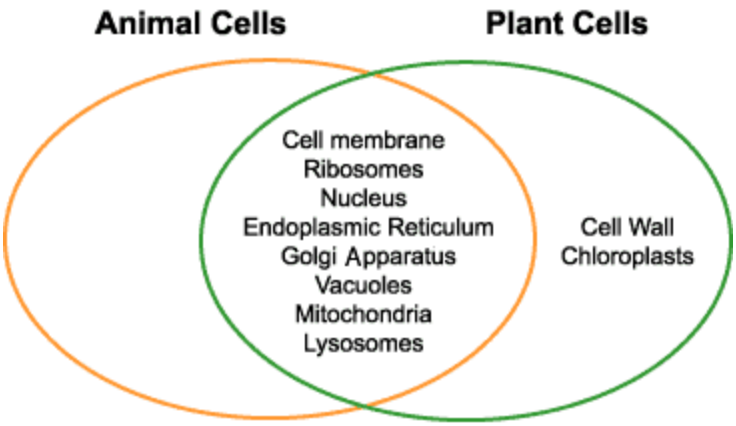
Complex organism: Atoms to molecules to cells to tissues to organs to organ systems to organisms (ex., plant, cat, dog, human, whale, etc.)



All organisms are classified according to shared characteristics with Domain being the largest category and species being the smallest. Organisms of the same species can reproduce and have offspring capable of reproducing and continuing the species.



A plant and animal cell comparison:



The major body systems that help the body function include the skeletal system, muscular system, digestive system, nervous system, circulatory system, respiratory system, reproductive system, immune system, and excretory system.

Skeletal system: The skeletal system is made up of bones that support the body and help it move. (Closely related to the muscular system to help bones move.)

Muscular system: The muscular system is composed of muscles throughout the body. Muscles are responsible for moving the body, as well as providing the motion for other body organs, such as the heart and lungs, to function. (Closely related to the skeletal system.)

Digestive system: The digestive system takes in food and breaks it down into nutrients the body can absorb and use. Parts of the digestive system include the mouth, teeth, esophagus, stomach, liver, gallbladder, pancreas, small intestines, and large intestines. (Closely related to the urinary system.)

Nervous system: The nervous system processes information about the environment and transmits information and commands throughout the body. The brain and spinal cord are the main components of the nervous system, along with the network of nerve cells that transmit information. (Closely related to the muscular system)

Circulatory system: The circulatory system is made up of blood vessels that transport blood throughout the body. Blood provides nutrients to the body's cells and collects waste from them. The circulatory system is powered by the heart. (Closely related to the respiratory system)

Respiratory system: The respiratory system takes in oxygen and releases carbon dioxide. Gas exchange takes place in the lungs. (Closely related to the circulatory system)

Reproductive system: The reproductive system produces male and female gametes that combine to create a fetus for reproduction. (Closely related to endocrine system.)

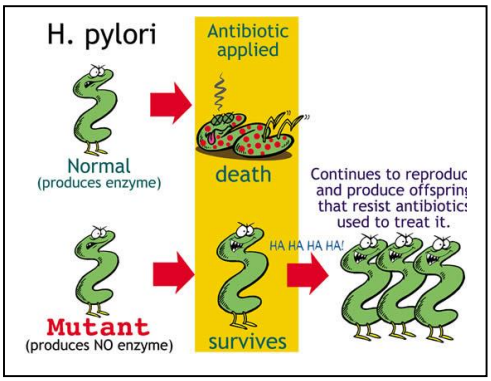
Immune system: The immune system, which is made up of special cells, proteins, tissues, and organs, defends people against germs and microorganisms every day. In most cases, the immune system does a great job of keeping people healthy and preventing infections. But sometimes problems with the immune system can lead to illness and infection. (Closely related to the integumantary system.)

Excretory system: The excretory system in important in getting rid of wastes and extra water that your body doesn't need. (Closely related to the digestive system.)

BIG IDEA 15: DIVERSITY AND EVOLUTION OF LIVING ORGANISMS

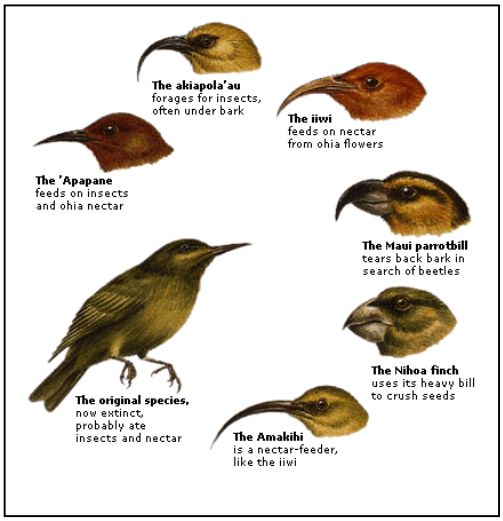
A. The scientific theory of evolution is the organizing principle of life science.
B. The scientific theory of evolution is supported by multiple forms of evidence.
C. Natural Selection is a primary mechanism leading to change over time in organisms.

The ultimate goal for behavior or characteristics of an organism or species is to survive and reproduce. When you must evaluate a characteristic or change, try to think about how that change might help or hurt an organism's ability to survive or create offspring.



Over many generations, characteristics or behaviors that help an organism survive will typically become more common. Characteristics that hurt an organism's chances of surviving or reproducing will eventually disappear as organisms with these characteristics do not survive long enough to reproduce. Most new characteristics or behaviors begin as random events. It is only after several generations of reproduction that some of these traits become more common as they have caused individuals that have the traits to be more successful than other organisms.

Although the new physical characteristics or behaviors that organisms exhibit are usually random in origin, they may be either helpful or harmful to the organism's ability to survive and reproduce. If the adaptation is helpful, it will increase in occurrence because it will allow those organisms to live and reproduce, passing on their characteristics to new offspring.



The new characteristics that develop can be either a change in a specific structure of an organism, such as a change in a bird's beak, or an animal's claw, or the change can also take the form of a behavior, such as a mating ritual or nesting ability. It may take the form of a difference in physiology, or body type.

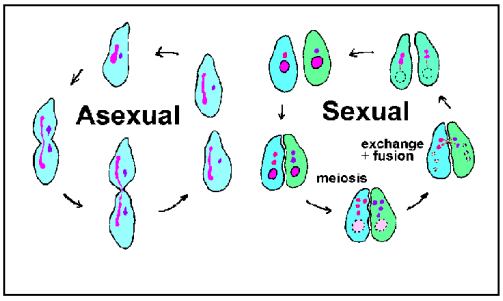
When thinking about whether a change is adaptive (helpful) or non-adaptive (harmful), it is wise to consider the organism's environment. Most organisms develop specific characteristics or behaviors that help them adapt to a specific environment, or niche. By becoming better at surviving in this specific environment, they are able to out-compete other organisms' lack of special skills or structures.


Can you see me?

Specialization can make them successful in their environments. For example, polar bears are white. Since they live in snowy environments, their white fur helps them hide from potential prey.

BIG IDEA 16: HEREDITY AND REPRODUCTION

A. Reproduction is characteristic of living things and is essential for the survival of species.
B. Genetic information is passed from generation to generation by DNA; DNA controls the traits of an organism.
C. Changes in the DNA of an organism can cause changes in traits, and manipulation of DNA in organisms has led to genetically modified organisms.

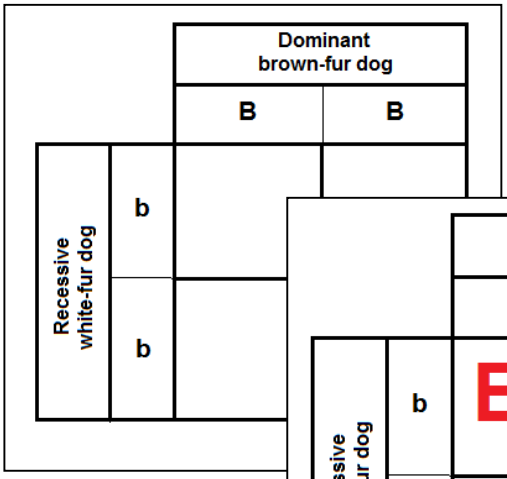


Reproduction in organisms can occur through sexual or asexual means, depending on the organism.

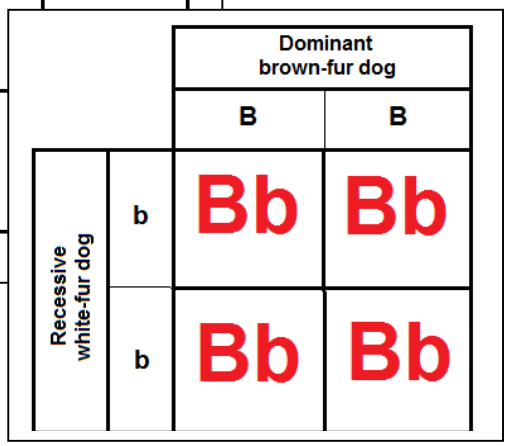
Asexual reproduction produces an identical copy of the parent.

Sexual reproduction creates new combinations of traits in offspring because each parent contributes different genes that are passed on. You should be familiar with Punnett squares, and how they work. You may need to fill out a Punnett square in order to answer questions about how genes are passed on to offspring from parents.

You should first know whether a gene is dominant or recessive. Dominant genes express themselves even if there is only one dominant gene present. They are usually indicated by a capital letter. For example, if B represents the gene that give a dog brown fur, then a dog with one dominant and one recessive gene would be designated by Bb and would have brown hair. A BB god would have both dominant genes and be brown, white a bb dog would have only recessive genes and would not be brown.



You can fill out a Punnett square to determine the probability of different genes being passed on to offspring. If you had a dog with brown fur that had both dominant genes mate with a dog with white fur that had both recessive genes, you might make a table like this:

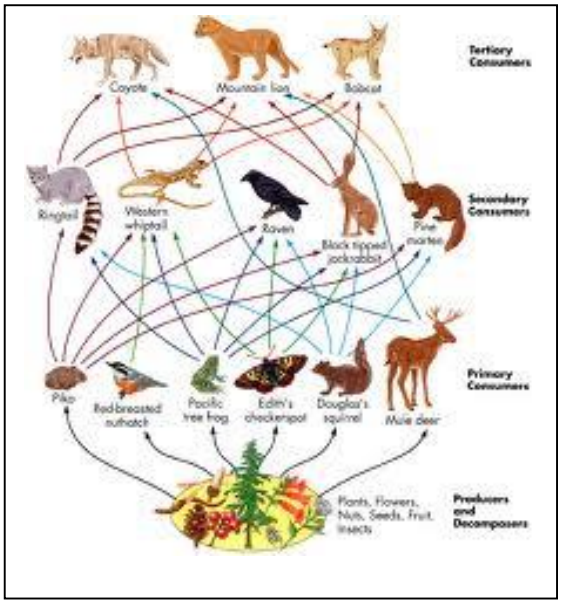


B gene. The b gene or another b

You then fill in the four squares between them with the genes that would be passed on. In this case, the dominant dog would pass along either one B gene or another recessive dog would pass on one gene.

In this case, all offspring would be **genotype** Bb, with **phenotype** brown fur.

BIG IDEA 17: INTERDEPENDENCE



A. Plants and animals, including humans, interact with and depend upon each other and their environment to satisfy their basic needs.
B. Both human activities and natural events can have major impacts on the environment.
C. Energy flows from the sun through producers to consumers.

Energy travels through organisms in a food chain. As energy moves from one level to the next, some energy is lost as waste heat.

Producers are organisms that convert energy from sunlight into sugars that can be used by themselves and by other organisms. Consumers are other organisms that obtain energy from producers or other consumers. Herbivores are organisms that obtain energy directly from eating plants. Carnivores are organisms that obtain energy indirectly from plants by eating other organisms that have eaten plants. Omnivores are organisms that eat plants and animals. Herbivores are also known as primary consumers. Carnivores are also known as secondary consumers. Carnivores that eat other carnivores may be known as tertiary, or higher, consumers. Decomposers are organisms such as bacteria or fungi that break down dead organisms into basic components.

Symbiosis (http://www.yorku.ca/tnoel/march5/Symbiosis.html)
A close ecological relationship between the individuals of two (or more) different species. Sometimes a symbiotic relationship benefits both species (**mutualism**), sometimes one species benefits at the other's expense (**parasitism**), sometimes one species benefits without harming the other (**commensalism**) and in other cases neither species benefits. The nature of a symbiotic association depends on the relative "strengths" of the partners ... and the balance of power can change over time.

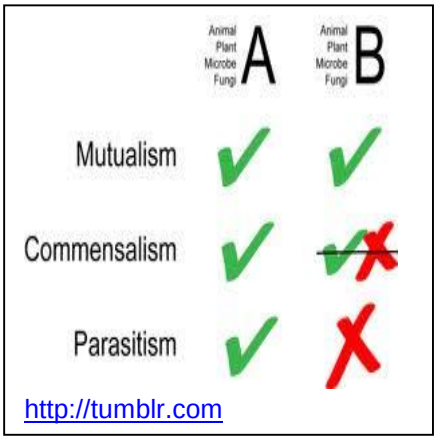
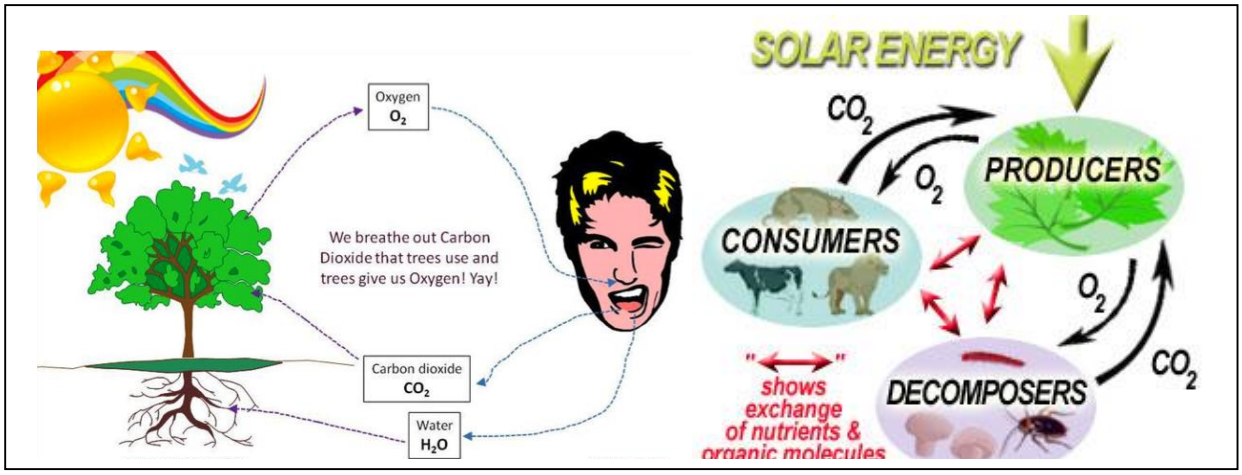


Table 1 – Impact of symbiotic relationships on organisms.

Relationship	Self	Opponent
Amensalism	Neutral	Harm
Commensalism	Benefit	Neutral
Competition	Harm	Harm
Mutualism	Benefit	Benefit
Parasitism	Benefit	Harm
Predation	Benefit	Harm

BIG IDEA 18: MATTER AND ENERGY TRANSFORMATIONS

A. Living things all share basic needs for life.
B. Living organisms acquire the energy they need for life processes through various metabolic pathways (photosynthesis and cellular respiration).
C. Matter and energy are recycled through cycles such as the carbon cycle.



Appendix F: Periodic Table of the Elements FCAT 2.0 Science Grade 8 and Biology 1 End-of-Course Assessment