Content Review Notes for Parents and Students

SUFFOLK PUBLIC SCHOOLS

Grade 6 Science

2017-2018

Science Content Review:
Standards of Learning in Detail
Grade 6 Science
2017-2018

This resource is intended to be a guide for parents and students to improve content knowledge and understanding. The information below is detailed information about the Standards of Learning taught during this semester and comes from the *Science Standards of Learning Curriculum Framework, Grade 6* issued by the Virginia Department of Education. The Curriculum Framework in its entirety can be found at the following website.

http://www.doe.virginia.gov/testing/sol/standards_docs/science/index.shtml

SOL 6.1
The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

a) observations are made involving fine discrimination between similar objects and organisms;
b) precise and approximate measurements are recorded;
c) scale models are used to estimate distance, volume, and quantity;
d) hypotheses are stated in ways that identify the independent and dependent variables;
e) a method is devised to test the validity of predictions and inferences;
f) one variable is manipulated over time, using many repeated trials;
g) data are collected, recorded, analyzed, and reported using metric measurements and tools;
h) data are analyzed and communicated through graphical representation;
i) models and simulations are designed and used to illustrate and explain phenomena and systems; and
j) current applications are used to reinforce science concepts.

- The nature of science refers to the foundational concepts that govern the way scientists formulate explanations about the natural world. The nature of science includes the following concepts

  a) the natural world is understandable;
  b) science is based on evidence, both observational and experimental;
  c) science is a blend of logic and innovation;
  d) scientific ideas are durable yet subject to change as new data are collected;
  e) science is a complex social endeavor; and
  f) Scientists try to remain objective and engage in peer review to help avoid bias.

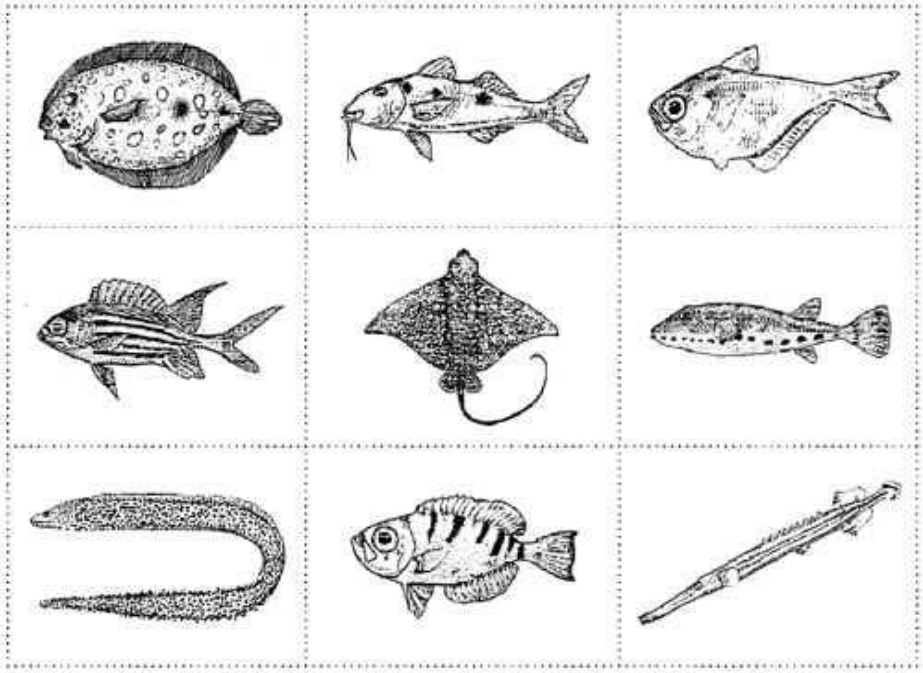
- To communicate an observation accurately, one must provide critical details of exactly what is being observed. Using that information, students will be able to differentiate definitively between or among similar objects and/or organisms.
- In an effective classification system, accurate comparisons and contrasts are made.

SOL 6.1: Scientific Investigation

- A Dichotomous Key is a useful tool for classifying things.

Make up a classification system based on the information below on fish: Write the name of each fish in the box.

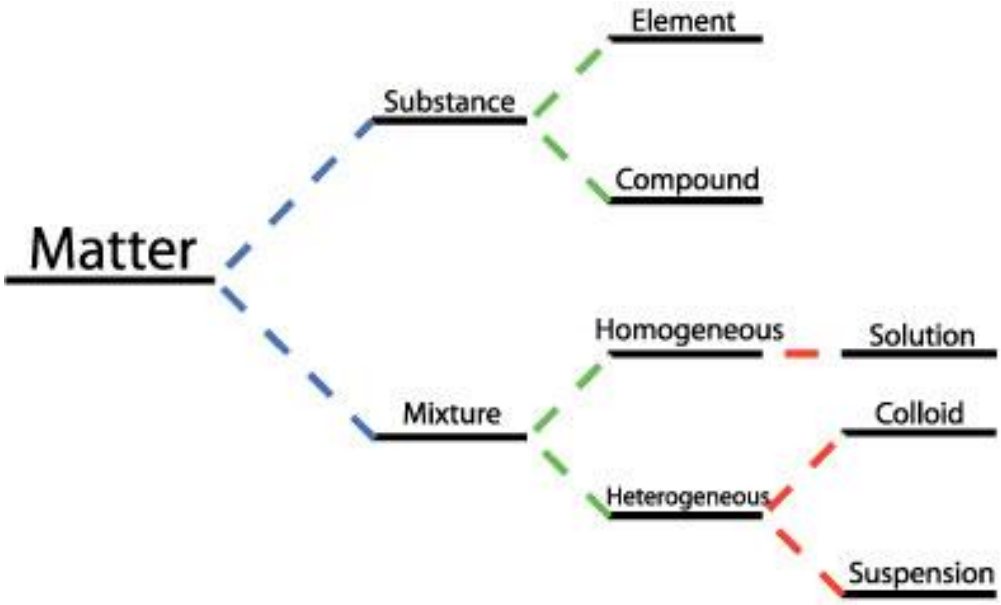
Fish Dichotomous Key



Step 1 If fish shape is long and skinny then go to step 2 If fish shape is not long and skinny, then go to step 3	**Step 5** If fish has spots, then go to step 6 If fish does not have spots, then go to step 7
Step 2 If fish has pointed fins, it is a trumpet fish If fish has smooth fins, it is a spotted moray eel	**Step 6** If fish has chin "whiskers," it is a spotted goat fish If fish does not have chin "whiskers," it is a band-tail puffer
Step 3 If fish has both eyes on top of the head, then go to step 4 If fish has one eye on each side of the head, then go to step 5	**Step 7** If fish has stripes, then go to step 8 If fish does not have stripes, it is a glassy sweeper
Step 4 If fish has long whip-like tail, it is a spotted eagle ray If fish has short, blunt tail, it is a peacock flounder	**Step 8** If fish has a v-shaped tail, it is a squirrel fish If fish has a blunt tail, it is a glass-eye snapper

Nova: Treasures of the Great Barrier Reef

SOL 6.1: Scientific Investigation



- Accurate observations and evidence are necessary to draw realistic and plausible conclusions.
  An *observation* is using the five senses to gather information about the natural world.
  An observation can be either qualitative (physical characteristics) or quantitative (numerical data).

- An inference is an explanation based on observations and background knowledge. A conclusion is formulated from collected data. For example, one might observe darkly colored pond water and make the inference that it is polluted. However, only after data are collected can a conclusion be formulated.
-
- A scientific prediction is a forecast about what may happen in some future situation. It is based on the application of scientific principle and factual information.

  Example:
  Observation: The stands are empty during the football game.
  Inference: The weather is cold and rainy.
  Prediction: If the weather gets warmer, then there will be higher attendance at the next game.

- Patterns discerned from direct observations can be the basis for predictions or hypotheses that attempt to explain the mechanism responsible for the pattern.

- An experiment is a structured test of a hypothesis. A *hypothesis* is stated in terms of a testable relationship. Example: The plant that is given fertilizer will grow faster than the one that did not receive any fertilizer.

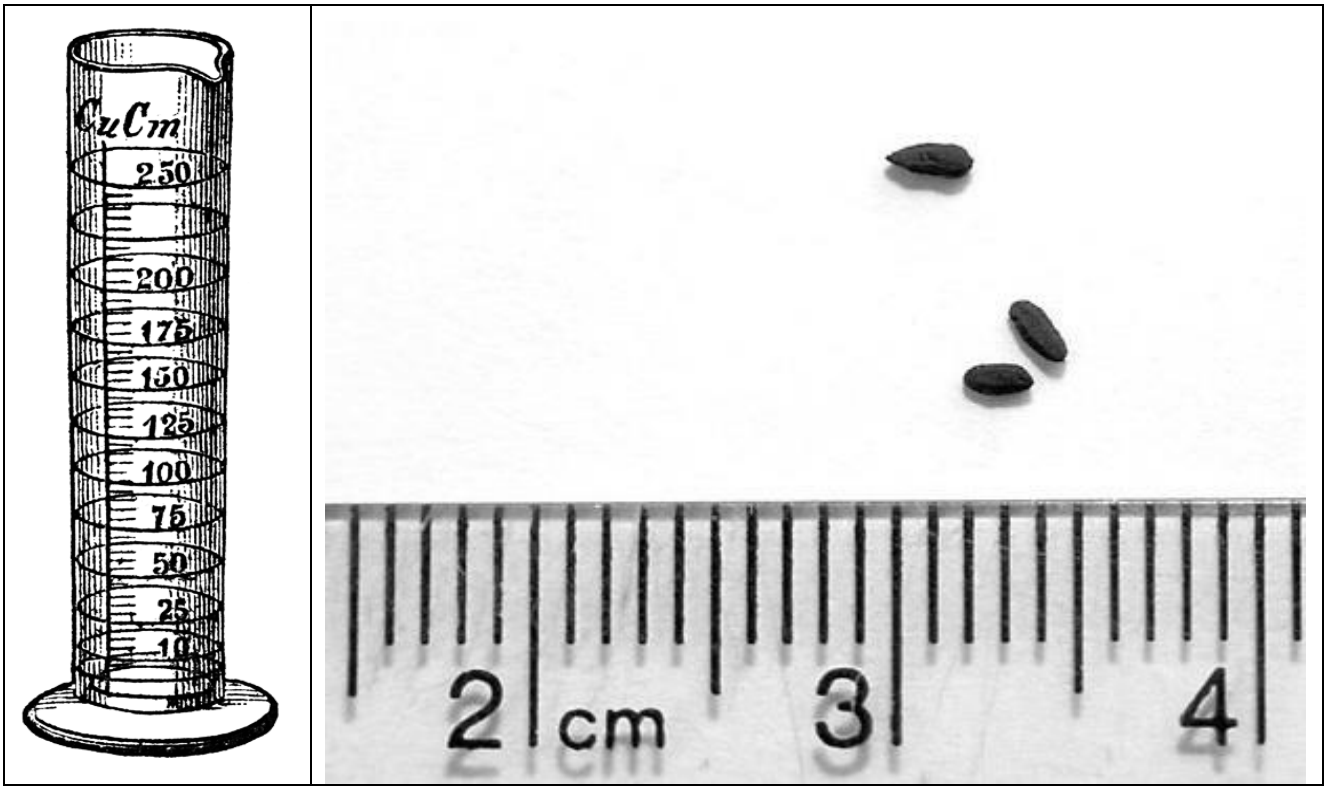
SOL 6.1: Scientific Investigation

- In order to conduct an experiment, one must recognize all of the potential variables that can affect an outcome.

  Example:
  In our plant experiment where we were testing the effect of fertilizer on the growth of plants, when we manipulate or changed the amount of fertilizer we have varied the amount of fertilizer. The fertilizer is a variable we changed to see the effect it would have on the growth of the plants. The features of the experiment that we keep the same, for example, the type of plant used would be the same for all 5 plants ; the height of the plants would be the same at the start of the experiment. These variables are kept the same because they are not being tested they must remain controlled so as not to confuse our results.
  Think of two other variables that you would want to keep the same/control in this experiment. _____ , _____ .

- In a scientific investigation, data should be collected, recorded, analyzed, and reported using appropriate metric measurement and tools.

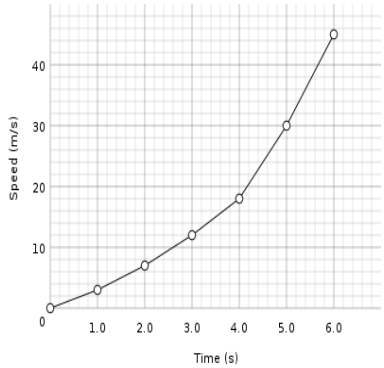
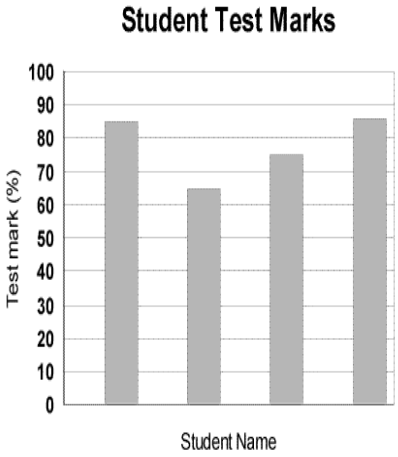
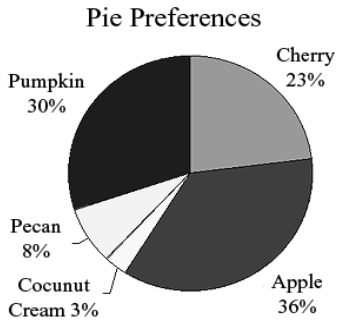
- Systematic investigations require accurate measurements; however, in the absence of precision tools, observers must record careful estimations.



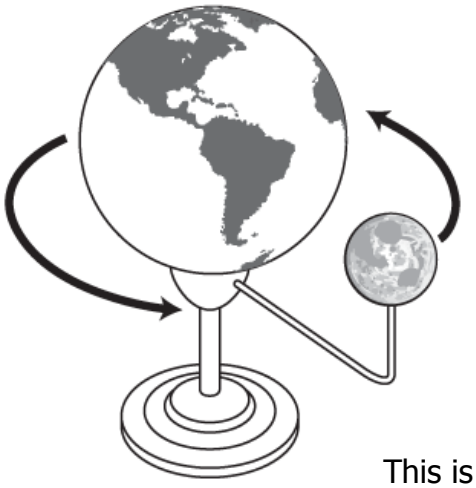
What would you say is an appropriate unit of measurement for one of the seeds in the picture above? _____

SOL 6.1: Scientific Investigation

- In a scientific investigation, data should be organized and communicated through appropriate graphical representation (graph, chart, table, and diagram).

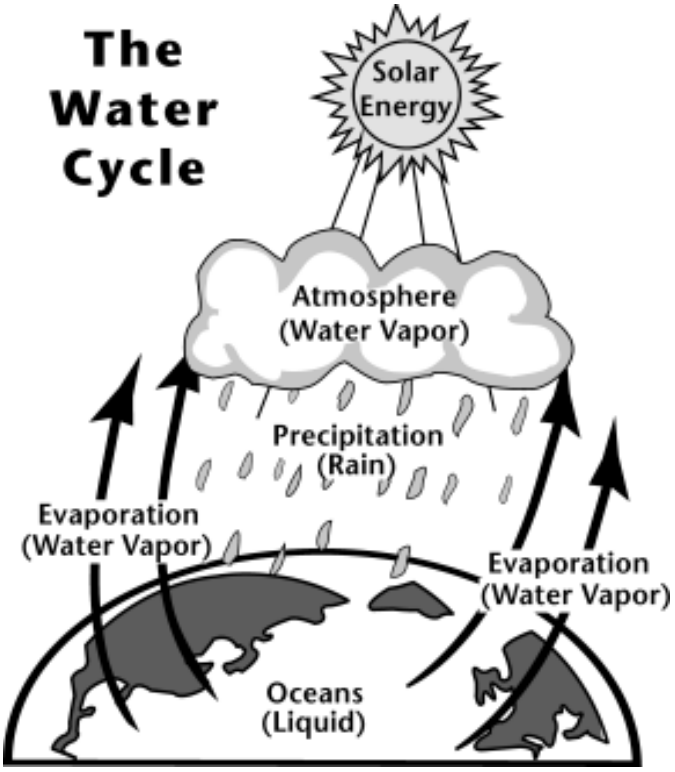
LINE GRAPH	BAR GRAPH	PIE GRAPH
		

- Models provide a way of visually representing abstract concepts. The use of models permits students to order events or processes.
- Scale models must maintain relative values of size and/or quantity in order to maintain the integrity of the object or topic being modeled.

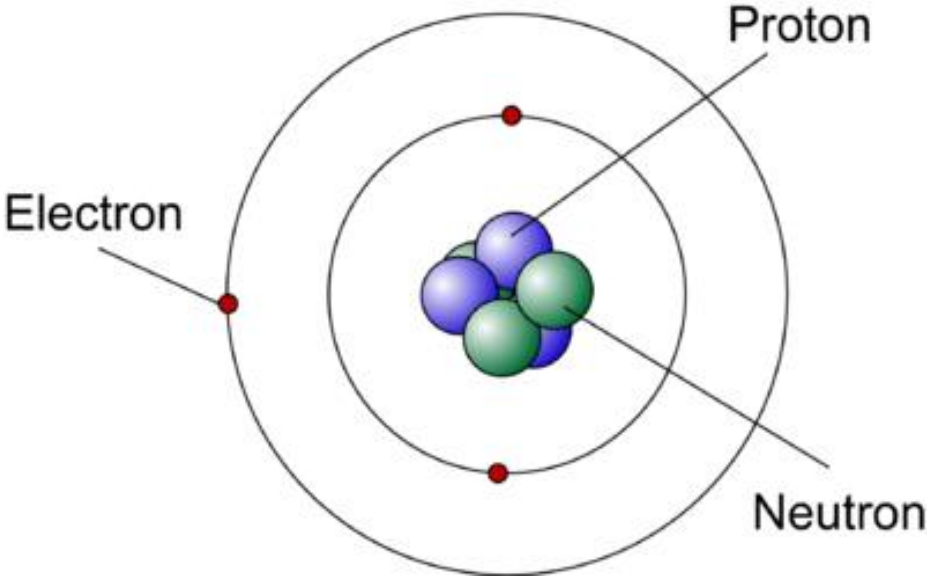


This is a model of the Earth and moon.

SOL 6.1: Scientific Investigation



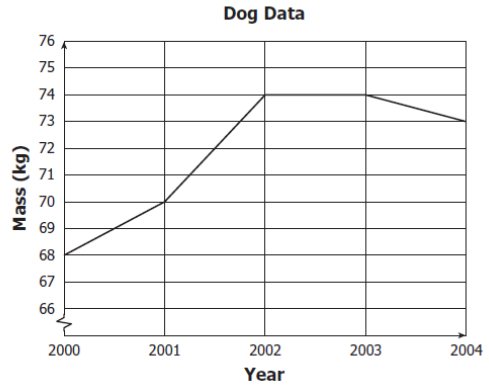
This is a model of the Water Cycle



This is a model of an atom

SOL 6.1: Scientific Investigation

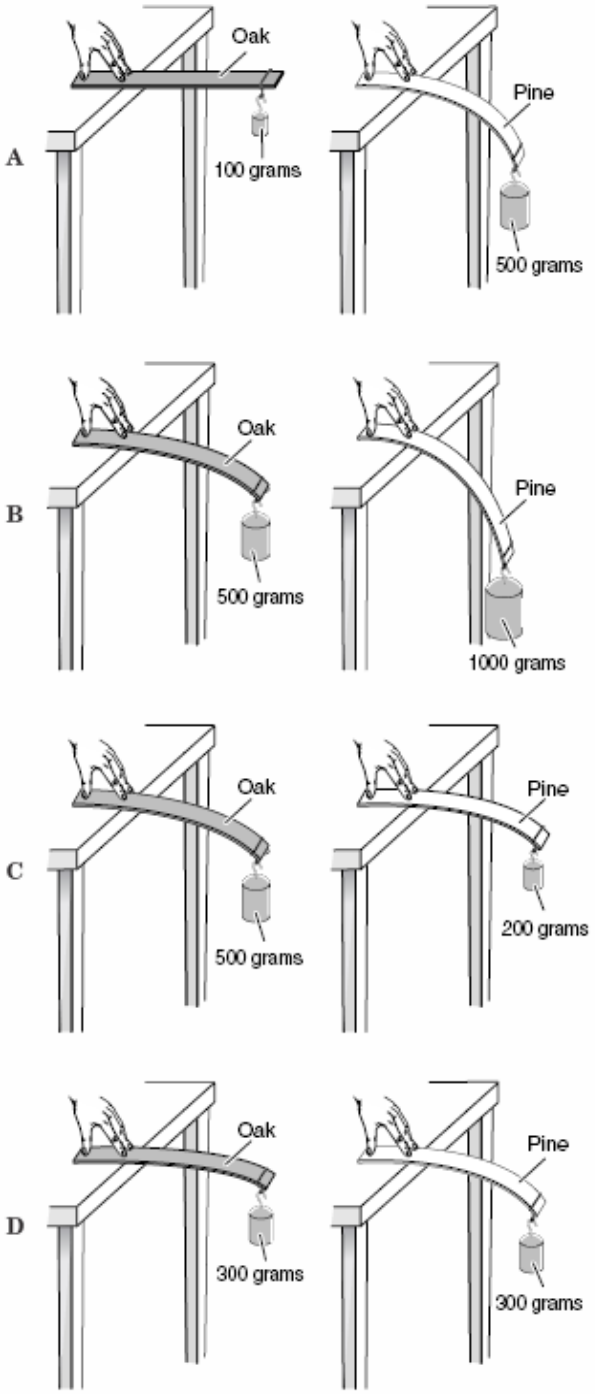
1



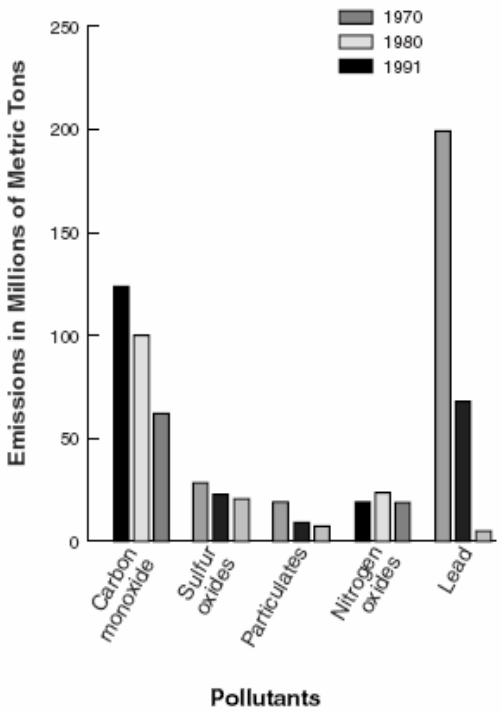
The line graph shows five years of data about a dog. What information does the graph show?

A How the mass of the dog changed
B How much food the dog consumed
C What kinds of food the dog consumed
D When the dog was measured each month

2 **Which of these would be the best way to prove that a pine stick is more flexible than an oak stick?**



3 **Emissions of Air Pollutants, 1970 - 1991**

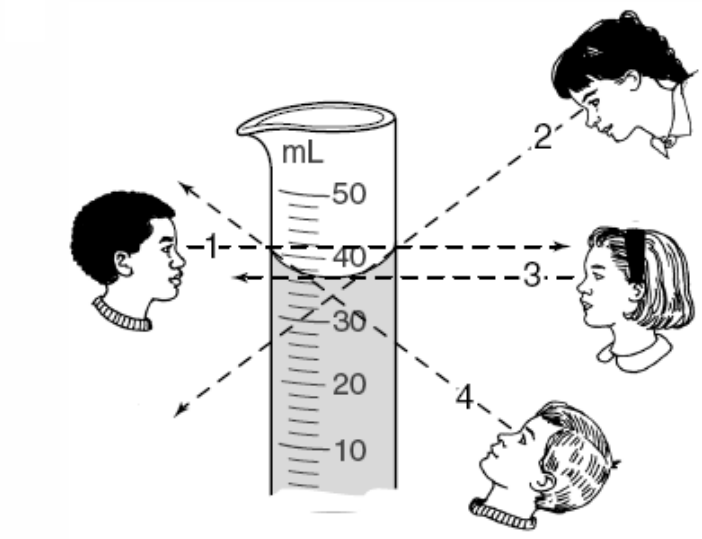


According to the graph, which air pollutant decreased the *most* from 1970 to 1991?

A Carbon monoxide
B Sulfur oxides
C Particulates
D Lead

SOL 6.1: Scientific Investigation

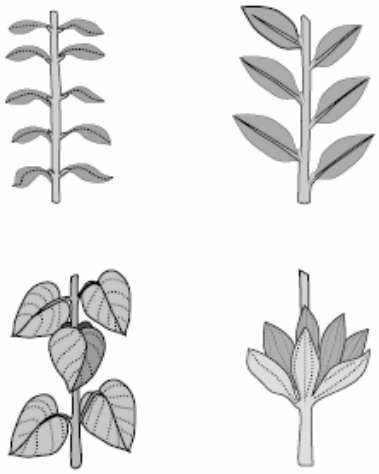
4.



The diagram shows a graduated cylinder containing water. From which position will the most accurate measure of the volume of the water be made?

A Position 1
B Position 2
C Position 3
D Position 4

5.



Botanists often use leaves to identify plants. Which trait of the leaves shown would be *most* useful in identifying the plants they came from?

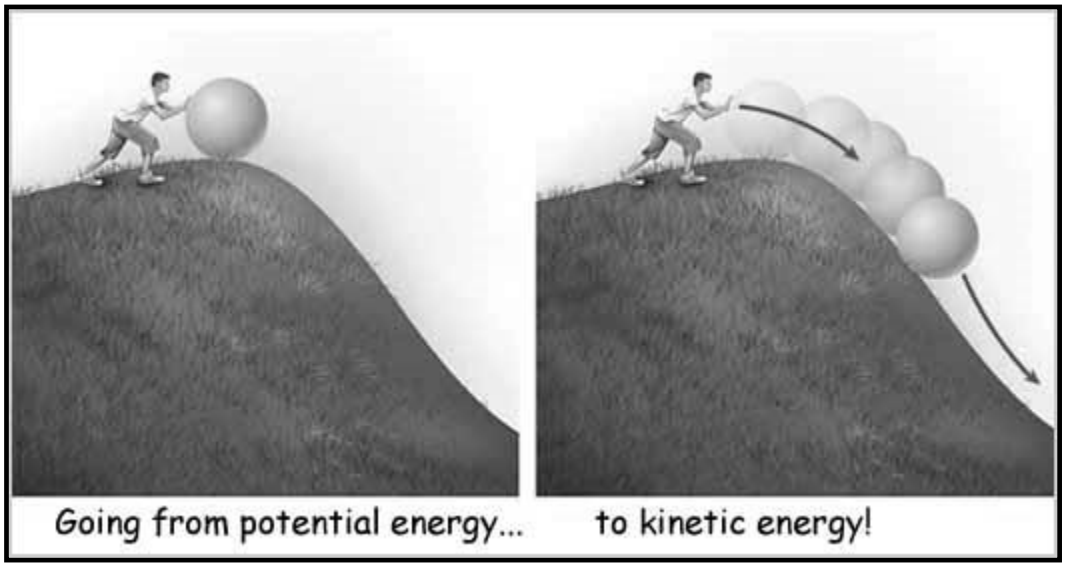
A Color of the leaf
B Function of the leaf
C Arrangement of leaves on a stem
D Presence or absence of veins

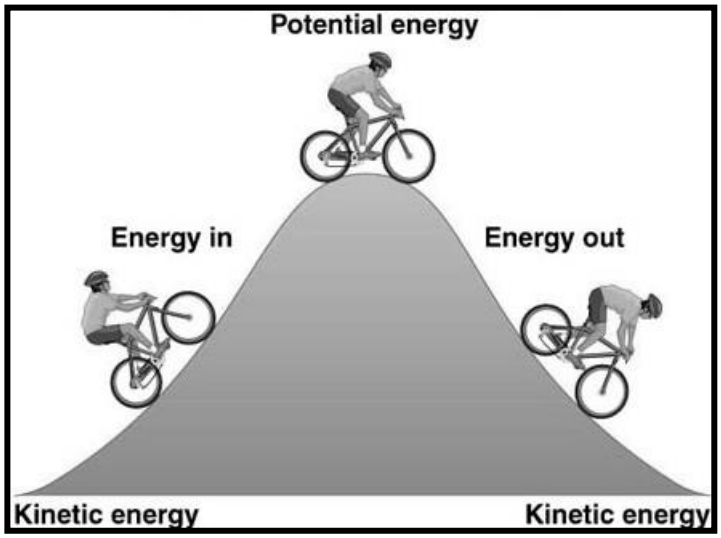
SOL 6.2

The student will investigate and understand basic sources of energy, their origins, transformations, and uses. Key concepts include

a) potential and kinetic energy;
b) the role of the sun in the formation of most energy sources on Earth;
c) nonrenewable energy sources;
d) renewable energy sources; and
e) energy transformations.

- Potential energy is energy that is not "in use" and available to do work. Kinetic energy is energy that is "in use" — the energy a moving object has due to its motion. For example, moving water and wind have kinetic energy. The chemical energy in fossil fuels is potential energy until it is released.

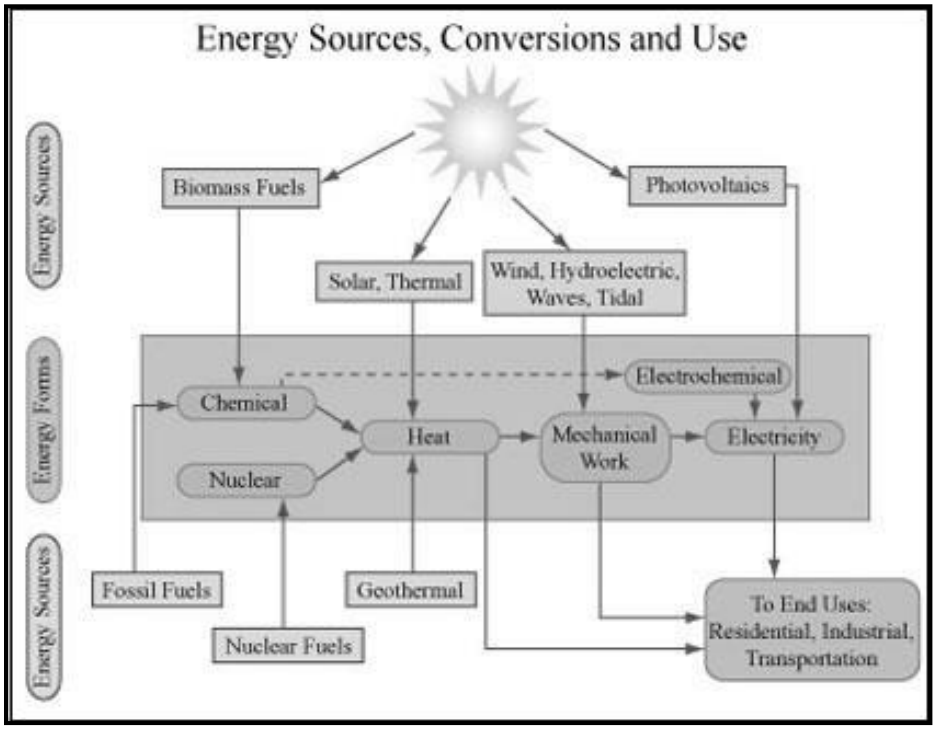




SOL 6.2: Sources of Energy and Energy Transformations

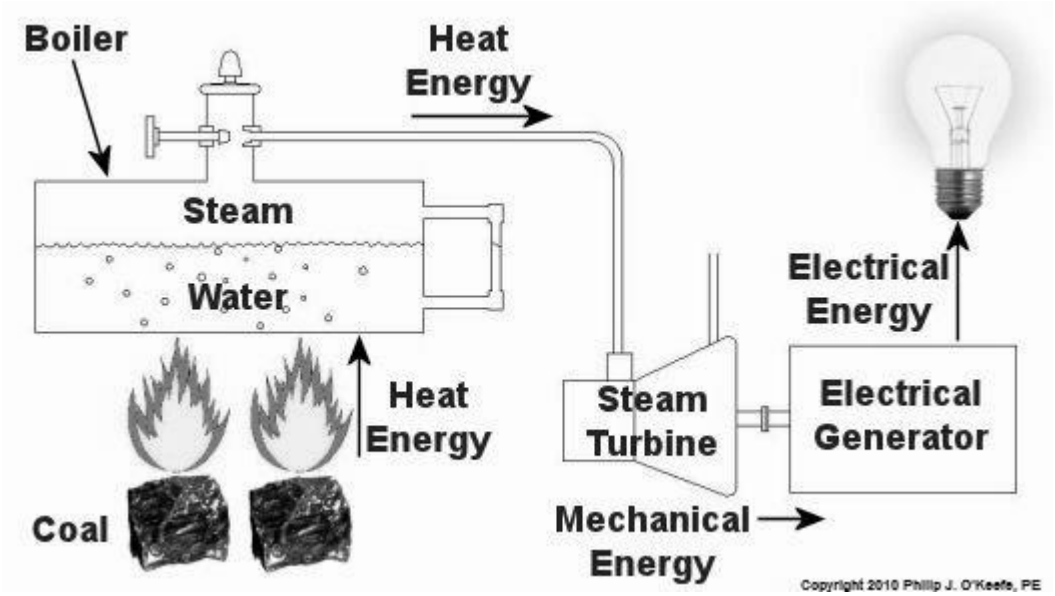
- Thermal and radiant energy can be converted into mechanical energy, chemical energy, and electrical energy and back again.

  In the example below, heat and light can be converted into mechanical energy, chemical energy, and electrical energy and back again.



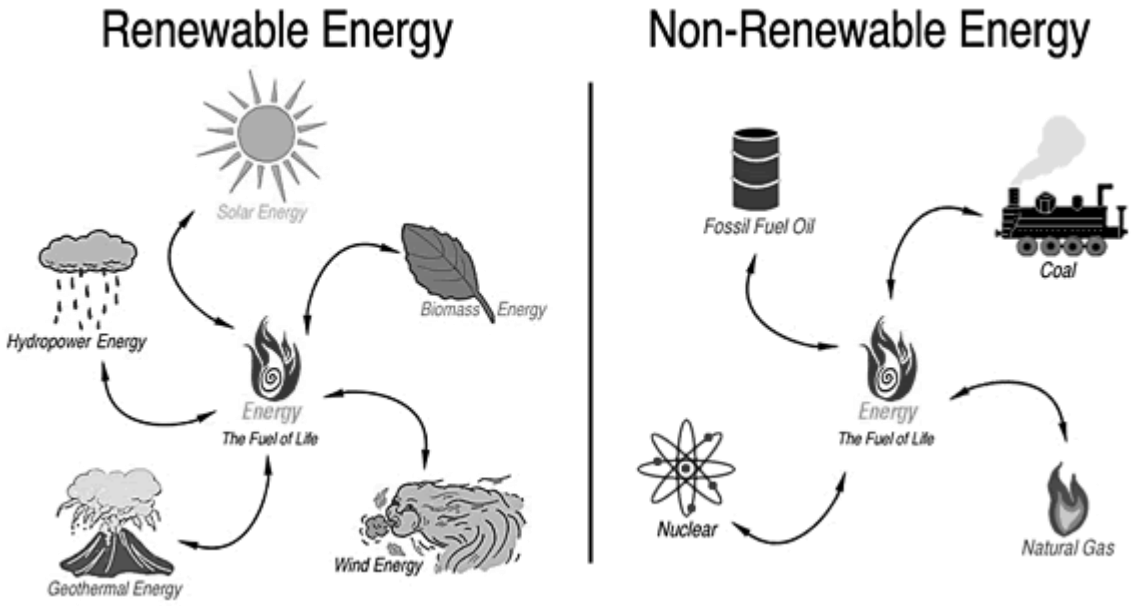
An *energy transformation* is when one form of energy is converted into another form of energy.

According to the *Law of Conservation of Energy,* energy cannot be created or destroyed. It is transformed from one form to another, it is never lost.



SOL 6.2: Sources of Energy and Energy Transformations

- Solar energy from the ancient past is stored in fossil fuels, such as coal, petroleum and natural gas. Fossil fuels are rich in the elements carbon and hydrogen. These sources of energy take very long periods of time to form and once depleted, are essentially nonrenewable. Nuclear power is also a source of nonrenewable energy.



Some important sources of energy include fossil fuels, wood, wind, water (hydropower), the sun (solar energy), and the Earth's interior.

Many of the Earth's energy resources are available on a perpetual basis. These include solar, wind, water, and geothermal energy. Some energy sources can be replenished over relatively short periods of time. These include wood and other biomass. All are considered renewable.

Modern industrial society is dependent upon energy. Fossil fuels are the major sources of energy in developed and industrialized nations.

- Secondary sources of energy, such as electricity, are used to store, move, and deliver energy easily in usable form. Hydrogen is also a secondary source of energy, also called an energy carrier.

SOL 6.2: Sources of Energy and Energy Transformations

1. **Which energy transformation occurs first in a coal-burning power plant?**

   A Chemical energy to thermal energy
   B Thermal energy to mechanical energy
   C Thermal energy to electrical energy
   D Mechanical energy to electrical energy

2. **Which of the following is an example of potential energy?**

   A A glass jar sitting on a shelf
   B A flag waving in the wind
   C A ball rolling along a sidewalk
   D A battery powering a radio

3. **As the energy needs for Virginia increase, new sources of energy are required to replace or supplement the nonrenewable sources of energy now in use. Two sources of energy that are renewable and available in Virginia are —**

   A natural gas and wind power
   B coal and hydropower
   C petroleum and solar power
   D wind power and solar power

4. **Which of the following is a nonrenewable energy source?**

   A Solar collector
   B Wind turbine
   C Fossil fuel
   D Hydroelectric generator

SOL 6.2: Sources of Energy and Energy Transformations

5. **Water stored behind a dam is an example of what type of energy?**

A Kinetic
B Potential
C Solar
D Chemical

6. **Fossil fuels such as gas, oil, and coal have what kind of energy?**

A Mechanical energy
B Chemical energy
C Electrical energy
D Nuclear energy

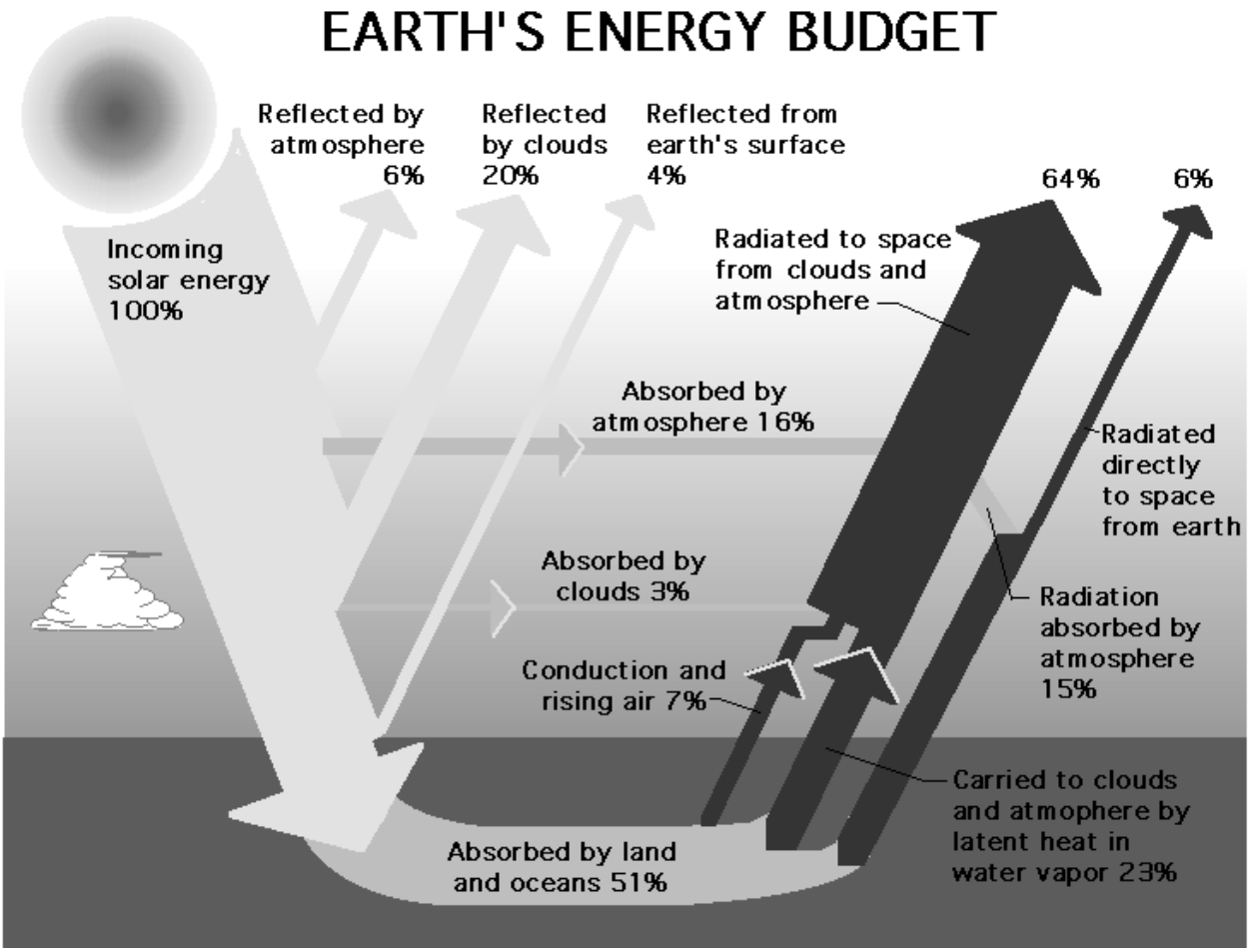
7 **A burning candle is in the process of transforming —**

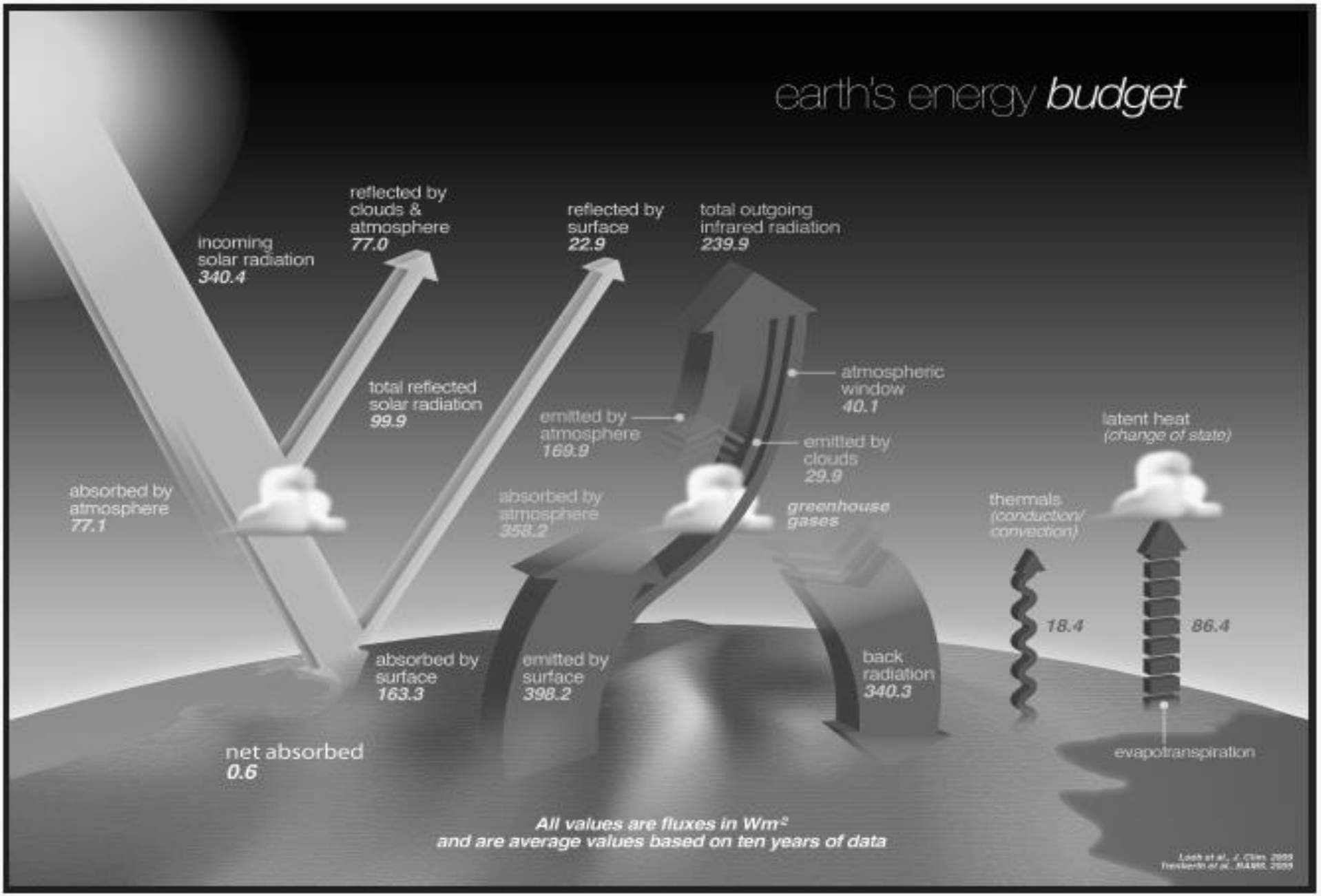
A heat energy into chemical energy
B chemical energy into light and heat
C chemical energy into mechanical energy
D chemical energy into nuclear energy

SOL 6.3
The student will investigate and understand the role of solar energy in driving most natural processes within the atmosphere, the hydrosphere, and on Earth's surface. Key concepts include

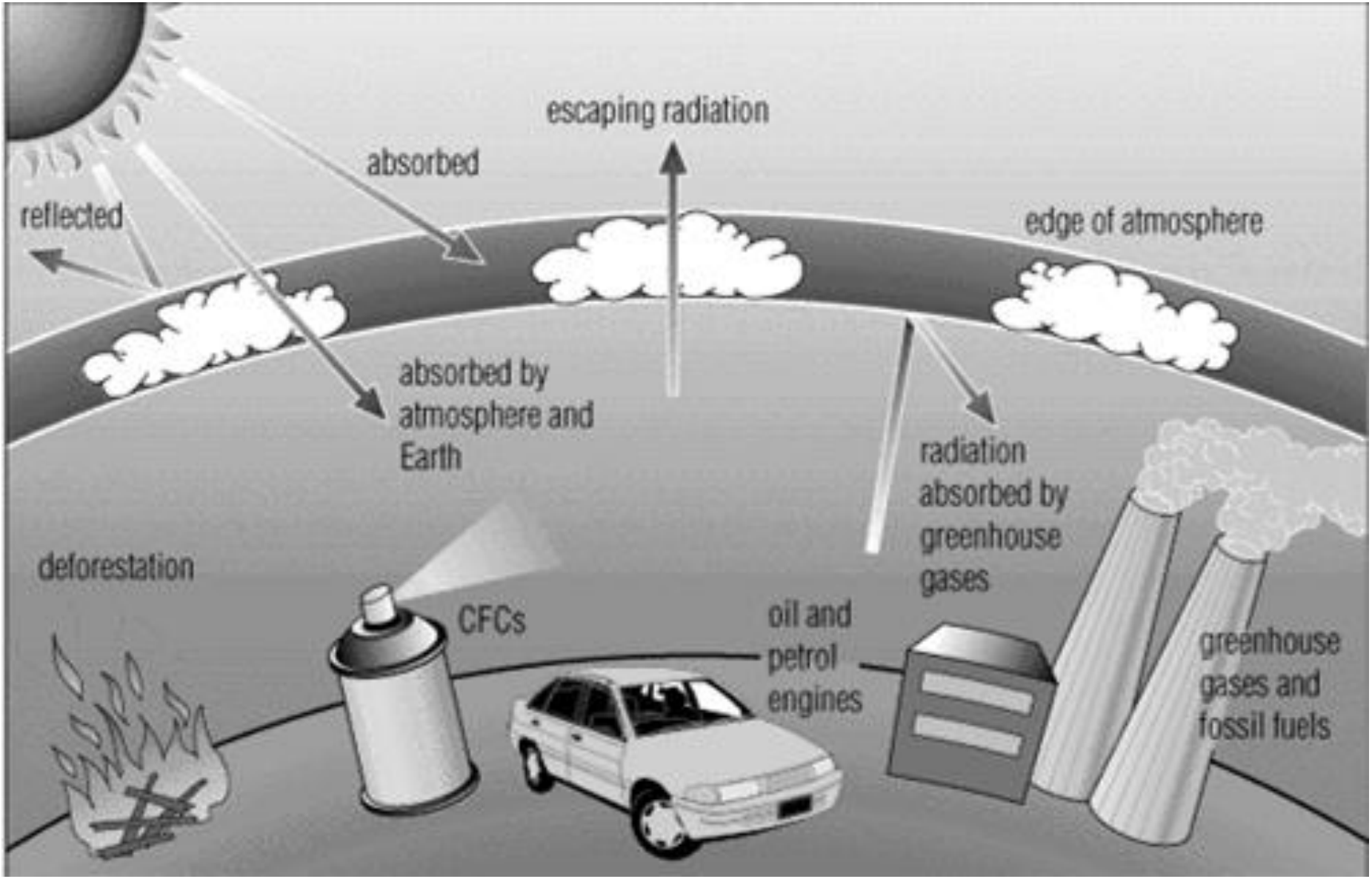
a) Earth's energy budget;
b) the role of radiation and convection in the distribution of energy;
c) the motion of the atmosphere and the oceans;
d) cloud formation; and
e) the role of thermal energy in weather-related phenomena including thunderstorms and hurricanes.

- The Earth receives only a very small portion of the sun's energy, yet this energy is responsible for powering the motion of the atmosphere, the oceans, and many processes at the Earth's surface.
- Solar radiation is made up of different types of radiation (including infrared, visible light, and ultraviolet).
- Incoming solar radiation is in close balance with the energy that leaves the atmosphere; otherwise the Earth would heat up or cool down. Excess carbon dioxide and other gases may disrupt this balance, creating a Greenhouse Effect.



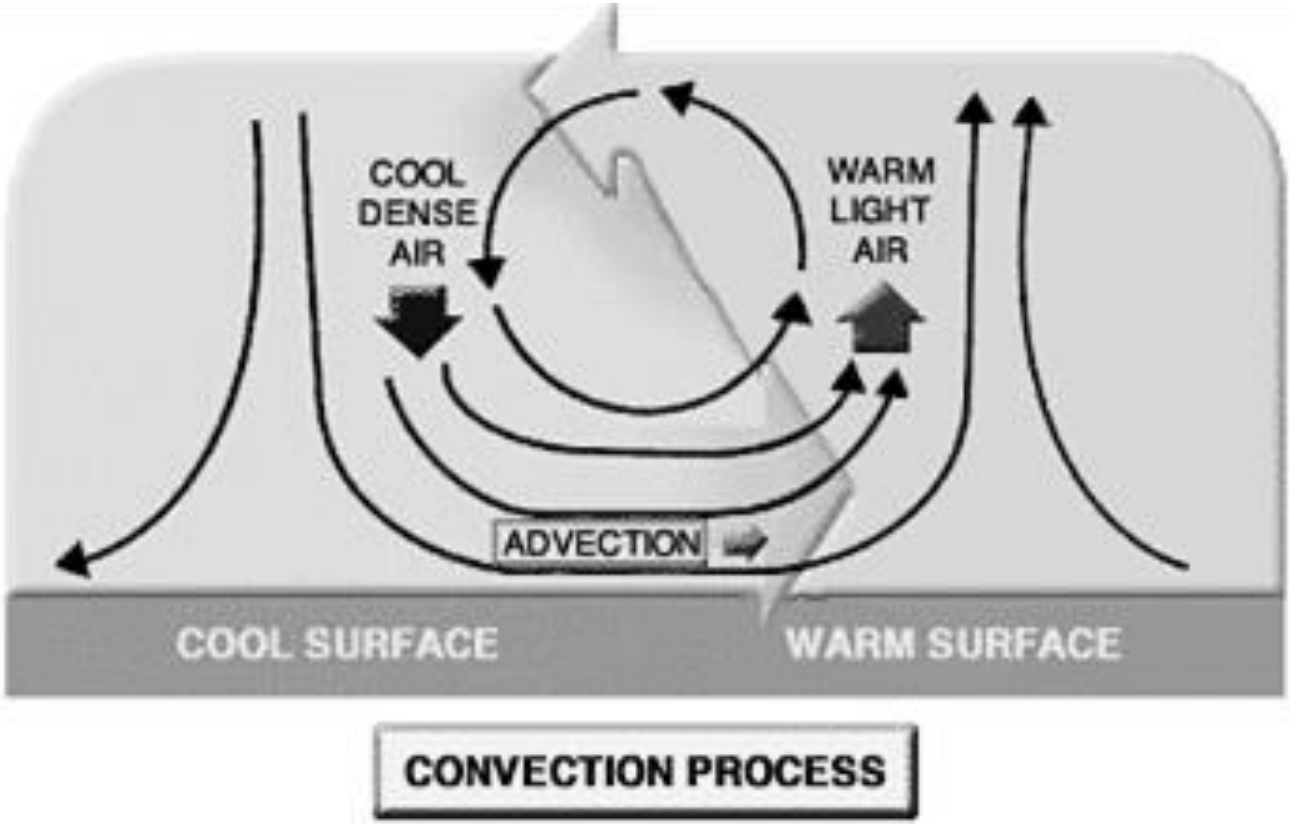

earth's energy budget
incoming solar radiation 340.4
reflected by clouds & atmosphere 77.0
reflected by surface 22.9
total outgoing infrared radiation 239.9
total reflected solar radiation 99.9
atmospheric window 40.1
emitted by atmosphere 169.9
emitted by clouds 29.9
absorbed by atmosphere 77.1
absorbed by atmosphere 358.2
greenhouse gases
latent heat (change of state)
thermals (conduction/ convection)
18.4
86.4
absorbed by surface 163.3
emitted by surface 398.2
back radiation 340.3
evapotranspiration
net absorbed 0.6
All values are fluxes in Wm-2
and are average values based on ten years of data

Major Contributors to the Greenhouse Effect



SOL 6.3: Solar Energy and Natural Processes

- About one third of the sun's incoming energy is reflected back out to space. About one half of the energy striking the Earth is absorbed by the Earth's surface.
- The Earth's surface is heated unequally.

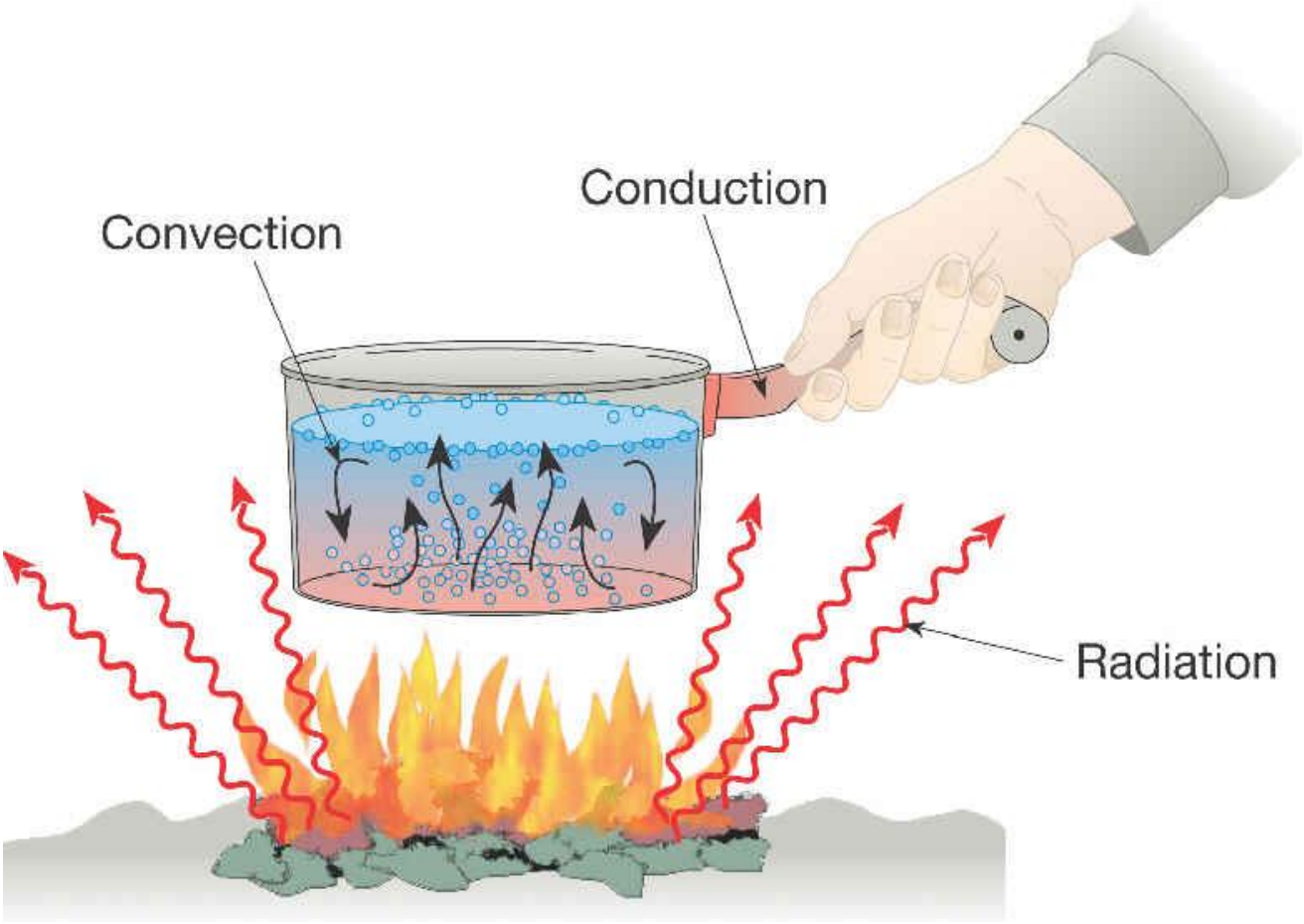


- When air or water is heated, the molecules move faster and farther apart, reducing their density and causing them to rise. Cooler air or water molecules move more slowly and are denser than warm air or water. Warm air or water rising coupled with cooler air or water descending forms a cyclic rising/falling pattern called convection.

SOL 6.3: Solar Energy and Natural Processes

- Radiation and convection from the Earth's surface transfer heat energy. This energy powers the global circulation of the atmosphere and the oceans on our planet.

  Example: The diagram below illustrates the three mechanisms of heat transfer (radiation, conduction, convection)



- As bodies of water (oceans, lakes, rivers, etc.) absorb thermal energy, the water evaporates causing the air to be warm and moist. Warm, moist air is less dense than cold, dry air, so it rises relative to colder, drier air. As warm, moist air rises, it gives off some thermal energy as the moisture condenses, forming clouds. Clouds are not gaseous water vapor; rather they are minute, condensed water particles.
- Some thunderstorms are formed where the land is strongly heated. Hurricanes form over warm, tropical water and are fed by the energy of that water.

SOL 6.3: Solar Energy and Natural Processes

1. **Clouds are formed when millions of drops of water become suspended in the air. Which of the following is a step in the process of cloud formation?**

A Expansion of cold air
B Formation of carbon dioxide
C Condensation of water vapor
D Breakdown of atmospheric ozone

2. **Energy from the Sun is distributed around Earth by —**

A subduction and rift zones
B radiation and convection
C tectonic plates
D solar flares

3. **What information can be found on a diagram of the Earth's Energy Budget?**
A the gains of the Sun's energy on the Earth
B the losses of the Sun's energy on the Earth
C the reflection only of the Sun's energy on the Earth
D the gains and losses of the Sun's energy on the Earth

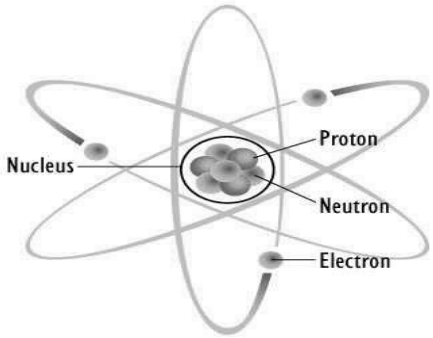
4. **In the winter, where will the temperatures be the warmest in Virginia?**
A the coastal plain region
B the mountain regions
C the valley and ridge region
D the piedmont region

SOL 6.4

The student will investigate and understand that all matter is made up of atoms. Key concepts include

a) **atoms consist of particles, including electrons, protons, and neutrons;**
b) **atoms of a particular element are alike but are different from atoms of other elements;**
c) **elements may be represented by chemical symbols;**
d) **two or more atoms interact to form new substances, which are held together by electrical forces (bonds);**
e) **compounds may be represented by chemical formulas;**
f) **chemical equations can be used to model chemical changes; and**
g) **a limited number of elements comprise the largest portion of the solid Earth, living matter, the oceans, and the atmosphere.**

- The basic structural components of the typical atom are electrons, protons, and neutrons. Protons and neutrons comprise the nucleus of an atom.



- An element is a form of matter made up of one type of atom. The atoms of an element are basically alike, though the number of neutrons may vary.

Example:

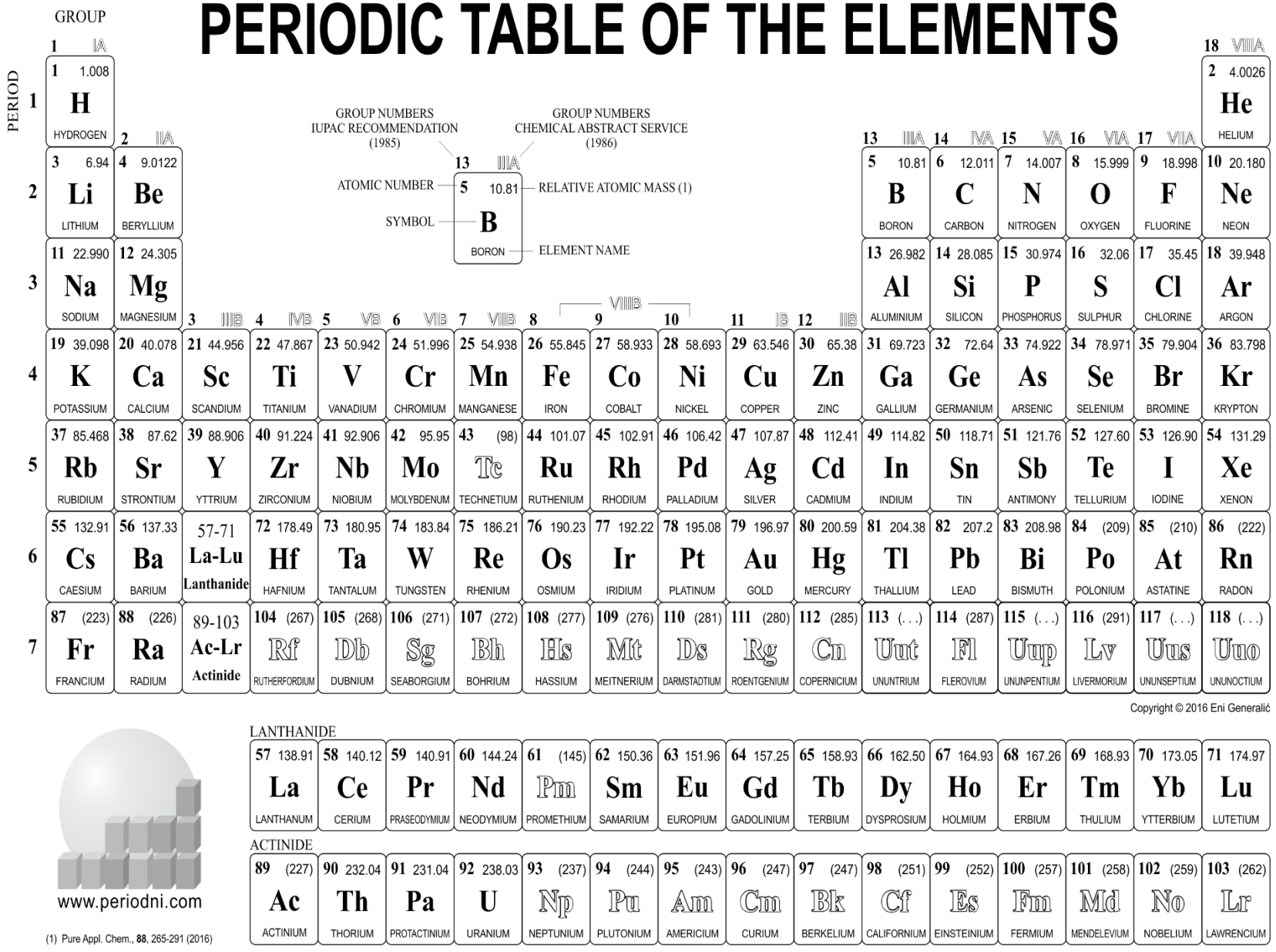
The element carbon contains only carbon atoms and the element neon is made up only of neon atoms and so on.

- The atoms of one element differ from those of another element in the number of protons.

Example:

Hydrogen has only one proton that is what makes it the element hydrogen and no other element has exactly one proton. Using the Periodic Table of Elements you can find out how many protons are in the different elements by the atomic number. The atomic number can be located on this periodic table at the top center of each element. The atomic mass is located at the bottom center, so for example Iron, which is given the symbol Fe, has 26 protons and its atomic mass is 55.84. The atomic number is the number of protons in an atom of that element.

PERIODIC TABLE OF THE ELEMENTS



LANTHANIDE

57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
138.91	140.12	140.91	144.24	(145)	150.36	151.96	157.25	158.93	162.50	164.93	167.26	168.93	173.05	174.97
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
LANTHANUM	CERIUM	PRASEODYMIUM	NEODYMIUM	PROMETHIUM	SAMARIUM	EUROPIUM	GADOLINIUM	TERBIUM	DYSPROSIUM	HOLMIUM	ERBIUM	THULIUM	YTTERBIUM	LUTETIUM

ACTINIDE

89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
(227)	232.04	231.04	238.03	(237)	(244)	(243)	(247)	(247)	(251)	(252)	(257)	(258)	(259)	(262)
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr
ACTINIUM	THORIUM	PROTACTINIUM	URANIUM	NEPTUNIUM	PLUTONIUM	AMERICIUM	CURIUM	BERKELIUM	CALIFORNIUM	EINSTEINIUM	FERMIUM	MENDELEVIUM	NOBELIUM	LAWRENCIUM

www.periodni.com

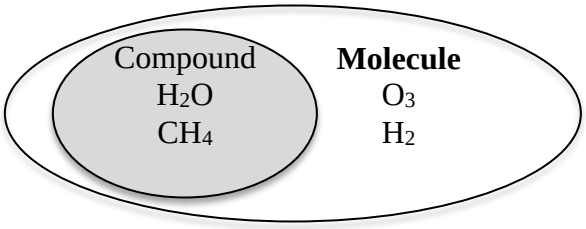
(1) Pure Appl. Chem., **88**, 265-291 (2016)

SOL 6.4: Matter

- Elements can be represented by chemical symbols.

The symbols on the periodic table above are the letters that appear in the center of each element in boldface. Notice that these are not the initials of the common name of the element always, but the Greek or Latin initials. An example would be Au is the symbol for gold *not Go* and the symbol for Iron is Fe *not* Ir.

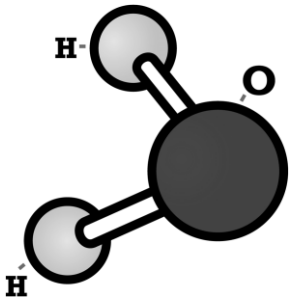
- Molecules are 2 or more atoms that are chemically combined.



- Two or more atoms of **different** elements may combine to form a compound. In other words, compounds are a special type of molecule.

This is a model of a single water compound.

It contains 2 atoms of hydrogen and 1 atom of oxygen.



Compounds can be represented by chemical formulas. Each different element in the compound is represented by its unique symbol. The number of each type of element in the compound (other than 1) is represented by a subscript (small number) to the right of the element symbol.

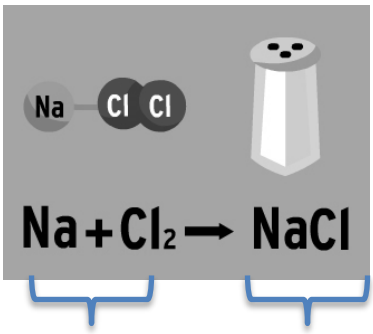
Here are some examples of some simple chemical formulas:
Water is written as H_20 so there are 2 atoms of Hydrogen and 1 atom of Oxygen.

- Remember when there is no subscript number written it means there is 1 atom of that element.
- Take a look at this formula for Calcium Carbonate. $CaCO_3$ it contains the elements calcium (Ca), carbon (C) and Oxygen (O). The elements calcium and carbon have no subscript so there is only one atom of calcium and only one atom of carbon but there are three atoms of oxygen.

- Chemical equations can be used to model chemical changes, illustrating how elements become rearranged in a chemical reaction.

SOL 6.4: Matter

A chemical equation is read from left to right.



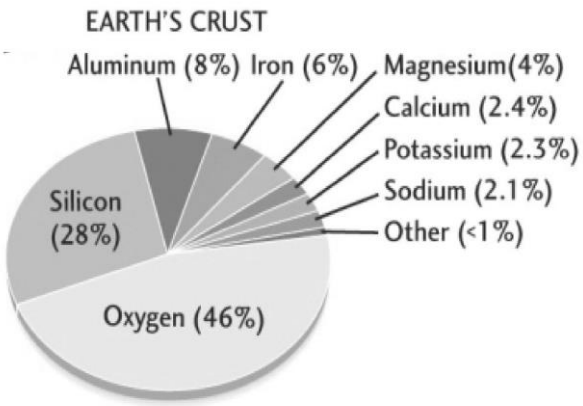
Reactant yields Product

In the above example, the 1 atom of the element sodium (Na) is combined with the 2 atoms of the element chlorine (Cl).

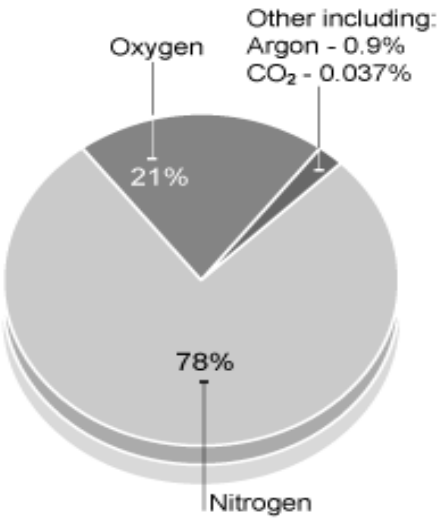
This side of the equation is called the reactant side and it is always on the left side of the yield sign (arrow). A chemical reaction takes place and the compound salt (NaCl) is formed. This side of the equation is called the product side and it is always on the right side of the arrow (yield sign).

- A limited number of elements, including silicon, aluminum, iron, sodium, calcium, potassium, magnesium, hydrogen, oxygen, nitrogen, and carbon, form the largest portion of the Earth's crust, living matter, the oceans, and the atmosphere.

EARTH'S CRUST



EARTH'S ATMOSPHERE



SOL 6.4: Matter

1.

$$C + O_2 \longrightarrow CO_2$$

According to this equation, what happened to the carbon and oxygen?

A They combined chemically to form a new compound.
B They combined chemically to form carbon and oxygen.
C They combined physically to form a new mixture.
D They combined physically to form a new element.

2. **Which of these substances is an element?**

A Steel
B Chlorine
C Plastic
D Sugar

3 **In the chemical formula for ammonia, NH_3, what does the subscript 3 represent?**

A The number of nitrogen and hydrogen atoms in each molecule of ammonia
B The number of hydrogen atoms in each molecule of ammonia
C The number of ammonia molecules that will bond together
D The number of nitrogen atoms in each molecule of ammonia

4 **A substance made up of two or more elements that have been chemically combined is called —**

A an atom
B a compound
C an element
D a mixture

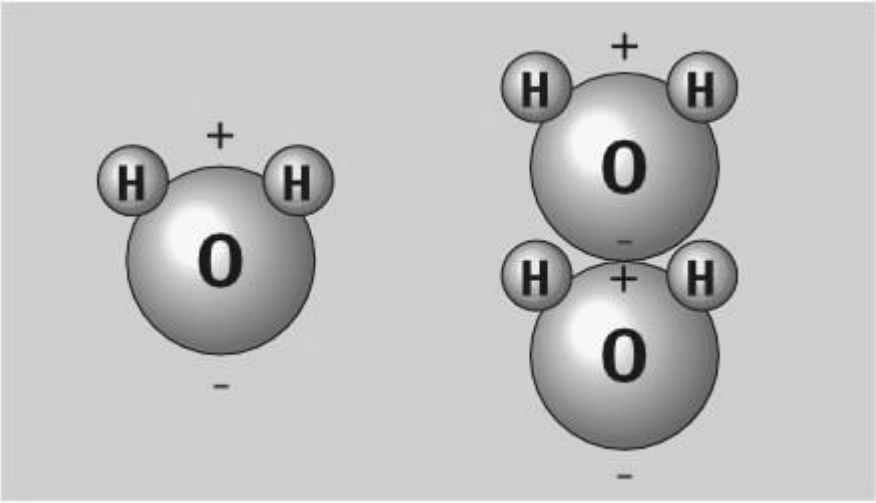
5. **Which of these belongs in the outermost shell (energy level) of an atom?**

A Electrons
B Protons
C Neutrons
D Photons

SOL 6.5
The student will investigate and understand the unique properties and characteristics of water and its roles in the natural and human-made environment.
Key concepts include

a) **water as the universal solvent;**
b) **the properties of water in all three phases;**
c) **the action of water in physical and chemical weathering;**
d) **the ability of large bodies of water to store thermal energy and moderate climate;**
e) **the importance of water for agriculture, power generation, and public health; and**
f) **the importance of protecting and maintaining water resources.**

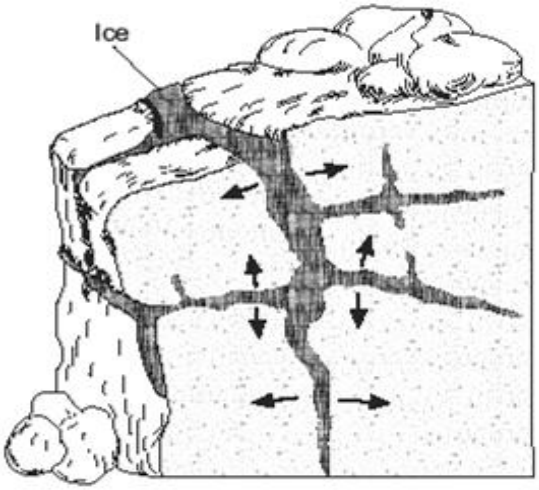
- Water is the only compound that commonly exists in all three states (solid, liquid, gas) on Earth. The unique properties of water are a major factor in the ability of our planet to sustain life.
- Among water's unique properties is that one side of each water molecule is slightly negative and the other is slightly positive. Individual water molecules, therefore, attract other water molecules like little magnets as the slightly positive portion of a water molecule is attracted to the slightly negative portion of an adjacent water molecule. In this way, water molecules "stick together."



- Due to water's polar nature, a large number of substances will "dissolve" in water. For this reason, water is often called the universal solvent.
- Additional properties of water are its high surface tension and the large range of temperature (0–100 degrees Celsius) in which it can be found in the liquid state, as well as the fact that, unlike other substances, solid water is less dense than liquid water.
- Water is able to absorb thermal energy without showing relatively large changes in temperature. Large bodies of water act to moderate the climate of surrounding areas by absorbing thermal energy in summer and slowly releasing that heat in the winter. For this reason, the climate near large bodies of water is slightly milder than areas without large bodies of water.

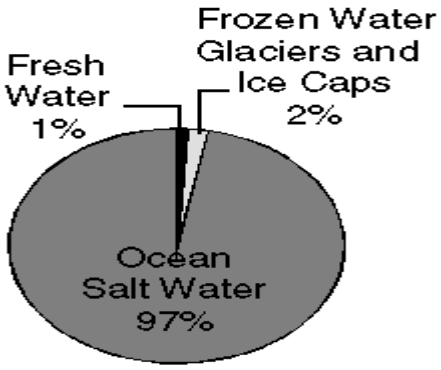
SOL 6.5: Properties and Characteristics of Water

- Water (rain, ice, snow) has shaped our environment by physically and chemically weathering rock and soil and transporting sediments. Freezing water can break rock without any change in the minerals that form the rock (physical weathering). This usually produces small particles and sand. Water with dissolved gases and other chemicals causes the minerals in rocks to be changed, leading to the deterioration of the rock (chemical weathering).



Scientific evidence indicates that the Earth formed about four-and-a-half billion years ago from the dust and debris orbiting the sun. Due to gravity, this debris became compacted and grew quite hot, creating hot gases, including water vapor and carbon dioxide. Over millions of years, the Earth and its gases cooled, and seas are believed to have formed when the Earth cooled enough for water vapor in the atmosphere to condense.

- Most of Earth's water is salt water in the oceans (97 percent). Available non-frozen, fresh water makes up less than 1 percent of the water on Earth.



Earth's Supply of Water

- Water occurs on Earth in oceans, lakes, rivers, streams, and in rock layers underground called aquifers. A large amount of water is also found in the bodies of living things.
- Water is essential for agriculture. Crops watered by reliable irrigation systems are more productive, and harvests more dependable.
- Water is an important resource used in power generation. Hydroelectric power plants make use of the kinetic energy of water as it flows through turbines. Water is also heated in power plants and turned to steam. The steam is used to turn turbines, which generate electricity.

SOL 6.5: Properties and Characteristics of Water

- In the past, streams and rivers were often used to dispose of human waste, and open sewers were common. During the mid-1800s, public health officials recognized the connection between disease outbreaks and contamination of public wells and drinking water. Advances in water treatment and sanitary sewers have helped eliminate diseases associated with human waste.
- Due to water's importance in power generation, agriculture, and human health, it is important to conserve water resources.
- The first human settlements were established near springs, rivers, and lakes. Reliable fresh water sources and irrigation systems allowed civilizations to grow and flourish. As cities grew, different strategies (tunnels, aqueducts, wells, cisterns, pumps, reservoirs) were employed to collect water.

1 **It is important to protect air quality because —**

A storms worsen as air pollution decreases
B acid rain is caused by air pollution
C wind currents change when the air is polluted
D energy produced by the Sun decreases when air is polluted

2 **Where is water *most* likely to become contaminated?**

A In a forest
B By a dam
C Near a cattle farm
D At the ocean bottom

4 **What allows water to have its many properties?**

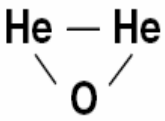
A. Water is a polar molecule
B. Water is a nonpolar molecule
C. Water is a solvent
D. Water is an atom

5. Which of the following would be evidence of chemical weathering?

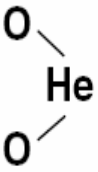
A. The rocks are smooth
B. The rocks have cracks
C. The rocks are jagged
D. The rocks have tiny holes

3 Which picture illustrates the structure of a molecule of water?

A



B



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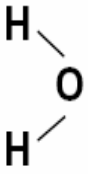

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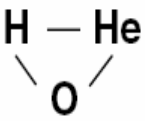
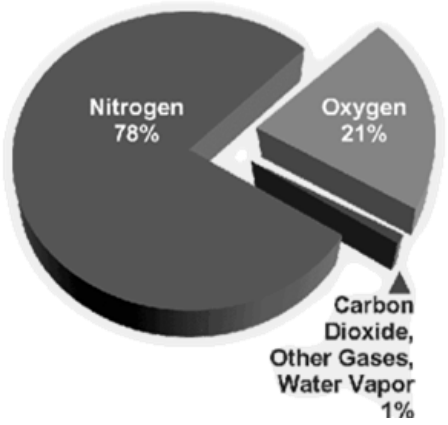


SOL 6.6
The student will investigate and understand the properties of air and the structure and dynamics of Earth's atmosphere. Key concepts include

a) air as a mixture of gaseous elements and compounds;
b) pressure, temperature, and humidity;
c) atmospheric changes with altitude;
d) natural and human-caused changes to the atmosphere and the importance of protecting and maintaining air quality;
e) the relationship of atmospheric measures and weather conditions; and
f) basic information from weather maps, including fronts, systems, and basic measurements.

- Air is a mixture of gaseous elements and compounds. These include nitrogen, oxygen, water, argon and carbon dioxide. Nitrogen makes up the largest proportion of air.



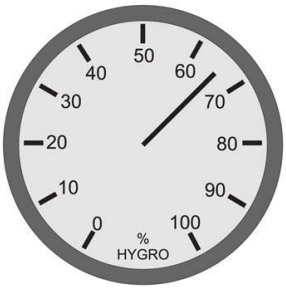
- Air exerts pressure. Air pressure decreases as altitude increases.

  Example:

  Pretend you have a stack of books in front of you. The bottom book is the air closest to the Earth the top book is the air farther away from the Earth. The air closest to the Earth (the bottom book) is heavier from the weight of the top air pressing down on it.

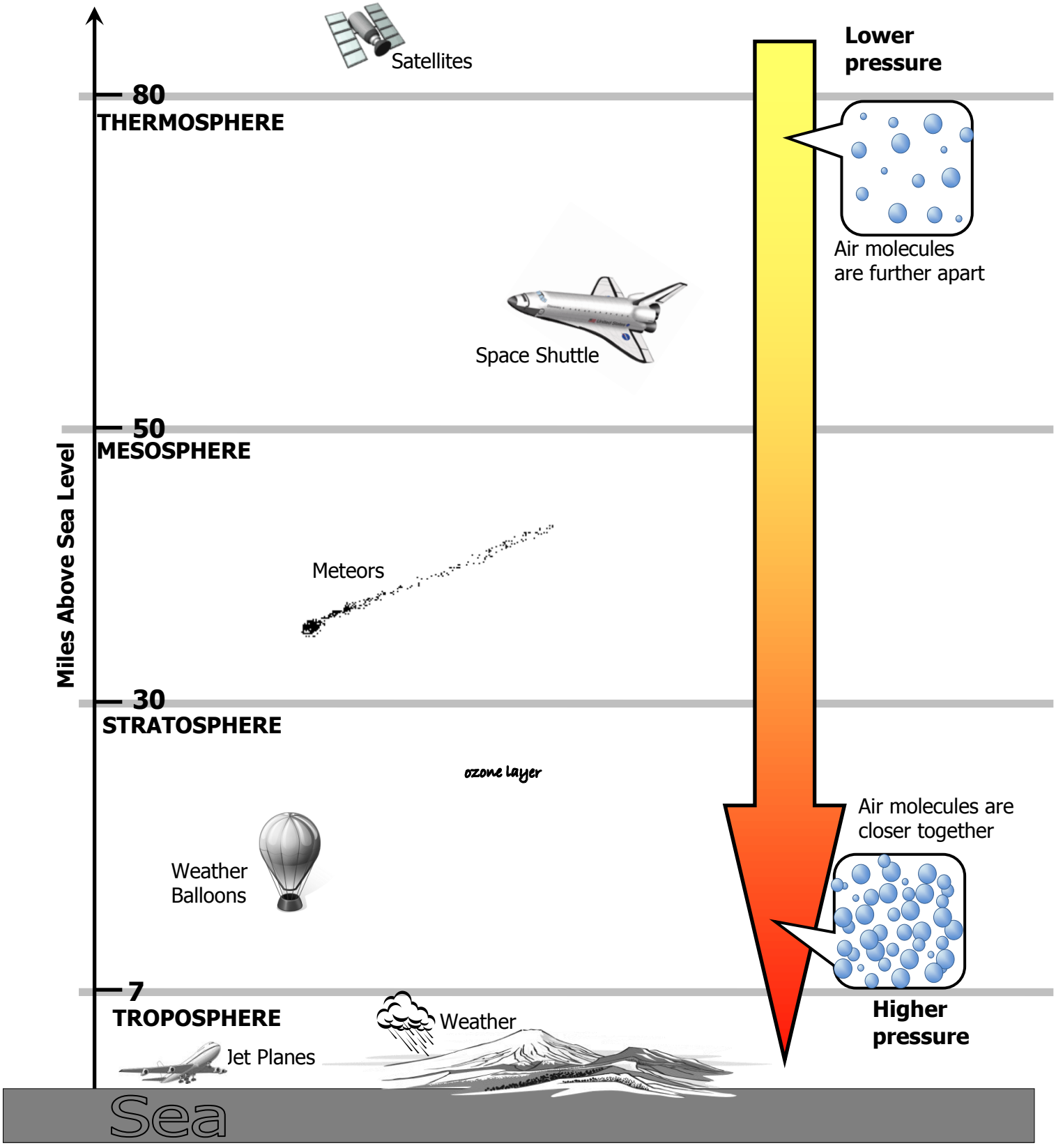
- Moisture in the air is called humidity.

  Humidity in the air is measured with a hygrometer (pictured below).



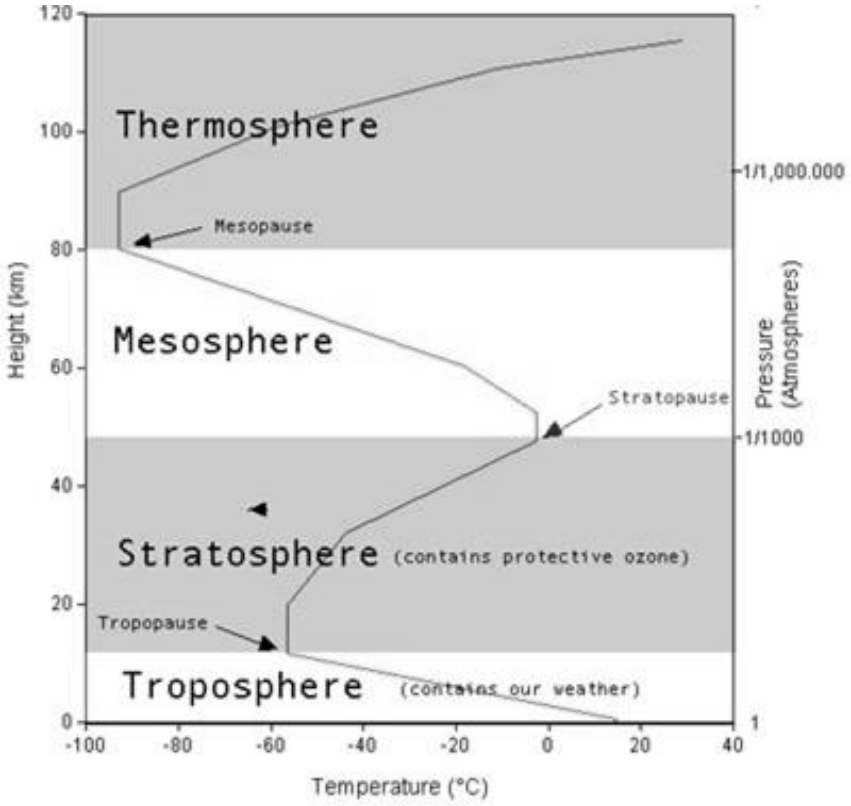
SOL 6.6: Air & Atmosphere

- The atmosphere is made up of layers (troposphere, stratosphere, mesosphere, and thermosphere) that have distinct characteristics.



SOL 6.6: Air & Atmosphere

- Temperature decreases as altitude increases in the lowest layer of the atmosphere.



The "zigzag" line in the table above shows how the temperature changes based on the distance away from sea level.

Apply Your Understanding:
Look at the graphic above and pretend the layers of the atmosphere are a mountain you are climbing. As you climb through the troposphere, you get colder. The higher your elevation from sea level, the colder the air feels. (Remember, we're talking about climbing in the troposphere.)

Apply Your Understanding:
Now, pretend you are **still** climbing and you reach the outer levels of the troposphere and you are entering the stratosphere. Based on the graph above, what do you think will happen to the temperature as you climb to a higher elevation within the stratosphere?

If you guessed that the temperature would begin to increase and get warmer you are CORRECT!

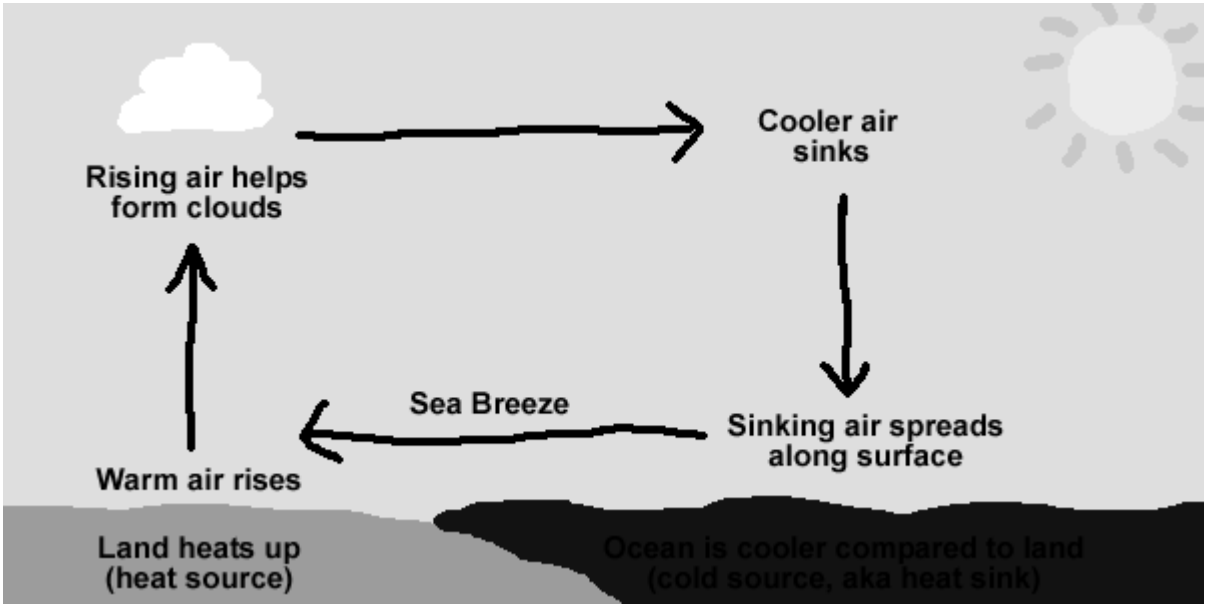
Apply Your Understanding:
Now, pretend you are **still** climbing and you reach the outer levels of the stratosphere and are entering the mesosphere. Based on the graph above, what do you think will happen to the temperature as you climb to a higher elevation within the mesosphere?

If you guessed that the temperature would begin to decrease and get colder you are CORRECT!

SOL 6.6: Air & Atmosphere

- Most of the air that makes up the atmosphere is found in the troposphere (the lowest layer). Virtually all weather takes place there.
- Forest fires and volcanic eruptions are two natural processes that affect the Earth's atmosphere. Many gaseous compounds and particles are released into the atmosphere by human activity. All of the effects of these materials are not yet fully understood.

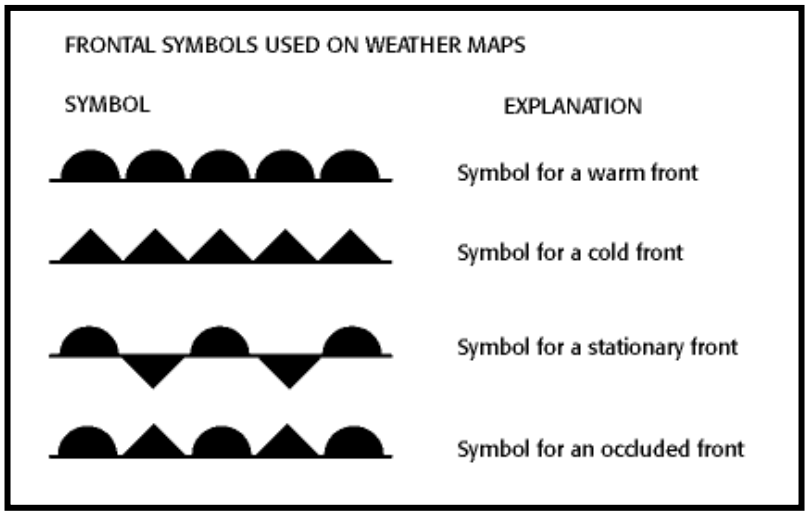
- The amounts of heat energy and water vapor in the air and the pressure of the air largely determine what the weather conditions are.

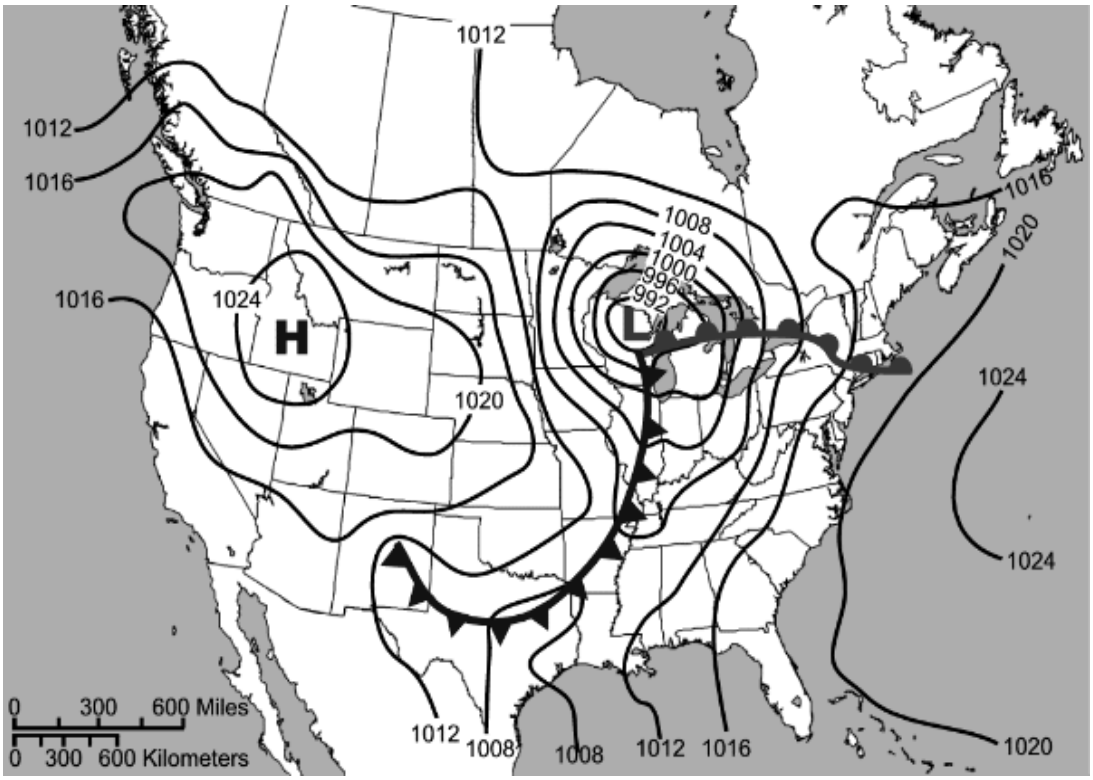


SOL 6.6: Air & Atmosphere

- Weather maps show much useful information about descriptive air measurements, observations, and boundaries between air masses (fronts). The curved lines showing areas of equal air pressure and temperature are key features of weather maps. Weather maps are important for understanding and predicting the weather.

  Fronts are boundaries between air masses.

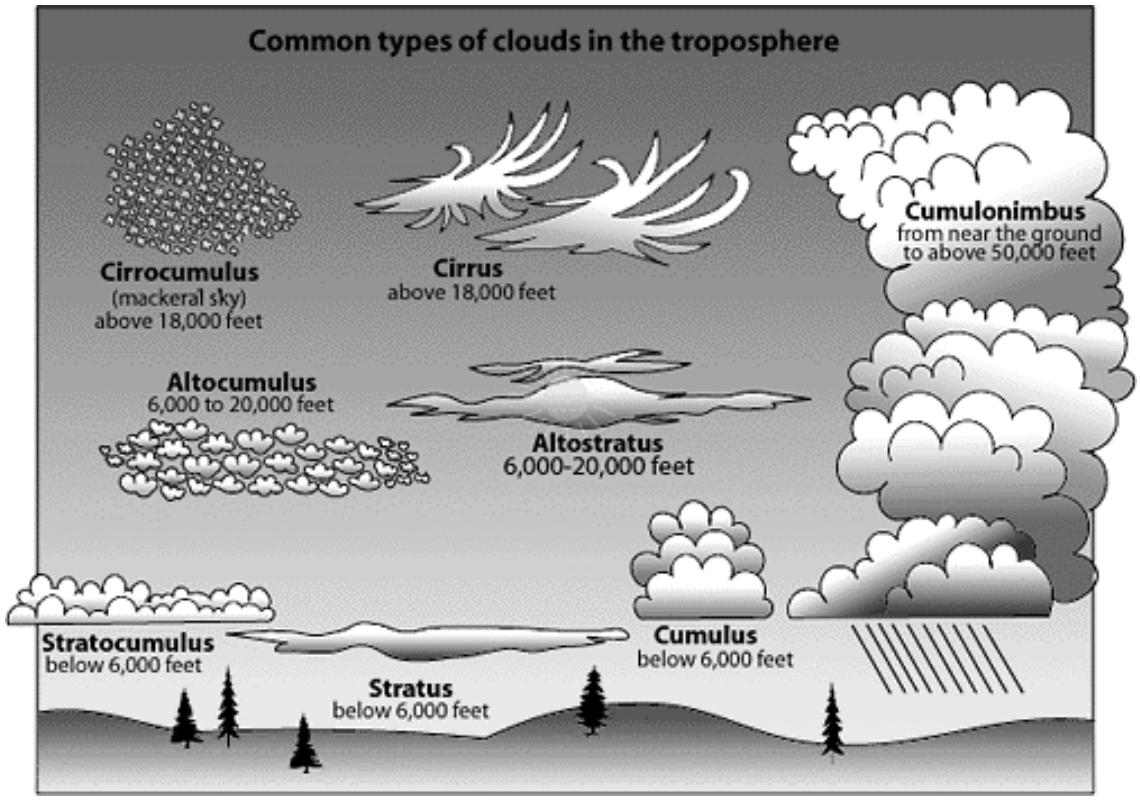




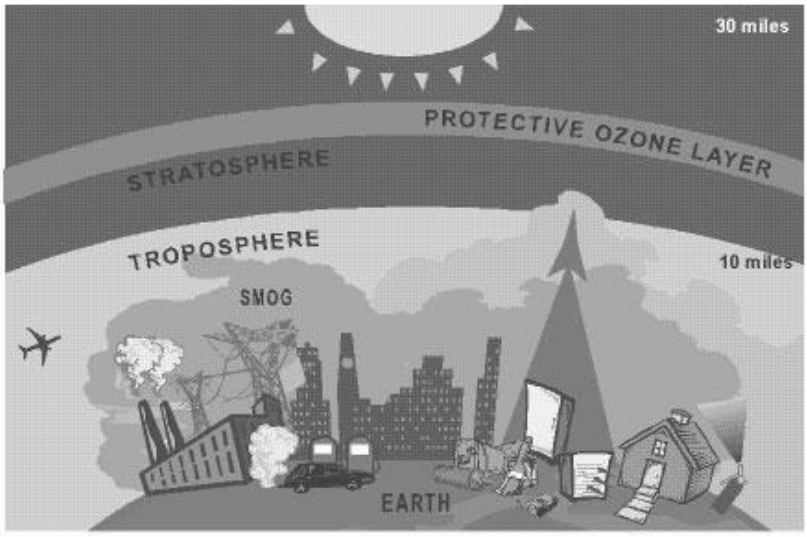
The following is a good website for information about weather and weather related topics.
http://www.ussartf.org/predicting_weather.htm

SOL 6.6: Air & Atmosphere

- Clouds are important indicators of atmospheric conditions. Clouds are found at various levels within the troposphere. Three major types of clouds are cumulus, stratus, and cirrus.



- Ozone, a form of oxygen, can form near the surface when exhaust pollutants react with sunlight. This pollutant can cause health problems. Naturally occurring ozone is also found in the upper atmosphere and helps to shield the Earth from ultraviolet radiation.



- Maintaining good air quality is a crucial goal for modern society, and it is everyone's responsibility to work toward it.

1. The main components of air are…
A Hydrogen and Oxygen
B Krypton and Nitrogen
C Oxygen and Nickel
D Nitrogen and Oxygen

2. Temperature decreases as _____ increases in the lowest layer of the atmosphere.
A altitude
B pollution
C clouds
D fronts

3. Most of the air that makes up the atmosphere is found in the…
A mesosphere
B troposphere
C thermosphere
D stratosphere

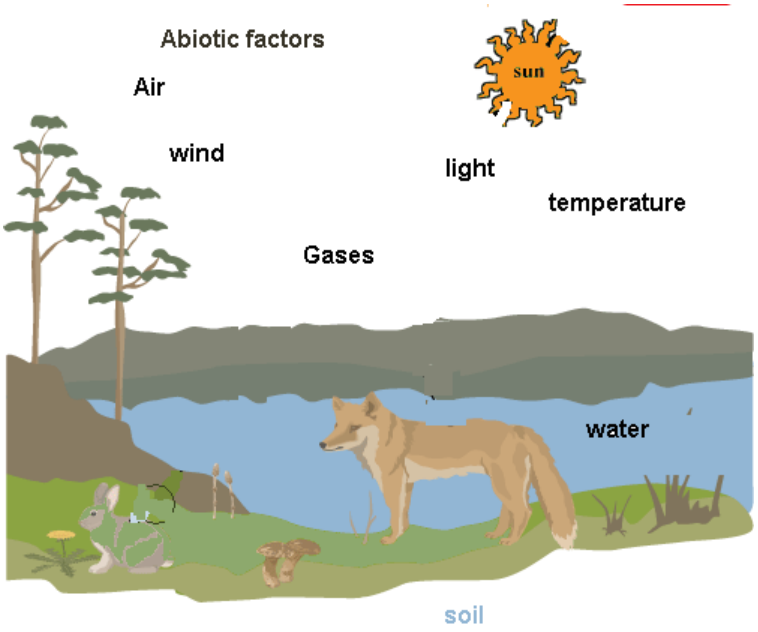
4. The boundaries between air masses are…
A humidity
B atmosphere
C altitude
D fronts

SOL 6.7

The student will investigate and understand the natural processes and human interactions that affect watershed systems. Key concepts include

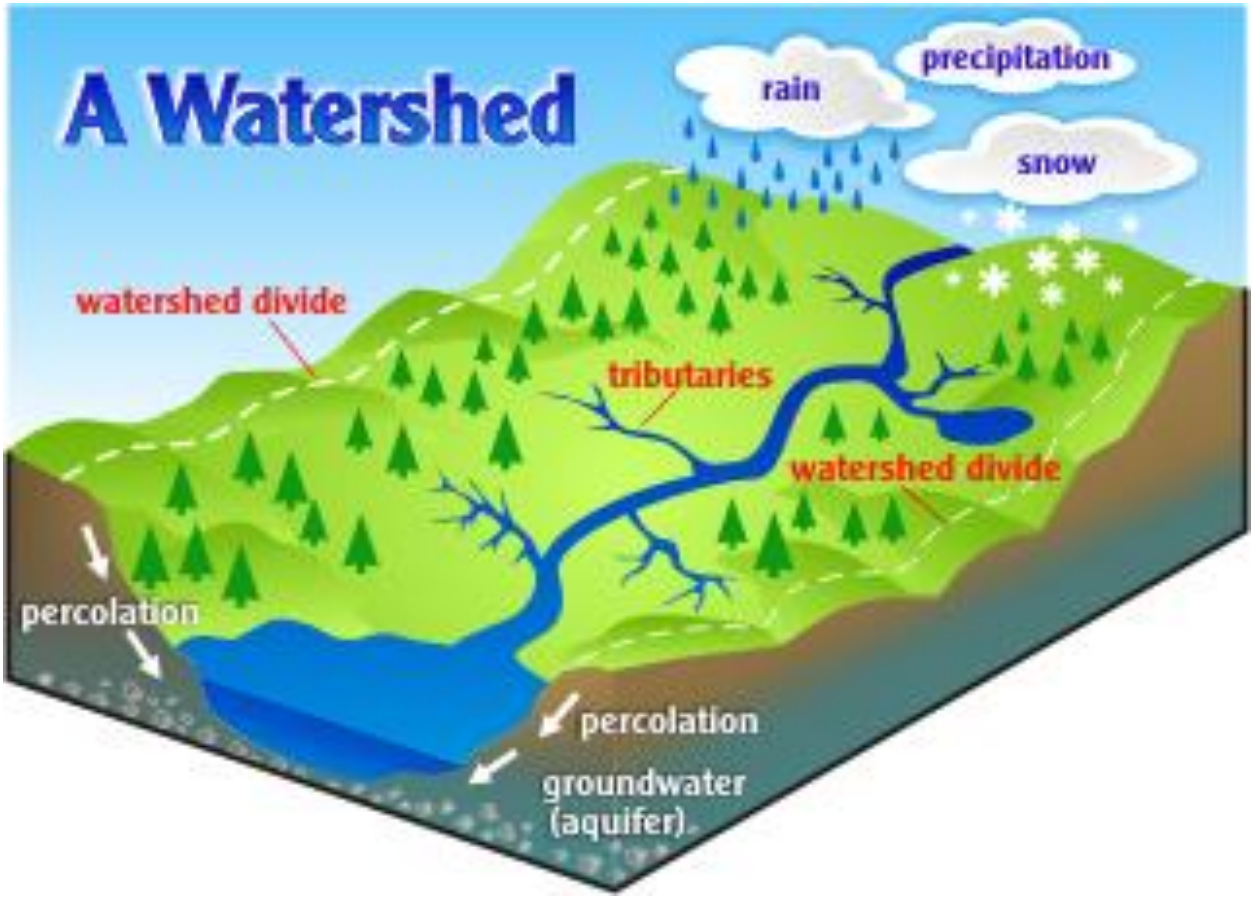
a) the health of ecosystems and the abiotic factors of a watershed;
b) the location and structure of Virginia's regional watershed systems;
c) divides, tributaries, river systems, and river and stream processes;
d) wetlands;
e) estuaries;
f) major conservation, health, and safety issues associated with watersheds; and
g) water monitoring and analysis using field equipment including hand-held technology.

- An ecosystem is made up of the biotic (living) community and the abiotic (nonliving) factors that affect it. The health of an ecosystem is directly related to water quality.
- Abiotic factors determine ecosystem type and its distribution of plants and animals as well as the usage of land by people. Abiotic factors include water supply, topography, landforms, geology, soils, sunlight, and air quality/O_2 availability.



- Human activities can alter abiotic components and thus accelerate or decelerate natural processes. For example, people can affect the rate of natural erosion. Plowing cropland can cause greater erosion, while planting trees can prevent it. Flood protection/wetland loss is another example.
- A watershed is the land that water flows across or through on its way to a stream, lake, wetland, or other body of water. Areas of higher elevations, such as ridgelines and divides, separate watersheds.

SOL 6.7: Watershed Systems



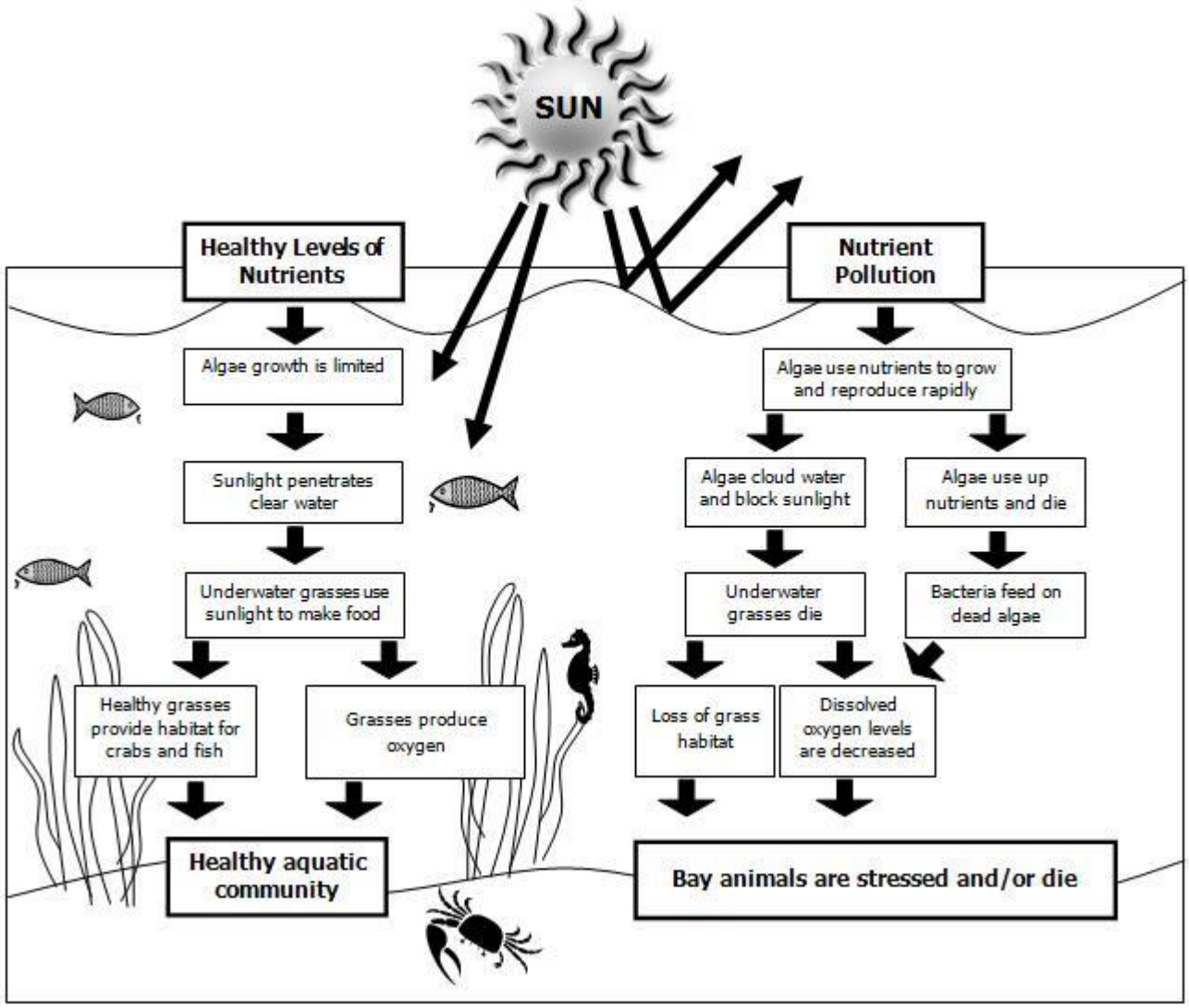
- The three major regional watersheds systems in Virginia lead to the Chesapeake Bay, the North Carolina sounds, or the Gulf of Mexico.
- River systems are made up of tributaries of smaller streams that join along their courses. Rivers and streams generally have wide, flat, border areas, called flood plains, onto which water spills out at times of high flow.
- Rivers and streams carry and deposit sediment. As water flow decreases in speed, the size of the sediment it carries decreases.
- Wetlands form the transition zone between dry land and bodies of water such as rivers, lakes, or bays. Both tidal and non-tidal wetlands perform important water quality functions, including regulating runoff by storing flood waters; reducing erosion by slowing down runoff; maintaining water quality by filtering sediments, trapping nutrients, and breaking down pollutants; and recharging groundwater. They also provide food and shelter for wildlife and fish and nesting and resting areas for migratory birds.
- Estuaries perform important functions, such as providing habitat for many organisms and serving as nurseries for their young.
- The Chesapeake Bay is an estuary where fresh and salt water meet and are mixed by tides. It is the largest estuary in the contiguous United States and one of the most productive.

SOL 6.7: Watershed Systems

The Chesapeake Bay Watershed

- Water quality monitoring is the collection of water samples to analyze chemical and/or biological parameters. Simple parameters include pH, temperature, salinity, dissolved oxygen, turbidity, and the presence of macroinvertebrate organisms.

SOL 6.7: Watershed Systems



1 A coal-burning facility is constructed in an area containing several pond ecosystems. How will this human activity *most* likely affect the pond ecosystems?

A More nutrients will be available.
B Organism diversity will increase.
C Disease will become less common.
D Water quality will be reduced.

SOL 6.7: Watershed Systems

2 **Which body of water is often protected naturally from storms by barrier islands and also contains a mixture of fresh water and salt water?**

A Estuary

B Ocean

C Lake

D Pond

3. What are the three major watershed in Virginia?

A Chesapeake Bay, San Francisco Bay, Gulf of Mexico
B Galveston Bay, North Carolina Sound, Gulf of Mexico
C Chesapeake Bay, North Carolina Sound, Gulf of Mexico
D Chesapeake Bay, North Carolina Sound, Gulf of Maine

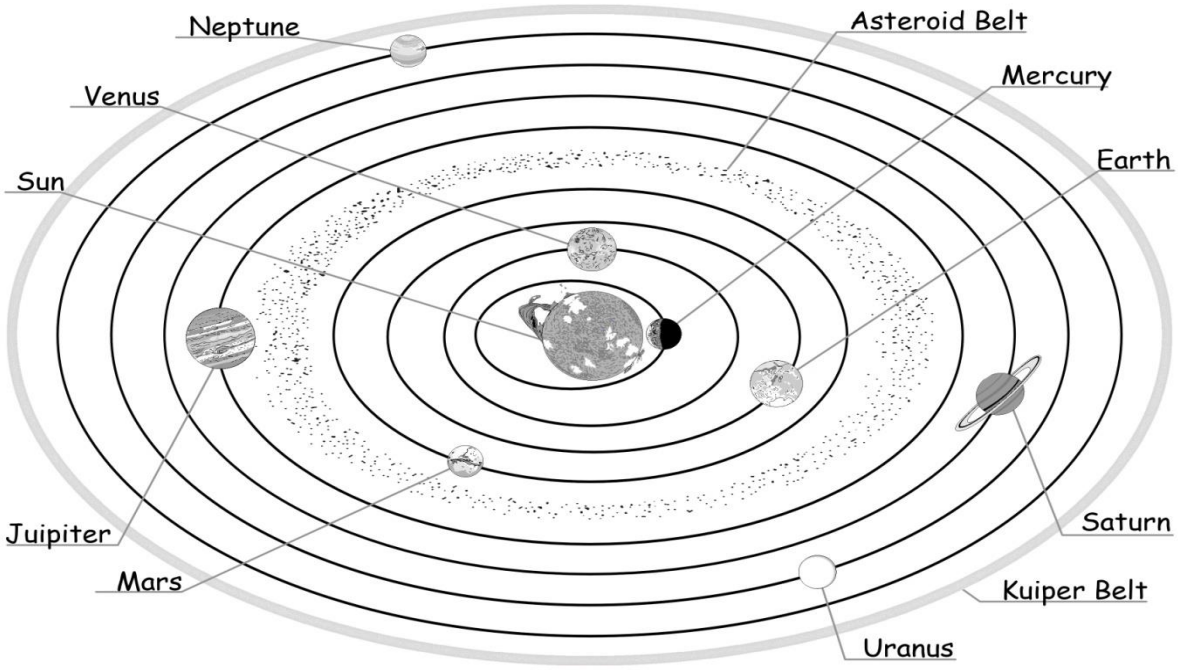
4. The abiotic and biotic factors in and area determine its …

A water type
B ecosystem type
C salinity
D pH

SOL 6.8
The student will investigate and understand the organization of the solar system and the interactions among the various bodies that comprise it. Key concepts include

a) the sun, moon, Earth, other planets and their moons, dwarf planets, meteors, asteroids, and comets;
b) relative size of and distance between planets;
c) the role of gravity;
d) revolution and rotation;
e) the mechanics of day and night and the phases of the moon;
f) the unique properties of Earth as a planet;
g) the relationship of Earth's tilt and the seasons;
h) the cause of tides; and
i) the history and technology of space exploration.

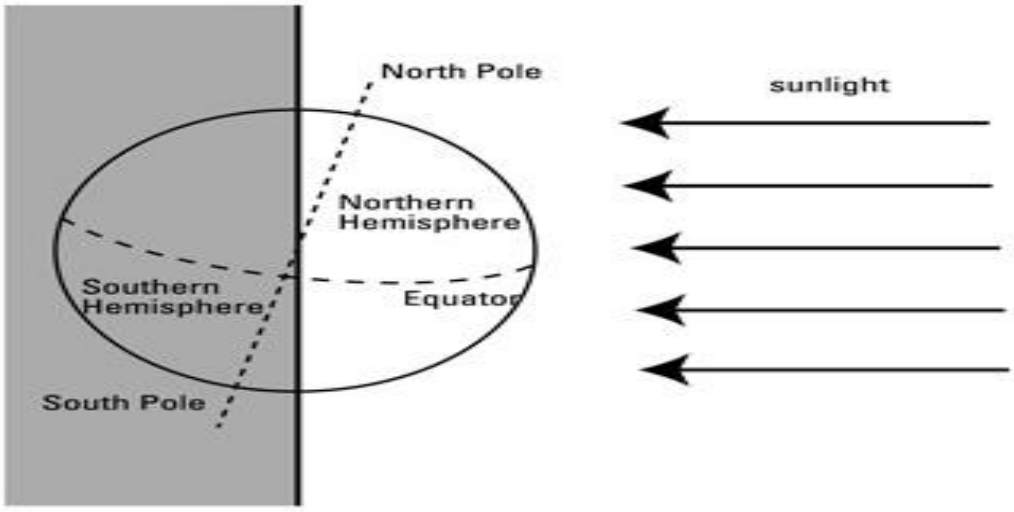
- The solar system consists of the sun, moon, Earth, other planets and their moons, meteors, asteroids, and comets. Each body has its own characteristics and features.
- The distance between planets and sizes of the planets varies greatly. The outer, "gas" planets are very large, and the four inner planets are comparatively small and rocky.



- Gravity is a force that keeps the planets in motion around the sun. Gravity acts everywhere in the universe.

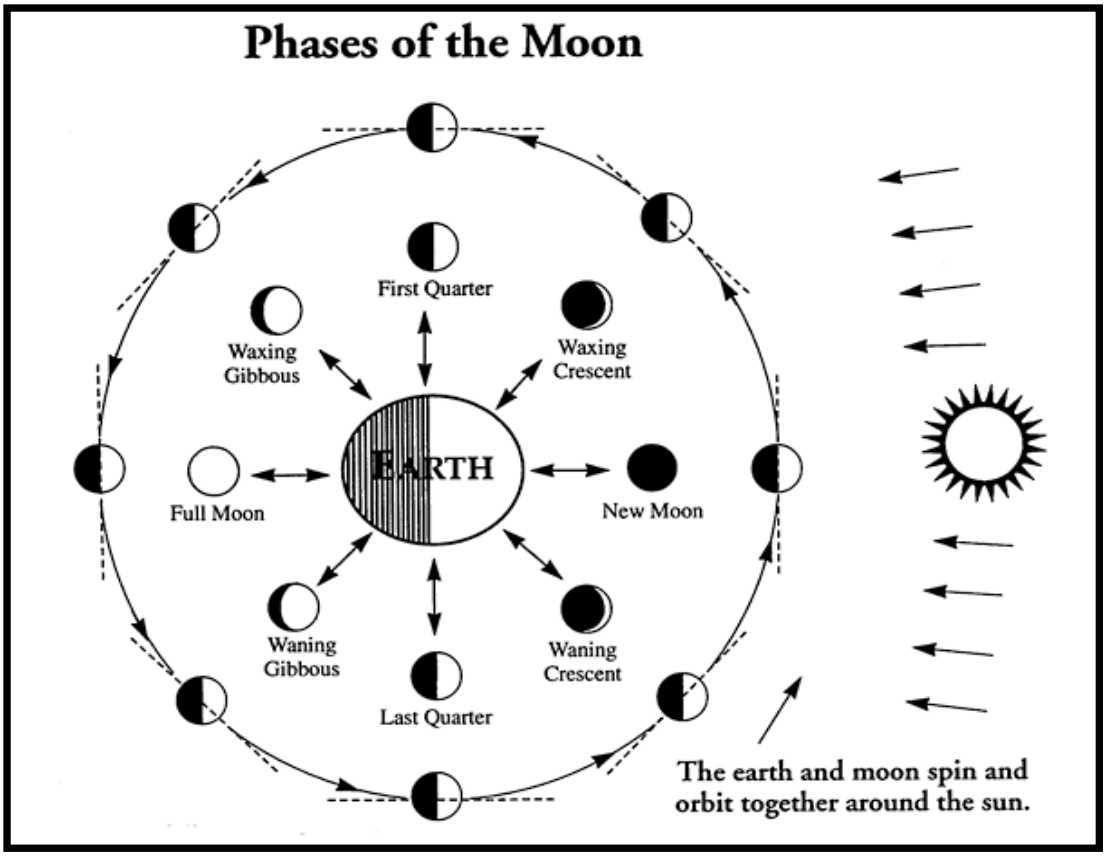
SOL 6.8 Earth and Space Systems

- Planets revolve around the sun, and moons revolve around planets. A planet rotates upon an axis.



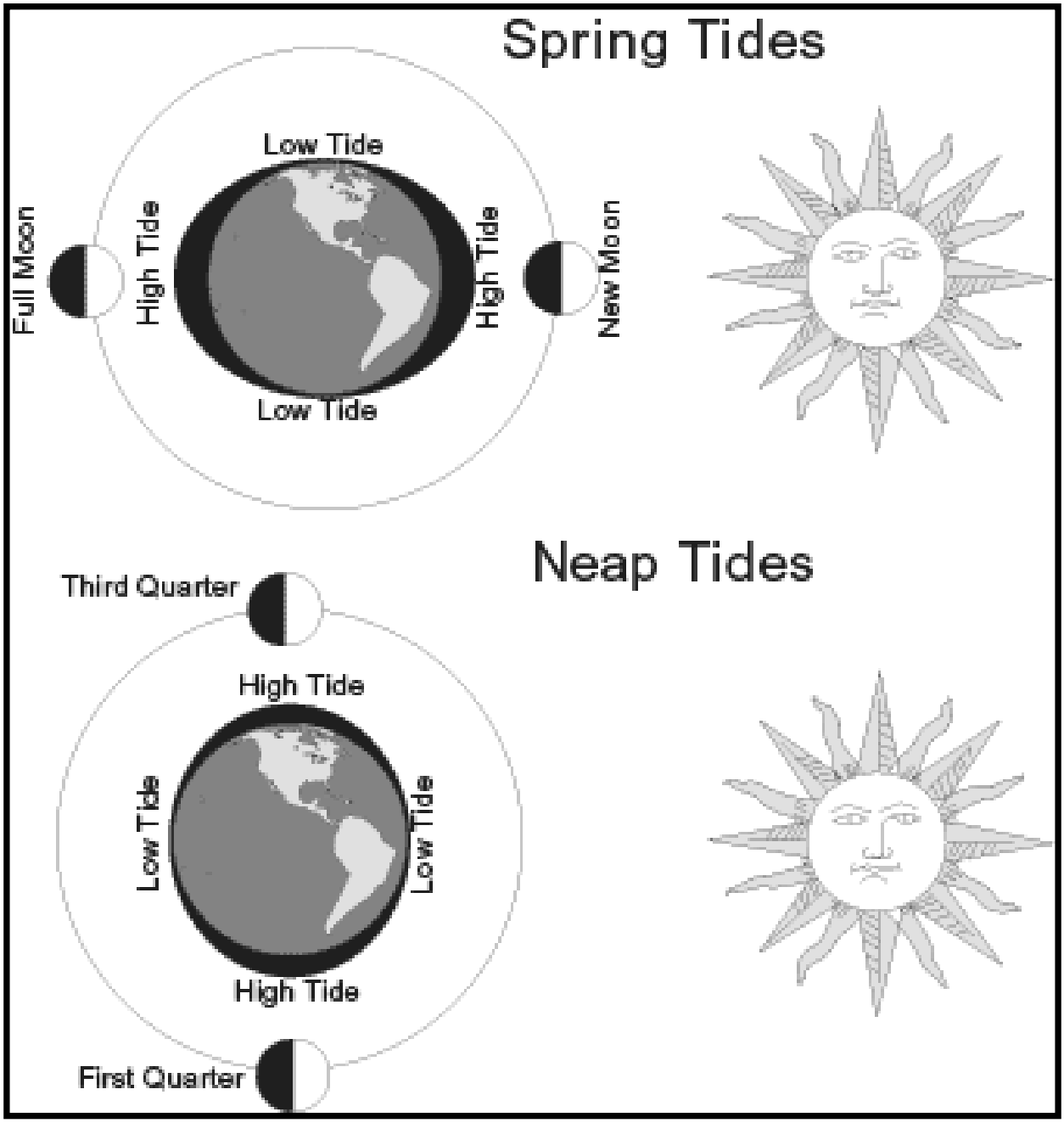
As the Earth rotates, different sides of the Earth face toward or away from the sun, thus causing day and night, respectively.

- The phases of the moon are caused by its position relative to the Earth and sun.



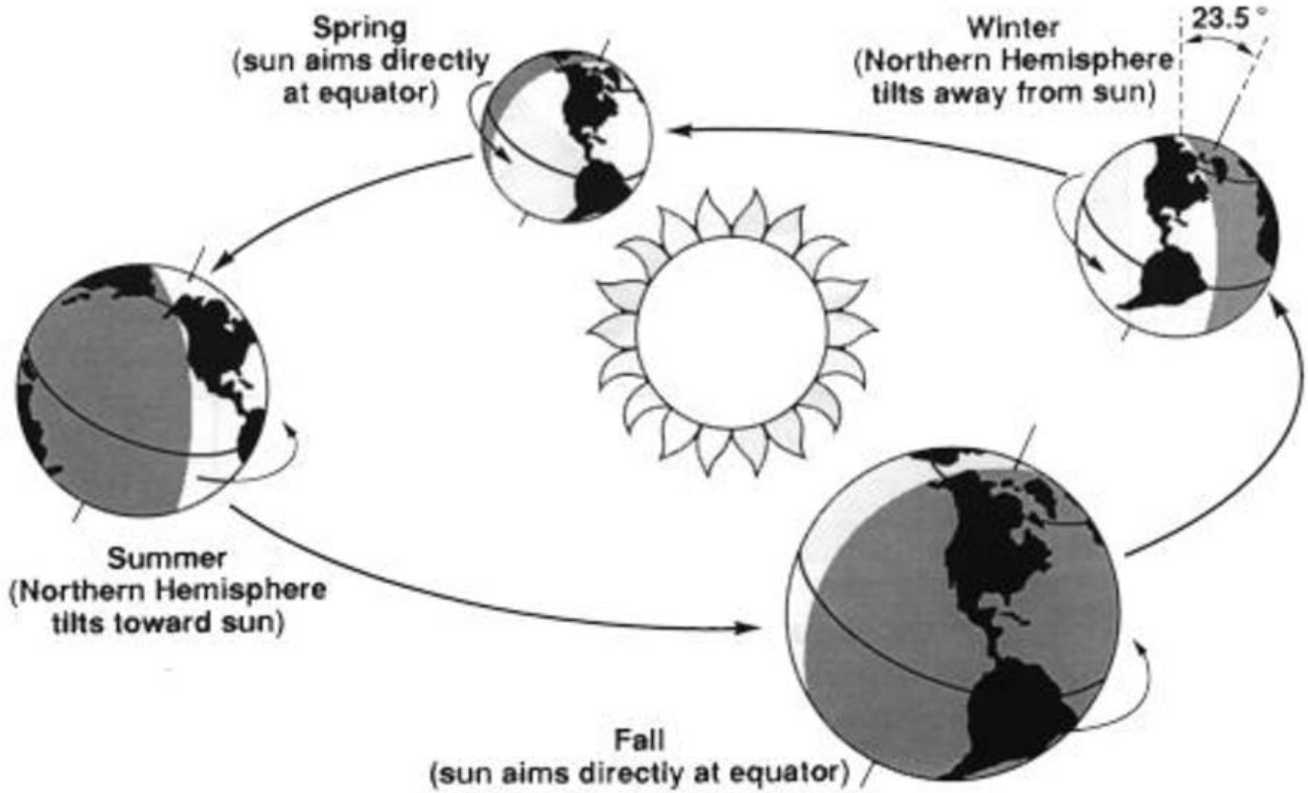
SOL 6.8 Earth and Space Systems

- The Earth is a rocky planet, extensively covered with large oceans of liquid water and having frozen ice caps in its polar regions. The Earth has a protective atmosphere consisting predominantly of nitrogen and oxygen and has a magnetic field. The atmosphere and the magnetic field help shield the Earth's surface from harmful solar radiation. Scientific evidence indicates that the Earth is about 4.5 billion years old.
- Tides are the result of the gravitational pull of the moon and sun on the surface waters of the Earth.



SOL 6.8 Earth and Space Systems

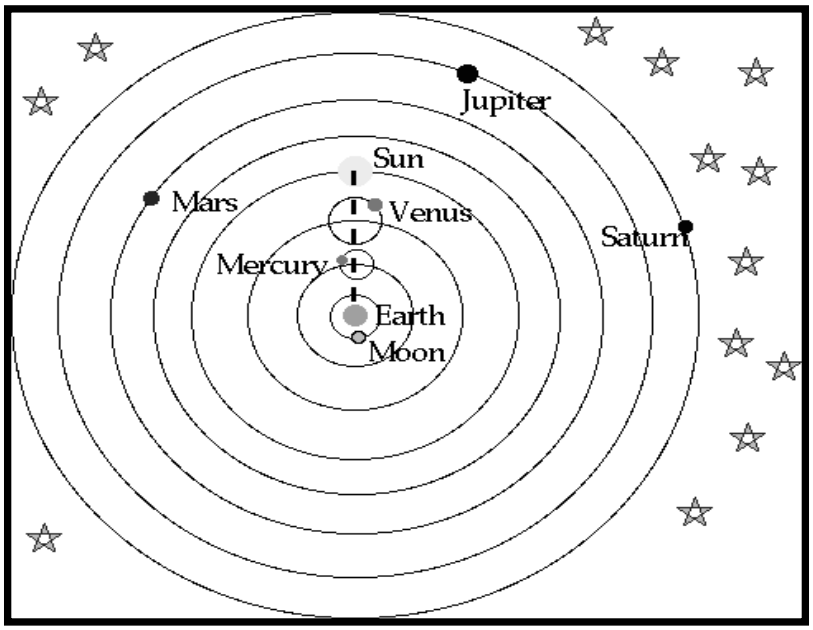
- Seasons are caused by a combination of the tilt of Earth on its axis, the curvature of Earth's surface and, thus, the angle at which sunlight strikes the surface of Earth during its annual revolution around the sun.



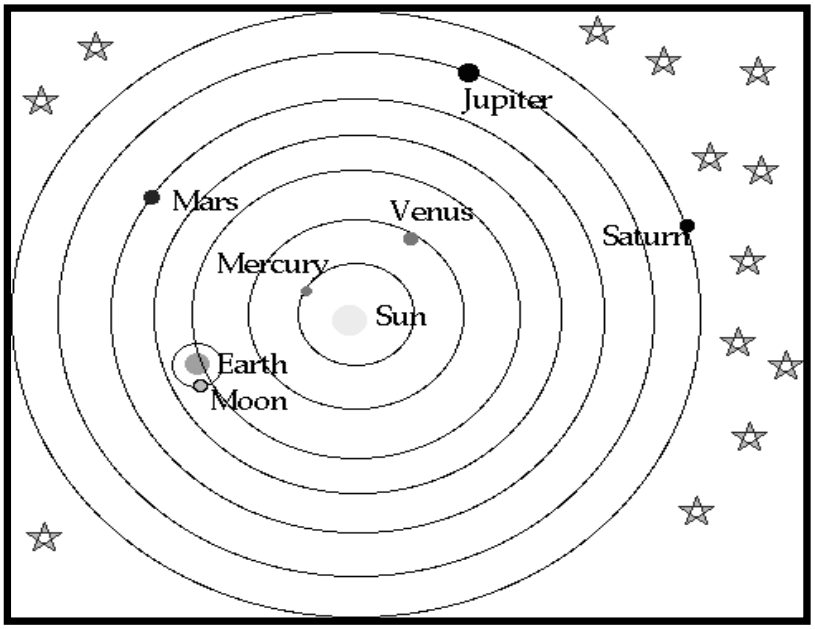
SOL 6.8 Earth and Space Systems

- The ideas of Ptolemy, Aristotle, Copernicus, and Galileo contributed to the development of our understanding of the solar system.

Geocentric (Ptolemy)



Heliocentric (Copernicus)



- With the development of new technology over the last half-century, our knowledge of the solar system has increased substantially

SOL 6.8 Earth and Space Systems

1. **Which of the following *best* describes why the Moon orbits Earth?**

   A The distance the Moon and Earth are from the Sun
   B The energy reflected from the surface of Earth
   C The winds generated on Earth by the energy of the Sun
   D The gravitational attraction between the Moon and Earth

2. **Earth is different from the other planets in our solar system because it —**

   A orbits a star
   B has collided with meteorites
   C has oceans and lakes
   D makes up the majority of the mass of our solar system

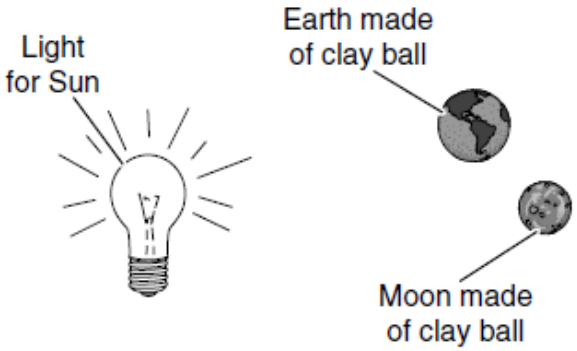
3. **Which body in the solar system usually contains an atmosphere?**

   A An asteroid
   B A planet
   C A meteor
   D A comet

SOL 6.8 Earth and Space Systems

4. **Which of these would be the best model to use to study the cause of the moon's phase changes?**

A



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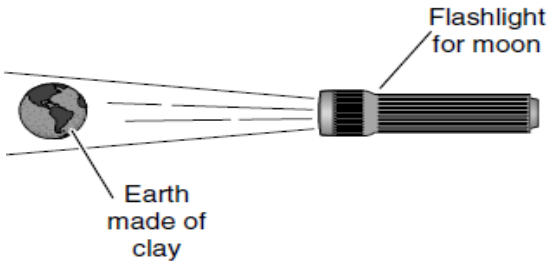
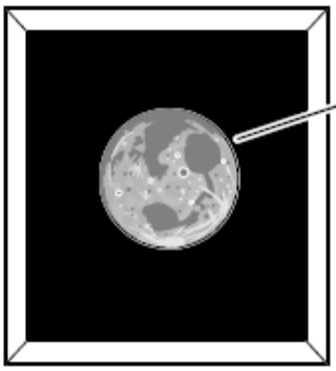
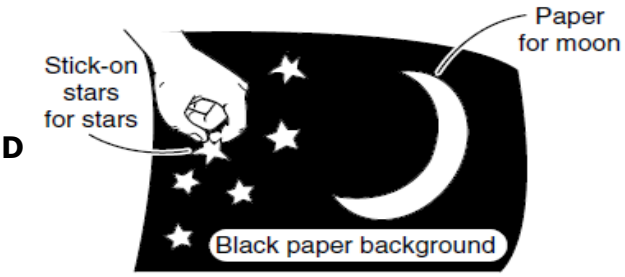


C



D



5. **Which of these has the *most* influence on ocean tides?**

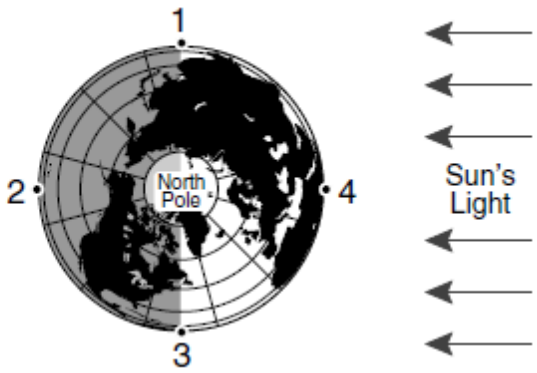
A The magnetic field of the Earth
B Gravity between the Earth and the moon
C Radiation from the sun
D Electrical forces in the atmosphere

SOL 6.8 Earth and Space Systems

6. **The science of astronomy is concerned with the observation and analysis of the movements of celestial objects. The invention of which instrument was *most* helpful to the advancement of astronomy?**

A Telescope
B Microscope
C Camera
D Geiger counter

7.



At which of these points is it 12:00 noon?

A 1
B 2
C 3
D 4

8. **The time in which Earth makes one revolution around the sun is approximately one —**

A year
B season
C month
D day

SOL 6.9

The student will investigate and understand public policy decisions relating to the environment. Key concepts include

a) management of renewable resources;
b) management of nonrenewable resources;
c) the mitigation of land-use and environmental hazards through preventive measures; and
d) cost/benefit tradeoffs in conservation policies.

- People, as well as other living organisms, are dependent upon the availability of clean water and air and a healthy environment.
- Local, state, and federal governments have significant roles in managing and protecting air, water, plant, and wildlife resources.
- Modern industrial society is dependent upon energy. Fossil fuels are the major sources of energy in developed and industrialized nations and should be managed to minimize adverse impacts.
- Many renewable and nonrenewable resources are managed by the private sector (private individuals and corporations).
- Renewable resources should be managed so that they produce continuously. Sustainable development makes decisions about long-term use of the land and natural resources for maximum community benefit for the longest time and with the least environmental damage.
- Regulations, incentives, and voluntary efforts help conserve resources and protect environmental quality.
- Conservation of resources and environmental protection begin with individual acts of stewardship.
- Use of renewable (water, air, soil, plant life, animal life) and nonrenewable resources (coal, oil, natural gas, nuclear power, and mineral resources) must be considered in terms of their cost/benefit tradeoffs.
- Preventive measures, such as pollution prevention or thoughtfully planned and enforced land-use restrictions, can reduce the impact of potential problems in the future.
- Pollution prevention and waste management are less costly than cleanup.

SOL 6.9 Public Policy and the Environment

1. There are harvesting regulations for many fish species that limit the number and size of the fish that may be kept. What is the *most* likely reason these limits have been placed on harvesting these fish?

A To have enough fish for zoo aquariums
B To keep other game fish species populations low
C To have people spend more money on fishing
D To keep a healthy population of adult fish

2. A group of people were concerned about a new coal-burning power plant that might be built in their neighborhood. What is probably their main concern?

A Burning coal produces more heat than burning wood.
B The heat from burning coal can drive generators that produce electricity.
C Burning coal produces sulfur dioxide which contributes to acid rain.
D There is more coal in the earth than there is oil and gas.

3. Which is a problem with using wind turbines to produce energy?

A wind turbines are efficient only in certain areas
B wind turbines occupy a small area of land
C wind turbines produce a large amount of energy
D wind turbines create a large amount of pollution

4. In the United States, which is responsible for the country's drinking water?

A Food and Drug Administration (FDA)
B National Oceanic and Atmospheric Administration (NOAA)
C Environmental Protection Agency (EPA)
D Center for Disease Control (CDC)

SOL 6.1	
experiment	An experiment is a structured test of a hypothesis.
hypothesis	An idea or explanation that you then test through study and experimentation. It is stated in terms of a testable relationship.
scientific prediction	A scientific prediction is a forecast about what may happen in some future situation based on current evidence or past experiences.
inference	An inference is an explanation based on observations and background knowledge.
independent variable	"Manipulated Variable" of an experiment-It is the item changed on purpose by the scientist or person conducting the experiment
dependent variable	"Responding Variable" of an experiment-the result, response, or outcome the is measured to give you data
purpose	The reason for doing the experiment
conclusion	A conclusion is formulated from collected data.
dichotomous key	A guide used to identify organisms/based on like or unlike characteristics
triple beam balance (scale)	Instrument used to measure mass of an object.
graduated cylinder	Instrument used to measure the volume of a liquid.

SOL 6.2	
potential energy	Stored energy
kinetic energy	Energy in motion
renewable resources	Any natural resource that can replace itself naturally in a relatively short time/ within a lifetime.
nonrenewable resources	Energy sources that take a long period of time to form and are not replaced as they are used.
energy transformation	When one form of energy changes into another form of energy
geothermal energy	Energy from the Earth's interior
hydroelectric power	Electricity produced from the flow of water
solar energy	Energy generated by the sun.
tidal energy	Energy produced from the rise and fall of tides.
fossil fuels	A nonrenewable source of energy in the form of coal, oil, and natural gas.
biomass	Energy found in nature such as agricultural crops and residue, wood and wood waste, animal waste, aquatic plants, and organic components.
Wind energy	Energy of moving air.

SOL 6.3	
solar radiation	Energy from the sun that is made up of different types of radiation (including infrared, visible light, and ultraviolet).
wavelength	The distance between one point on a wave to the corresponding point on another wave in a series.
ultraviolet rays	Harmful rays from the sun.
visible light	The colors of the rainbow, the only light that we can see.
infrared radiation	Form of radiant energy that travels in wavelengths, not visible, and felt as warmth.
reflection	Transfer of energy when light waves strike a surface and change direction from one object to another.
absorption	Transfer of energy when light wave energy is taken on by other matter.
radiation	Transfer of heat away from an object through space.
convection	Transfer of heat through fluids (air, water).
conduction	Transfer of heat through touch.
thermal energy	Is an example of kinetic energy, as it is due to the motion of particles. It results in an object having a temperature that can be measured. **Thermal** energy can be transferred from one object to another in the form of **heat**.

SOL 6.4	
atom	Smallest unit of an element that still has the properties of that element.
proton	A positively charged subatomic particle found inside the nucleus.
neutron	A subatomic particle with no charge found in the nucleus.
electron	A negatively charged subatomic particle found outside the nucleus.
nucleus	The center of an atom that is made up of protons and neutrons.
atomic number	The number found on the periodic table of elements that determines the number of **protons.**
element	A pure substance made up of only one kind of atom.
compound	A substance made up of two or more elements that are chemically joined.
matter	Anything that has mass and takes up space (solid, liquid, gas)
chemical equation	A way to show a chemical reaction using symbols.
chemical change	A change in matter that produces new substances.
physical change	A change that alters the appearance of a substance but does not make the material change into another substance.

SOL 6.5	
universal solvent	The idea that a large number of substances will dissolve in water.
solute	The part of a solution present in a lesser amount and dissolved by a solvent.
adhesion	The unique property of water where water molecules stick to other substances.
cohesion	The unique property of water where one water molecule sticks to another water molecule.
density	The amount of mass in a given space.
surface tension	The tightness across the surface of water caused by the polar water molecules pulling on each other.
solvent	The part of a solution that is present in a largest amount and dissolves a solute.
capillary action	The ability of water to move through small spaces like a straw or paper towel.
chemical weathering	Breaking down or disintegration of rocks caused by chemical reactions
physical weathering	Breaking down of rocks without changing their chemical composition
polar molecule	A molecule with one side slightly positively charged and one side slightly negatively charged.

SOL 6.6	
air	Gases found in the atmosphere.
air pressure	A force that is the result of the weight of a column of air pushing down on an area.
humidity	A measure of the amount of moisture or water vapor in the air.
troposphere	1st Layer of the atmosphere where weather occurs.
stratosphere	2nd Layer of the atmosphere where the ozone layer is found.
mesosphere	3rd Layer of the atmosphere where most meteors burn up.
thermosphere	Outermost and hottest layer of the atmosphere
warm front	When a moving mass of warm air slides over a cold air mass and takes over the cold air mass.
cold front	When a moving mass of cold air abruptly moves under a warm air mass and pushing the warm air mass up and out of the way
temperature	The average amount of energy of motion in the molecules of a substance, used to measure heat energy
anemometer	Instrument used to measure the wind speed.
air mass	A huge body of air that has similar temperature, humidity and air pressure throughout it.

cumulus cloud	A cloud that appears fluffy and is low to the ground and indicates fair weather.
stratus cloud	A cloud that usually forms in flat layers and cover all or most of the sky.
cirrus cloud	A cloud that typically has a feathery, wispy appearance and forms at high levels (made of ice crystals). Often indicates a change is coming.
ozone	A layer within the stratosphere that protects against ultraviolet rays.
ultraviolet radiation	Radiant energy from the sun that is harmful to living organisms
hygrometer	Instrument used to measure the amount of moisture in the air
humidity	The amount of moisture in the air
front	The area where the air masses meet and do not mix
stationary front	Cold and warm air masses meet but neither has enough force to move the other
occluded front	A warm air mass is caught between two cooler air masses.
cumulonimbus cloud	Towering clouds with flat tops often producing thunderstorms.
weather vane	Instrument used to indicate the direction of air movement
thermometer	Instrument used to measure temperature.
rain gauge	An instrument used to measure the amount of precipitation.

SOL 6.7	
ecosystem	Made up of a living community and the nonliving factors that affect it.
biotic	Living organisms in an environment
abiotic	Nonliving factors of an environment
watershed	The land that water flows across or through on its way to a stream, lake, wetland, or other body of water.
wetland	An area of land that is covered with a shallow layer of water during some or all of the year to help prevent flooding (example: swamps, marshes, bogs)
estuary	A coastal inlet or bay where fresh water mixes with salty ocean water.
erosion	The process by which water, ice, wind, or gravity moves fragments of rock and soil.
swamp	A tree dominated wetland where the soil is saturated or flooded with water during most or all of the year.
marsh	A wetland characterized by soft, wet, low-lying land and having an abundance of emergent vegetation.
bog	A poorly drained wetland dominated by moss and shrubs
dissolved oxygen	The amount of gaseous oxygen in the water, measured in parts per million
salinity	The total amount of salts in a water sample.
tributary	A stream that flows into a larger stream.

sediment	Small, solid particles of material from rocks or organism which are moved by water or wind, resulting in erosion.
transition zone	The brackish area where fresh and saltwater inter mix.
habitat	The place where an organism lives and that provides the things it needs to live or survive.
water quality	The degree of purity of water, determined by measuring the substances in water, besides water molecules.
pH	A scale used to determine how acidic or basic a substance is ranging from 0-14.
turbidity	Indicator where a muddy look is created by suspended sediment or foreign particles.
tides	The daily rise and fall of the Earth's waters due to the gravitational force created by the Moon and Sun on the Earth.

SOL6.8	
meteor	A streak of light in the sky produced by the burning of a meteoroid in Earth's atmosphere.
asteroid	Any of thousands of dense rocky objects typically in orbit around the sun between Mars and Jupiter.
comet	A ball of ice and dust and frozen gases and in orbit around the sun in an elliptical orbit
revolution	The movement of an object around another object.
rotation	The spinning motion of a planet about its axis.
outer planets	Jovian planets that are gaseous, found outside of the asteroid belt (except Pluto-solid).
inner planets	Terrestrial planets that are dense solid planets inside of the asteroid belt.
gravity	The attractive force between two objects
axial tilt	The invisible axis that are tilted allowing for seasons to occur.
probe	An interplanetary spacecraft
satellite	Any object that revolves around another object in space.
Heliocentric Theory	The theory whereby the Sun is found at the center of the Solar System (Copernicus / Galileo)
Geocentric Theory	The theory whereby the Earth is found at the center of the Solar System (Ptolemy / Aristotle)

SOL 6.9	
renewable resources	Any natural resource that can replace itself naturally in a relatively short time.
nonrenewable resources	Energy sources that take a long period of time to form and are not replaced as they are used.
conservation	The process of using a resource wisely so it will not be used up.
preservation	The process of keeping up or maintaining.
SPSA	(Southeastern Public Service Authority) Solid Waste management
EPA	(Environmental Protection Agency) Federal Agency that regulates protecting human health and with safeguarding the natural environment.
Department of Inland Game and Fisheries	Established to ensure that all species of wildlife and aquatic resources are maintained, regulated and protected.
cost	Is what would be sacrificed or lost as a result of the action
benefit	An advantage to doing something

Answer Key:

SOL 6.1
1. A
2. D
3. D
4. C
5. C

SOL 6.2
1. A
2. A
3. D
4. C
5. B
6. B
7. B

SOL 6.3
1. C
2. B
3. D
4. A

SOL 6.4
1. A
2. B
3. B
4. B
5. A

SOL 6.5
1. B
2. C
3. A
4. C
5. D

SOL 6.6
1. D
2. A
3. B
4. D

SOL 6.7
1. D
2. A
3. C
4. B

SOL 6.8
1. D
2. C
3. B
4. A
5. B
6. A
7. D
8. A

SOL 6.9
1. D
2. C
3. A
4. C