Earth Science SOL Review

Scientific Investigation

These are the facts you should know…:

☐ Density = mass/volume The S.I. Unit for Density is: g/cm^3 or g/mL
☐ Volume for irregular objects is found by water displacement.
☐ Warm (air, water, magma) rises because it is less dense. Cold (air, water, magma) sinks because it is more dense.
☐ As pressure increases so does density.
☐ Water is most dense as a liquid. Density = 1 g/mL
☐ The same substance has the same density. As mass increases so does the volume.
☐ A hypothesis is a prediction about a problem that can be tested.
☐ A variable is a changeable factor in an experiment.
☐ Constants are factors that are the same.
☐ Any valid scientific theory has passed tests designed to invalidate it.
☐ There can be more than one explanation for any phenomena.
☐ The independent variable is the factor that YOU, the experimenter changes and that data is usually plotted on the x-axis.
☐ The dependent variable is the factor that changes as a result of the manipulation of the Independent variable and that data is usually plotted on the y-axis.
☐ A control is a standard for comparison. It can be thought of as the part of the experiment where there is no manipulation of the independent variable.
☐ Kilo = 1000; Deci = 1/10 or 0.1; Centi = 1/100 or 0.01; Milli = 1/1000 or 0.001
☐ SI Units: for length – meter (m); for volume – milliliter (mL) or cubic centimeter (cm^3); for mass – gram (g); for area – square meter (m^2); for temp. – Kelvin (K)

Mapping the Earth

These are the facts you should know…:

☐ Latitude lines go East-West but measure North and South of the Equator.
☐ Longitude lines go North-South but measure East and West of the Prime Meridian.
☐ When finding coordinates of a location, the latitude is first, longitude is second.
☐ The closer the contour lines, the steeper the slope.
☐ Contour lines form V's and point upstream when there are rivers and creeks present.
☐ The increase in elevation between two adjacent contour lines is the contour interval.

Minerals and Rocks

These are the facts you should know…:

☐ A mineral is found in nature, inorganic, solid, with a definite chemical composition and structure.
☐ Mineral properties depend on their atomic structure.
☐ Minerals may be identified by their physical properties such as hardness, color, luster, and streak.
☐ Most rocks are made of one or more minerals.
☐ Some major rock-forming minerals are quartz, feldspar, calcite, and mica.
☐ Ore minerals include pyrite, magnetite, hematite, galena, graphite, and sulfur.
☐ The major elements found in Earth's crust are oxygen, silicon, aluminum, and iron. The most abundant group of minerals is the silicates, which contain silicon and oxygen.
☐ Igneous rocks are classified by composition and texture.
☐ Igneous Rocks are produced by the cooling of magma (cooled below Earth's surface) or lava (cooled above Earth's surface).

- ☐ Fast cooling = Extrusive - Texture includes small, fine-grained mineral grains, glassy, air holes present. (pumice, basalt, obsidian)
- ☐ Slow cooling = Intrusive- Texture includes coarse or large mineral grains. (granite)
- ☐ Metamorphic formed by heat and pressure or chemical action.
- ☐ Metamorphic include foliated (banded) and non-foliated.
- ☐ Foliated rocks have bands of different minerals. Examples are slate, schist, gneiss.
- ☐ Non-foliated rocks have little or no banding and are relatively homogenous throughout and include marble and quartzite.
- ☐ Limestone morphs into marble. Sandstone morphs into quartzite.
- ☐ Sedimentary rocks form from rock fragments, organic material, or chemical precipitation.
- ☐ Sedimentary are found in flat layers or strata. Fossils are found in these layers.
- ☐ Sedimentary subclasses include clastic, organic, and chemical.
- ☐ Limestone is formed both chemically and organically.
- ☐ Clastic rocks are made of fragments- conglomerate, sandstone, and shale.
- ☐ Non-clastic sedimentary rocks include limestone and rock salt.
- ☐ Coal formation from softest to hardest- Peat, Lignite, Bituminous, Anthracite.
- ☐ Non-renewable resources are renewed very slowly or not at all. Non-renewable resources include coal, oil, and minerals.
- ☐ In Virginia, major rock and mineral resources include coal for energy, gravel and crushed stone for road construction, and limestone for making concrete.
- ☐ Nearly all fossils are found in sedimentary rocks.
- ☐ Interpret the rock cycle diagram.
- ☐ Classify the following rock types as igneous, metamorphic, or sedimentary: pumice, obsidian, basalt, granite, sandstone, conglomerate, shale, limestone, slate, schist, gneiss, marble, and quartzite.

When finished with this unit, you should be able to…:

- ☐ Determine if a substance is a mineral based upon the given characteristics.
- ☐ Identify the following minerals based on their specific chemical and physical properties (color, hardness, streak, color, luster, and breakage): quartz, feldspar, mica, calcite, bauxite, hematite, galena, halite, graphite, pyrite, sulfur, diamond and talc and know their commercial use(s).
- ☐ List ways that minerals are important to human wealth and welfare.
- ☐ Classify rocks into the three major groups by the processes that formed them.
- ☐ Explain the rock cycle diagram and identify the processes by which all rocks are formed and how materials are recycled through time.
- ☐ Identify the following rocks on the basis of mineral content and texture: Igneous – pumice, obsidian, basalt, granite; Sedimentary – sandstone, conglomerate, shale, limestone, gypsum; Metamorphic – slate, schist, gneiss, marble, quartzite.
- ☐ Distinguish between a rock and a mineral.
- ☐ Discuss why minerals and rocks are nonrenewable resources and are limited. Observe evidence of ancient, often extinct life preserved in sedimentary rock.

Geologic Processes/Features (Plate Tectonics, Earthquakes, Volcanoes)

These are the facts you should know…:

- ☐ The Earth consists of a solid Inner core (Fe & Ni), a liquid outer core (Fe & Ni), a plastic-like mantle (Si, O, Fe, Ni) and a thin rocky crust (Si & O)
- ☐ The lithosphere is made up of the crust and upper mantle.
- ☐ The asthenosphere is made up of the lower mantle.
- ☐ Ocean crust is thinner, younger, & denser (heavier) than continental crust. Oceanic crust is made of basaltic rock.
- ☐ Continental crust is thicker, older and less dense (lighter) than oceanic crust. Continental crust is made up of granitic rock.
- ☐ An Ocean plate will always sink under a continental plate because it is more dense.
- ☐ Convection currents move tectonic plates. Hot material rises, cools, becomes more dense and sinks. After it sinks it heat up and becomes less dense and rises.

- ☐ Convergent boundaries are colliding plates which cause folded or thrust faulted mountains, subduction zones (volcanoes & trenches), & reverse faults. The force involved is compression.
- ☐ Major features of convergent boundaries include collision zones (folded and thrust-faulted mountains) and subduction zones (volcanoes and trenches).
- ☐ Divergent boundaries are dividing plates and cause sea-floor spreading, mid-ocean ridges, rift valleys, & volcanoes. Normal faults are produced from this movement. The force involved is tension.
- ☐ Major features of divergent boundaries include mid-ocean ridges, rift valleys, and fissure volcanoes.
- ☐ Transform boundaries slide past each other and strike slip faults and earthquakes are produced. The force involved is shearing.
- ☐ Major features of transform boundaries include strike-slip faults.
- ☐ Features of the seafloor that are related to plate tectonic processes include mid-ocean ridges and trenches.
- ☐ Other major topographic features of the oceans are continental shelves, continental slopes, abyssal plains, and seamounts.
- ☐ When rocks are compressed horizontally, their layers may be deformed into wave-like forms called folds. This commonly occurs during continental collisions.
- ☐ The Appalachian Mountains are folded mountains.
- ☐ When rocks are pushed up vertically, they may break along one or more faults. These are fault block mountains and may be one of two types.
- ☐ Lifted mountains have 2 faults and 2 scarps. An entire block of mountain is raised due to the vertical pressure.
- ☐ Tilted mountains have 1 fault and 1 scarp. Only one section of earth is raised due to the vertical pressure.
- ☐ Earthquake activity is associated with all plate boundaries.
- ☐ A fault is a break or crack in the Earth's Crust where movement has occurred.
- ☐ Most active faults are located at or near plate boundaries. Earthquakes result when movement occurs along a fault.
- ☐ Three seismic stations are needed to find the epicenter of an Earthquake.
- ☐ P waves travel the fastest and reach the seismic station first, travel through solids and liquids, P waves slow down and bend when they hit the liquid outer core. The force is compression and the motion is push/pull.
- ☐ S waves arrive at the seismic station second and do not travel through liquids. The force is shearing and the motion is side to side.
- ☐ L waves are the last to arrive at the seismic station. The force is tension and the motion is undulating. These waves are also called Raleigh waves.
- ☐ Volcanic activity is associated with subduction, rifting, or sea floor spreading and hot spots.
- ☐ Hot Spots are not related to plate movement. They are a weak spot in the Earth's crust through which magma is released and volcanoes are formed.
- ☐ A volcano is an opening where magma is erupted onto Earth's surface. Most volcanic activity is associated with subduction, rifting or sea-floor spreading.
- ☐ There are 3 types of volcanoes.
- ☐ Cinder cones form steep sided mountains and their eruptions are violent.
- ☐ Shield volcanoes form low sloping and broad mountains where the eruptions are generally considered quiet and oozing.
- ☐ Composite volcanoes are a combination of cinder cones and shield volcanoes in their actions. They alternately erupt violently and quietly forming layers that show evidence of the varying eruption types.
- ☐ Explain how volcanic activity or meteor impacts could affect the atmosphere and life on Earth.

When finished with this unit, you should be able to…:

- ☐ Model the core, mantle, and crust of Earth as a dynamic system, constantly in motion.
- ☐ Compare and contrast the Law of Superposition and the Theory of Plate Tectonics.
- ☐ Describe the Theory of Plate Tectonics and cite supporting evidence (continental drift and seafloor spreading).
- ☐ Predict change according to the plate tectonic theory using a map of the world's ocean floor and continental landmasses.
- ☐ Identify and describe the different types of plate boundaries (converging, diverging, and transform fault boundaries) and their motions.
- ☐ Interpret continental collision, faulting (earthquakes), folding (mountain building), rifting (seafloor spreading), subduction (volcanism) and convection in the mantle.
- ☐ Identify the processes that form: folded mountains, volcanic mountains, island arcs, trenches, and mid-ocean ridge.

- ☐ Discuss how, why and where earthquakes happen.
- ☐ Differentiate between the focus and epicenter of an earthquake.
- ☐ Compare and contrast the Richter and Mercalli scales.
- ☐ Identify the causes and effects of earthquakes.
- ☐ Identify the different seismic waves (primary, secondary, long) and their characteristics.
- ☐ Locate the epicenter of an earthquake, given seismic wave information.
- ☐ Interpret a seismic wave time/travel graph.
- ☐ Describe how, why and where volcanoes form.

- ☐ Differentiate between magma and lava.
- ☐ Relate the locations of plate boundaries to a map of known earthquakes and volcanic activity.
- ☐ Interpret illustrations or models of geologic processes (faulting, folding, volcanism and metamorphism)
- ☐ Compare and contrast hypotheses, theories, and scientific laws.
- ☐ Use data to support or reject a hypothesis.
- ☐ Explain how the scientific method is used to validate scientific theories.

Freshwater / Geologic Processes and Features

These are the facts you should know…:

- ☐ Weathering is the process that rocks are broken down chemically and physically by water, air, and organisms.
- ☐ Chemical Weathering occurs in warm, humid climates.
- ☐ Mechanical Weathering occurs in cold climates--- Ice Wedging.
- ☐ Erosion is the process by which Earth materials are transported by moving water, ice, or wind. Gravity causes all these to happen.
- ☐ Streams and moving water are the major agents of Erosion.
- ☐ Deposition is the process by which Earth materials carried by wind, water, or ice settle out and are deposited.
- ☐ High Erosion=high relief areas; High deposition=low relief areas
- ☐ Large particles settle out first. Sediment size from largest to smallest – breccia, sand, silt, clay.
- ☐ As particle size increases, permeability (the ability to transport water) increases.
- ☐ Soil Evolution starts with the weathering of bedrock. Organic material must be present in order to have soil.
- ☐ Soil is loose rock fragments and clay derived from weathered rock mixed with organic material.
- ☐ Soil profile consists of 3 main horizons: A- Top Soil (most evolved), B- less humus, leaching from A, C- Weathered Rock.
- ☐ Some scientist include an O- horizon which is the upper most layer consisting of the organic material.
- ☐ Bedrock beneath the C horizon can also be considered a part of a soil profile.
- ☐ Karst topography has caves and sinkholes produced by acidic groundwater dissolving limestone.
- ☐ Karst topography forms when limestone is slowly dissolved away by slightly acidic groundwater.
- ☐ Because limestone is abundant in the Valley and Ridge province of Virginia, karst topography is common.
- ☐ Ground water layers from the surface down would include zone of aeration, water table, & zone of saturation.
- ☐ Permeability is a measure of the ability of a rock or sediment to transmit water or other liquids.
- ☐ Porosity is the amount of space between the materials where water will move freely.
- ☐ Water does not pass through impermeable materials.
- ☐ The cone of depression is formed when more water is removed by human use than is being replenished by natural means.
- ☐ An aquifer is a layer of permeable rock that transports groundwater freely and is confined between 2 impermeable rock layers.
- ☐ A spring is an area where the water table reaches the land's surface.
- ☐ Hydrologic cycle includes the processes of evaporation, transpiration, condensation, precipitation, and runoff.
- ☐ Geologic processes, such as erosion, and human activities, such as waste disposal, can pollute water supplies.

When finished with this unit, you should be able to…:

- ☐ Describe the processes of physical and chemical weathering.
- ☐ Give examples of physical and chemical weathering, including oxidation, freeze-thaw, exfoliation.
- ☐ Identify landforms related to erosion and deposition, such as: deltas, flood plains, moraines, glacial valleys, and sand dunes.
- ☐ Explain the relationship between velocity and particle size carrying ability.

- ☐ Given a description, identify the processes involved in the formation of soil.
- ☐ Given a description of a soil layer, identify the layer.
- ☐ Diagram a soil profile and label the horizons.
- ☐ Describe methods of preventing soil erosion and compare their effectiveness.
- ☐ Identify the processes involved in the formation of karst topography and their effects, including caves, sinkholes, stalactites, and stalagmites.
- ☐ Give examples of karst features found in Virginia and identify the province where they are found.
- ☐ Describe the characteristics of a permeable and impermeable rock and give examples of each.
- ☐ Interpret a simple hydrologic cycle diagram, including evaporation, condensation, precipitation, and runoff.
- ☐ Diagram and label the hydrologic cycle and describe the processes involved.
- ☐ On a diagram, identify the groundwater zones, including zone of aeration, zone of saturation, water table, and aquifer.
- ☐ Identify human behaviors that can overuse or contaminate groundwater resources.

Renewable & Non-Renewable Resources

These are the facts you should know…:

- ☐ Ores are useful and profitable.
- ☐ Virginia resources include limestone, coal, and gravel.
- ☐ Renewable resources can be replaced by nature at a rate close to the rate at which they are used. Renewable resources include vegetation, sunlight, and surface water.
- ☐ Non-renewable resources are renewed very slowly or not at all. Non-renewable resources include coal, oil, and minerals.
- ☐ The Earth's Water Supply is renewable but also finite.
- ☐ Fossil fuels are non-renewable and may cause pollution, but they are relatively cheap and easy to use.
- ☐ In Virginia, major rock and mineral resources include coal for energy, gravel and crushed stone for road construction, and limestone for making concrete.
- ☐ Human activities have increased the carbon dioxide content of the atmosphere.
- ☐ Man-made chemicals have decreased the ozone concentration in the upper atmosphere.

When finished with this unit, you should be able to…:

- ☐ Classify resources as renewable or nonrenewable.
- ☐ Identify resources found in Virginia, including coal, gravel, crushed stone, and limestone and their uses.
- ☐ Identify fuels as fossil fuels or alternative fuels.
- ☐ Describe the environmental consequences of using fossil fuels, including the use and the extraction processes.
- ☐ List advantages and disadvantages of the use of fossil fuels versus the use of alternative fuels (nuclear, hydroelectric, solar, geothermal)
- ☐ List economic reasons for using fossil fuels versus alternative fuels.
- ☐ List and describe causes of air pollution, acid deposition, and depletion of the ozone layer. Discuss environmental and economic costs related to each.

Historical Geology

These are the facts you should know…:

- ☐ A fossil is the remains, impressions, or other evidence of a former existence of life preserved in rock.
- ☐ Nearly all fossils are found in sedimentary rock.
- ☐ Some ways in which fossils can be preserved are molds, casts, and original bone or shell.
- ☐ In Virginia, fossils are found mainly in the Coastal Plain, Valley and Ridge, and Appalachian Plateau provinces.
- ☐ Most Virginia fossils are of marine organisms. This indicates that large areas of the state have been periodically covered by seawater.
- ☐ Paleozoic, Mesozoic, and Cenozoic fossils are found in Virginia.
- ☐ Law of Superposition states that the oldest rocks are found on the bottom of strata and the youngest on top of strata.
- ☐ Law of Cross-cutting relationships states that an igneous intrusion is younger than the layers it cuts across.

- ☐ Law of Horizontality states that when a rock layer is put down it is done horizontally. Any rock layer that is not horizontal has undergone some changes, like uplifting or tilting.
- ☐ Unconformities are missing rock layers usually a result of erosion.
- ☐ Fossils, superposition, and cross-cutting are used to determine relative ages.
- ☐ Relative dating places events in sequence without assigning exact numerical ages.
- ☐ Absolute time places a numerical age to an event.
- ☐ Radioactive decay or half-life is used to determine the absolute age of rocks.
- ☐ Uranium dating is used to find the ages of the oldest rocks while Carbon-14 is used to find the ages of human artifacts or things that were once living.
- ☐ The Earth is about 4.6 billion years old.
- ☐ The early atmosphere contained little oxygen and more carbon dioxide than the modern atmosphere.
- ☐ Early photosynthetic life such as cyanobacteria (blue-green algae) consumed carbon dioxide and generated oxygen.
- ☐ It was only after early photosynthetic life generated oxygen that animal life became possible.

When finished with this unit, you should be able to…:

- ☐ Describe the processes involved in the formation of fossils and identify the different types of fossils.
- ☐ Identify, on a map, the provinces in Virginia where fossils are found.
- ☐ Recognize that fossils are found mostly in sedimentary rock and that Virginia fossils are mostly of marine organisms.
- ☐ Identify the geologic periods that are represented by fossils found in Virginia.
- ☐ Sequence geologic events using principles of relative dating.
- ☐ Correlate rock layers from different locations using relative dating and index fossils.
- ☐ Describe the principles of relative dating, including superposition and cross-cutting relations.
- ☐ Describe the process of absolute dating, including radioactive decay and half-life. Give examples of radioactive isotopes used in absolute dating.
- ☐ Identify periods of geologic time based on geologic events or dominant life forms.
- ☐ Compare past and present composition of the Earth's atmosphere and give reasons for changes over geologic time.
- ☐ Explain how volcanic activity could affect the atmosphere and life on Earth.
- ☐ Describe how life has changed and become more complex over geologic time.
- ☐ Interpret a simple geologic history diagram using superposition and crosscutting relations.
- ☐ Compare and contrast hypotheses, theories and scientific laws. For example, students should be able to compare/contrast the Law of Superposition and the Theory of Plate Tectonics.

Virginia Geology

These are the facts you should know…:

- ☐ The five physiographic provinces are Coastal Plain, Piedmont, Blue Ridge, Valley and Ridge, and Appalachian Plateau.
- ☐ The Coastal plain is the flattest area underlain by all types of sediments produced by the erosion of the Appalachian mountains. Fossils are abundant here.
- ☐ The Piedmont is an area of rolling hills underlain by mostly ancient igneous and metamorphic rocks produced by ancient volcanoes. The igneous rocks are the roots of volcanoes formed during an ancient episode of subduction that occurred before the formation of the Appalachian Mountains. It is separated by a fall line from the Coastal plain.
- ☐ The Blue Ridge is a high ridge separating the Piedmont from the Valley and Ridge Province. The billion-year old igneous and metamorphic rocks of the Blue Ridge are the oldest in the state. Some metamorphism of these rocks occurred during the formation of the Appalachian Mountains.
- ☐ Valley and Ridge province is an area with long parallel ridges and valleys composed of folded and faulted rocks that occurred during the collision of Africa and North America during the Paleozoic. This collision produced the Appalachian Mountains. Karst Topography & fossils are abundant.
- ☐ The Appalachian Plateau has rugged, irregular topography and is underlain by ancient, flat-lying sedimentary rocks. The area is actually a series of plateaus separated by faults. Most of Virginia's coal resources are found in the plateau province. Fossils are present.

- ☐ Renewable resources can be replaced by nature at a rate close to the rate at which they are used. Renewable resources include vegetation, sunlight, and surface water.
- ☐ The three major regional watershed systems in Virginia lead to the Chesapeake Bay, the North Carolina Sounds, and the Gulf of Mexico.
- ☐ Pollution and over fishing can harm or deplete valuable resources.
- ☐ Chemical pollution and sedimentation are great threats to the chemical and biological well being of estuaries and oceans.

When finished with this unit, you should be able to…:

- ☐ Identify the five provinces of Virginia on a map.
- ☐ Describe the characteristics of each province, including the major rock type and the topography.
- ☐ Identify past geologic and tectonic events in Virginia that resulted in formation of the provinces.
- ☐ Define watershed.
- ☐ On a map, identify the Chesapeake Bay watershed.
- ☐ Identify resources found in the Chesapeake Bay.
- ☐ Describe major environmental problems related to the Chesapeake Bay and identify causes and effects (including loss of submerged aquatic vegetation, runoff, excess nutrients and algal blooms).
- ☐ Categorize resources as renewable or nonrenewable.
- ☐ Locate the major watershed systems on a map (Chesapeake Bay, Gulf of Mexico, and North Carolina Sounds).
- ☐ Identify the effects of human activity on the oceans

Oceanography

These are the facts you should know…:

- ☐ We have 2 high tides and 2 low tides each day.
- ☐ Tides are the daily periodic rise and fall of water level caused by the gravitational pull of the sun and the moon.
- ☐ Currents move from cold to warm areas.
- ☐ Upwelling brings cold, nutrient rich water from the bottom of ocean to the surface. This is rich in biological activity.
- ☐ Estuaries are areas where salt water mixes with fresh water. It is a partially enclosed body of water with open access to the sea or ocean. Example: Chesapeake Bay
- ☐ Sea level falls when glacial ice caps grow and rises when ice caps melt.
- ☐ Cyanobacteria was responsible for the first oxygen on Earth. Presently blue geen agae is an important source of atmospheric oxygen.
- ☐ The ocean is the largest reservoir of heat at the Earth's surface. It drives the weather of the Earth.
- ☐ The stored heat in the ocean causes climate near the ocean to be milder than the climate in the interior of continents.
- ☐ Most waves on the ocean surface are generated by wind.
- ☐ There are large current systems in the oceans that carry warm water towards the poles and cold water towards the equator.
- ☐ Estuaries, like the Chesapeake Bay, are areas where fresh and salt water mix, producing variations in salinity and high biological activity.
- ☐ Major topographic features of the oceans are continental shelves, slopes, abyssal plains, and seamounts.
- ☐ Features of the seafloor are related to plate tectonic processes, including mid-ocean ridges and trenches.
- ☐ The oceans are an important source of food and mineral resources as well as a venue for recreation and transportation.
- ☐ Pollution and over-fishing can harm or deplete valuable resources.
- ☐ Chemical pollution and sedimentation are great threats to the chemical and biological well being of estuaries and oceans.

When finished with this unit, you should be able to…:

- ☐ Determine those chemical factors that contribute to the salinity of sea water.
- ☐ Explain the relationship between salinity, temperature, and density.
- ☐ Identify a thermocline on a depth x temperature graph.

- ☐ Explain the relationship between winds and wind-driven currents.
- ☐ Differentiate surface currents from deep water currents.
- ☐ Define and explain tsunamis.
- ☐ Define the term estuary using the Chesapeake Bay as a model.
- ☐ Explain how upwelling brings cold, rich water up to the surface of oceanic waters.
- ☐ Relate tides to gravitational pull.
- ☐ Show how convection currents transfer heat energy in the oceans.
- ☐ Explain that oceans are the largest heat reservoir on the surface of the Earth and that stored heat in the oceans drives much of Earth's weather.
- ☐ Explain that stored heat in the oceans causes climate near the ocean to be mild.
- ☐ Explain the relationship between sea level and ice caps.
- ☐ Identify major oceans on a map.
- ☐ Identify near shore ocean features such as continental shelf, slope, and rise.
- ☐ Identify deep sea features such as abyssal plains, trenches, seamounts, volcanic islands, guyots, and ridges.
- ☐ Relate deep sea features to plate tectonic processes.
- ☐ Explain the nature of oceanic food webs.
- ☐ Explain how oceans produce much of the Earth's oxygen.
- ☐ Explain how the ocean's resources are finite and must be used with care.
- ☐ Explain how and why the oceans are environmentally and economically important.
- ☐ Explain why human activities have important consequences for the ocean.
- ☐ Explain how pollution and sedimentation affect the water quality in near-shore and open ocean waters.
- ☐ Students should be able describe the major pollutants of the Chesapeake Bay.

The Atmosphere (Meteorology)

These are the facts you should know…:

- ☐ The Early atmosphere was mostly CO_2 and very little O_2.
- ☐ Early photosynthetic life such as cyanobacteria (blue green algae) consumed carbon dioxide and generated oxygen.
- ☐ It was only after early photosynthetic life generated oxygen that animal life became possible.
- ☐ The Earth's atmosphere is 21% Oxygen, 78% Nitrogen, 1% trace gases.
- ☐ The atmosphere of Venus is mostly carbon dioxide and very dense.
- ☐ The atmosphere of Mars is very thin and mostly carbon dioxide.
- ☐ Human activities such as burning fossil fuels have increased CO_2 levels.
- ☐ High CO_2 levels produce the Greenhouse effect.
- ☐ CFC's are decreasing the ozone levels of the upper atmosphere
- ☐ Radiation is the transfer of energy from the sun to the Earth in the form of electromagnetic waves. This energy is reflected back to space, absorbed by the atmosphere, or mostly absorbed by Earth's surface.
- ☐ Conduction is the transfer of energy through direct contact.
- ☐ Convection is the transfer of energy through the flow a heated material and is a major cause of weather in the atmosphere.
- ☐ Areas near the Equator receive the most direct radiation.
- ☐ Clouds form when air is at or below its dew point and condensation nuclei are present.
- ☐ The Coriolis Effect causes deflections of the atmosphere and oceans due to the rotation of Earth.
- ☐ Global wind patterns result from the uneven heating of Earth by the sun and are influenced by the Coriolis Effect.
- ☐ A psychrometer measures humidity in the air. A barometer measures air pressure. A thermometer measures air temperature. An anemometer measures wind speed.
- ☐ Highs are generally cool and dry: Lows are generally warm and wet.
- ☐ Winds are formed due to unequal heating of the atmosphere that causes air pressure differences.
- ☐ Winds move from high pressure areas to low pressure areas.
- ☐ Cold fronts move quickly and produce rain at the front.
- ☐ Warm fronts move slow and produce miles and miles of clouds and long periods of gentle, soaking rains.
- ☐ The highest pressure is found at sea level.
- ☐ High pressure rotates clockwise and outward.
- ☐ Low pressure rotates counter-clockwise and inward.

- ☐ U.S. weather is dominated by prevailing Westerlies. Weather moves west to east at a general average of 25 miles per day.
- ☐ Weather describes day-to-day changes in atmospheric conditions.
- ☐ The conditions necessary for cloud formation are: air is at or below dew point; and condensation nuclei are present. Cloud droplets can join together to form precipitation.
- ☐ The four major factors affecting climate are latitude, elevation, proximity to bodies of water, and position relative to mountains.

- ☐ Climate describes the typical weather patterns for a given location over a period of many years.
- ☐ Areas near the equator receive more of the sun's energy per unit than areas nearer the poles.
- ☐ Earth's major climatic zones are the polar, temperate, and tropical zones.
- ☐ A tornado is a narrow violent funnel-shaped column of spiral winds that extends downward form the cloud base toward Earth.
- ☐ A hurricane is a tropical cyclone (counterclockwise movement of air) characterized by sustained winds of 120 km/hr (75 miles/hr) or greater.
- ☐ Human activities have increased the carbon dioxide content of the atmosphere.
- ☐ Man-made chemicals have decreased the ozone concentration in the upper atmosphere.
- ☐ Volcanic activity and meteorite impacts can inject large quantities of dust and gases into the atmosphere.
- ☐ The ability of Earth's atmosphere to absorb and retain heat is affected by the presence of gases like water vapor and carbon dioxide.

When finished with this unit, you should be able to…:

- ☐ Identify the atmospheric gases and list the percentages of which the atmosphere is composed.
- ☐ Identify the layers of the atmosphere.
- ☐ Account for the differences between atmospheric layers.
- ☐ Contrast Earth's atmosphere with that of other planets.
- ☐ Compare and contrast the three methods of energy transfer and identify them in the processes that create weather.
- ☐ Label a diagram of global wind patterns.
- ☐ Read and interpret data from a thermometer, a barometer, and a psychrometer.
- ☐ Read and interpret a weather map.
- ☐ Predict weather based on cloud type, temperature, and barometric pressure.
- ☐ Identify types of severe weather.
- ☐ Explain the difference between high and low pressure systems
- ☐ Identify the four types of fronts.
- ☐ Identify air masses and their characteristics.
- ☐ Explain how volcanic activity or meteor impacts could affect the atmosphere and life on Earth.
- ☐ Explain how biological activity, including human activities, may influence global temperature and climate.
- ☐ Interpret the causes of the greenhouse effect and survey the possible damage created by it.
- ☐ Outline human impacts on climate.

Astronomy

These are the facts you should know…:

- ☐ The Solar Nebulae Theory explains that the planets formed from the condensing of our sun or solar nebulae.
- ☐ Our Sun's Life cycle is Nebulae, protostar, Yellow Main Sequence Star, Red Giant, white dwarf and black dwarf.
- ☐ Our star, the sun is a Yellow Main Sequence star and is middle aged. It should last for another 4.6 billion years.
- ☐ Black holes are a death stage of stars.
- ☐ We are located in the Milky Way Galaxy which is a spiral galaxy.
- ☐ The 3 types of Galaxies are spiral, elliptical, and irregular.
- ☐ The Hubble Space telescope has improved our knowledge and understanding of the Universe.
- ☐ Red Shifts indicate the Universe is expanding outward. This is used to support the Big Bang Theory.
- ☐ Summer Solstice is June 21st (longest day). Winter Solstice is December 21st (shortest day).
- ☐ Solstice is when the sun is at its most Northern or Southern Point.
- ☐ Equinoxes are when the sun is directly over the equator. Spring March 21st and Fall September 22nd (12 hours of daylight and 12 hours of night).
- ☐ The Earth is closer to the sun in the winter.

- ☐ Earth revolves around the sun, tilted on its axis, causing seasons (equinoxes and solstices).
- ☐ The Earth rotates W to E once in approximately 24 hours.
- ☐ The Earth revolves CCW around the sun once in 365.25 days.
- ☐ The Earth is the 3rd planet from the sun.
- ☐ The moon has phases because of reflected sunlight and the angle at which we view it.
- ☐ The moon revolves around the earth creating the moon phases and eclipses.
- ☐ Foucault's pendulum and Coriolis Effect prove the Earth rotates.
- ☐ Parallax and seasonal constellations prove the Earth's revolution.
- ☐ Two types of planets-- Inner (rocky) and Outer (gaseous) – except for Pluto which is the outermost planet but appears to be rocky.
- ☐ Comets orbit the sun and consist mostly of frozen gas.
- ☐ Comets are known as dirty snowballs in space and originate in the Oort cloud.
- ☐ A comet's tail is the result of the solar wind and points away from the sun.
- ☐ A comet's coma is the result of the sun's radiation.
- ☐ Asteroids are rocky or metallic iron objects with origins between Mars and Jupiter. They range in size from millimeters to kilometers. They are the source of most meteorites.
- ☐ AU= distance between the Earth and the Sun. We measure planet distances in AU's.
- ☐ A light-year is the distance light travels in one year and is the most commonly used measurement for distance in astronomy.
- ☐ Apollo 11 was the 1st manned landing on the moon. Neil Armstrong was the 1st man on the moon.
- ☐ The Big Bang Theory explains the origin of the Universe. The Universe began as a dense sphere that expanded and condensed into galaxies.
- ☐ Solar eclipses occur when the moon blocks out sunlight from Earth's surface.
- ☐ Lunar eclipses occur when Earth blocks sunlight from reaching the moon's surface.
- ☐ The tides are the daily, periodic rise and fall of water level caused by the gravitational pull of the sun and moon.
- ☐ Areas near the equator receive more of the sun’s energy per unit area than areas nearer the poles.
- ☐ Earth is the third planet from the sun and is located between the sun and the asteroid belt. It has one natural satellite, the moon.
- ☐ Water vapor occurs on Earth as a solid, liquid or gas due to the Earth's position in the solar system.
- ☐ The sun consists largely of hydrogen gas.
- ☐ The sun's energy comes from nuclear fusion of hydrogen to helium.
- ☐ Moons are natural satellites of planets that vary widely in composition.
- ☐ A meteoroid is a smaller rocky or metallic object in space, a meteor is when that object enters Earth’s atmosphere and a meteorite is when that object hits the Earth.
- ☐ Earth’s atmosphere is 21% oxygen, 78% nitrogen and 1% trace gases.
- ☐ The atmosphere of Venus is mostly carbon dioxide and very dense.
- ☐ The atmosphere of Mars is very thin and mostly carbon dioxide.
- ☐ Explain how volcanic activity or meteor impacts could affect the atmosphere and life on earth.
- ☐ The Big Bang Theory states that the universe began in a very hot dense state that expanded and eventually condensed into galaxies
- ☐ The solar (stellar) nebular theory explains that the planets formed through condensing of the solar nebula material
- ☐ Stars form by condensation of interstellar gas.
- ☐ The Hertzsprung-Russell diagram illustrates the relationship between the absolute magnitude and the surface temperature of stars. As stars evolve, their position moves on the HR diagram.
- ☐ Galaxies are collections of billions of stars and there are three types: spiral, elliptical and irregular.
- ☐ The solar system is located in the Milky Way galaxy.
- ☐ Much of our information about our galaxy and the universe comes from ground-based observations.

When finished with this unit, you should be able to…:

- ☐ Explain how the space program has contributed to our understanding of the solar system.
- ☐ Describe how various technologies are used in the exploration of space.
- ☐ Explain how the sun-earth relationship causes the seasons.
- ☐ Describe the processes involved in creating the moon phases.
- ☐ Draw a diagram explaining how solar and lunar eclipses occur.

- ☐ List types of tides and give reasons for the tides.
- ☐ Label a diagram of the solar system, including the locations of the planets and asteroid belt.
- ☐ Describe the composition of the sun.
- ☐ Explain the process of fusion in the sun.
- ☐ List and describe the 2 types of planets in our solar system.
- ☐ Given a description of an object in the solar system, identify it as a planet, satellite, asteroid, comet, or meteoroid.
- ☐ Explain the Big Bang Theory.
- ☐ Explain the Solar (or Stellar) Nebula Theory.
- ☐ Describe the relationship between a star's mass and its lifetime.
- ☐ Draw and label the three types of galaxy.
- ☐ Identify the major groups of stars on the Hertzsprung-Russell Diagram.
- ☐ Explain how volcanic activity or meteor impacts could affect the atmosphere and life on Earth.

Concept Checks

Review the list of terms belowYou need to be able to explain or identify the term or concept.

Unit	✓/+/o	Concept	Unit	✓/+/o	Concept	Unit	✓/+/o	Concept
S.I.		hypothesis	2		intrusive	3		lava
S.I.		theory	2		sedimentary	3		hot spot
S.I.		law	2		clastic	4		weathering
S.I.		independent variable	2		non-clastic	4		deposition
S.I.		dependent variable	2		metamorphic	4		delta
S.I.		constant	2		foliated	4		flood plain
S.I.		control	2		non-foliated	4		moraine
S.I.		conclusion	2		sediment	4		velocity
S.I.		research	2		weathering/erosion	4		particle size
S.I.		trial	2		cementation/compaction	4		carrying ability
S.I.		table	2		heat/pressure	4		horizon
S.I.		graph	3		plate tectonics	4		oxidation
S.I.		metric	3		continental drift	4		exfoliation
S.I.		mass	3		seafloor spreading	4		ice wedging
S.I.		volume	3		convergent boundary	4		soil profile
S.I.		density	3		divergent boundary	4		karst
S.I.		area	3		transform boundary	4		sinkhole
S.I.		length	3		faulting	4		stalactite
S.I.		temperature	3		folding	4		stalagmite
S.I.		weight	3		subduction	4		permeable
S.I.		solid	3		convection	4		impermeable
S.I.		liquid	3		rifting/rift valley	4		aquifer
S.I.		gas	3		focus	4		artesian well
S.I.		plasma	3		epicenter	4		zone of aeration
1		GPS	3		earthquake	4		zone of saturation
1		longitude	3		seismic waves (P,S,L)	4		groundwater
1		latitude	3		normal fault	4		hydrologic cycle
1		legend	3		reverse fault	4		spring
1		contour	3		strike-slip fault	4		hydrolysis
1		contour interval	3		island arc	4		carbonic acid
1		map scale	3		trench	5		energy
1		compass rose	3		shield volcano	5		resource
1		topographic map	3		composite volcano	5		renewable
1		elevation	3		cinder cone volcano	5		non-renewable
1		profile	3		compression force	5		geothermal energy
1		hachure	3		tension force	5		wind energy
1		coordinates	3		shearing force	5		hydroelectric energy

2		mineral	3		Richter Scale	5		solar energy
2		color	3		Mercalli Scale	5		nuclear energy
2		hardness	3		inner core	5		peat
2		streak	3		outer core	5		lignite
2		luster	3		mantle	5		bituminous
2		cleavage	3		crust	5		anthracite
2		fracture	3		continental crust	5		coal
2		rock cycle	3		oceanic crust	5		fossil fuel
2		igneous	3		mid-ocean ridge	5		alternative fuel
2		extrusive	3		magma	5		ozone layer

Concept Checks – cont'd.

Review the list of terms below. For each one, determine how well you understand the term or the concept that it represents after having completed the review questions on the previous pages.

Unit	✓/+/o	Concept	Unit	✓/+/o	Concept	Unit	✓/+/o	Concept
6		fossil formation	8		trench	10		chromosphere
6		fossil types	8		ocean resources	10		nebula
6		fossil location (rock)	8		human impact on oceans			
6		relative dating						
6		absolute dating	9		troposphere			
6		rock layer correlation	9		stratosphere			
6		superposition	9		mesosphere			
6		cross-cutting	9		thermosphere			
6		unconformity	9		barometer			
6		horizontality	9		psychrometer			
6		radioactive decay	9		cP			
6		half-life	9		mP			
6		carbon-14 dating	9		cT			
7		coastal plain	9		mT			
7		piedmont	9		cold front			
7		blue ridge	9		warm front			
7		valley & ridge	9		occluded front			
7		Appalachian plateau	9		stationary front			
7		VA topography	9		air pressure			
7		Chesapeake Bay	9		Coriolis Effect			
7		watershed	9		hurricane			
7		drainage area	9		tornado			
7		estuary	9		thunderstorms			
7		VA resources	9		greenhouse effect			
7		Bay pollution	9		ozone			
8		salinity	10		solar system			
8		density	10		planet			
8		thermocline	10		comet			
8		wind driven current	10		asteroid			
8		parts of a wave	10		meteor			
8		cause of tides	10		meteorite			
8		neap tide	10		solar eclipse			
8		spring tide	10		lunar eclipse			
8		ocean origin	10		Stellar Nebula Theory			
8		tsunami	10		Big Bang Theory			
8		upwelling	10		H-R Diagram			
8		convection current	10		Hubble Tuning Fork			
8		ocean/climate relationship	10		spiral galaxy			
			10		barred spiral galaxy			
8		ocean as a heat	10		elliptical galaxy			

		reservoir	10		irregular galaxy			
8		guyot	10		life cycle of stars			
8		abyssal plain	10		phases of the moon			
8		sea mount	10		rotation			
8		continental shelf	10		revolution			
8		continental slope	10		corona			
8		mid ocean ridge	10		photosphere			

SOL Verbs

Study this list of frequently used SOL verbs. Define them briefly. Learn to say them and understand what they mean.

SOL Verb	**short definition**
analyze	
categorize	
clarify	
classify	
communicate	
compare	
contrast	
correspond	
demonstrate	
describe	
differentiate	
discover	
discuss	
drive	
estimate	
evaluate	
exhibit	
explain	
generalize	
hypothesize	
infer	
interpret	
investigate	
persuade	
portray	
predict	
problem solving	
reasoning	
restate	
show	
solve	
speak	
survey	
transform	
verify	
write	

SOL Vocabulary Terms

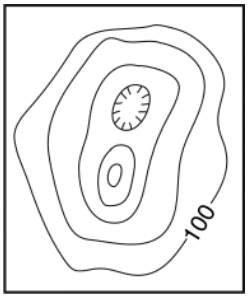
There are terms that show up over and over again on the Earth Science SOL. Understanding these terms will help you understand what is being asked in the question. Below is a list of the top 25 most often used and misunderstood terms in the Released Earth Science SOLs. Using a dictionary, look up the terms and write out the definition. Make sure you clearly understand what each of these terms means before taking the Earth Science SOL.

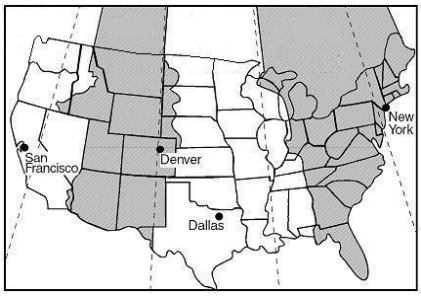
#	Term	Definition as used in Earth Science
1	abundant	
2	accumulate	
3	ascends	
4	associated	
5	composition	
6	conserved	
7	contracting	
8	derived	
9	descends	
10	expanding	
11	horizontal	
12	hypothesis	
13	observation	

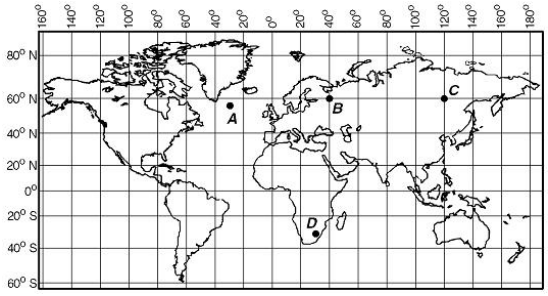
14	originates	
15	overturned	
16	periodically	
17	primarily	
18	relationship	
19	relative	
20	stationary	
21	subjected	
22	transform	
23	underlain	
24	vertical	
25	vicinity	

Pictures and Diagrams

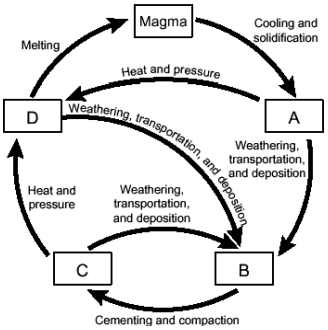
Shown below are unlabelled diagrams and pictures that you should be very familiar with and should be able to recognize and label. Review these pictures and seek out any information you don't readily know.

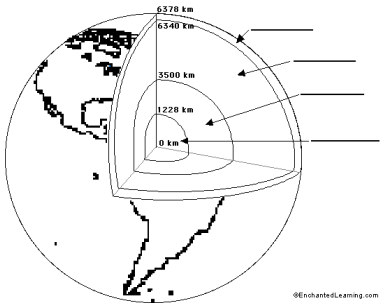


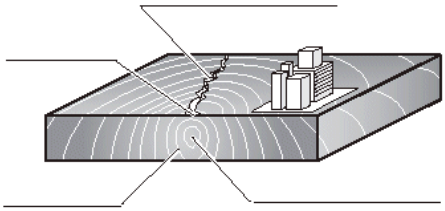


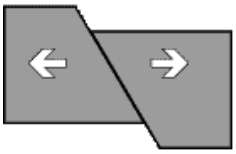


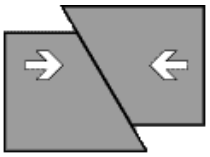
The Rock Cycle

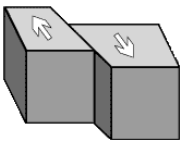


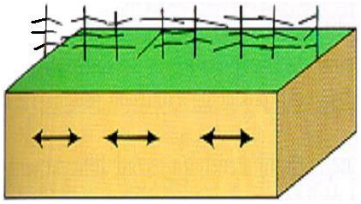


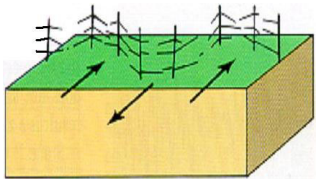


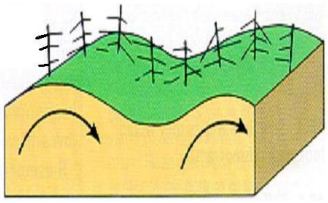


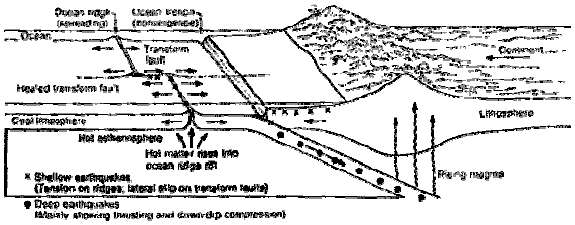


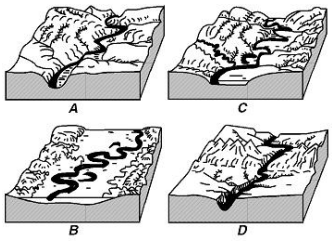


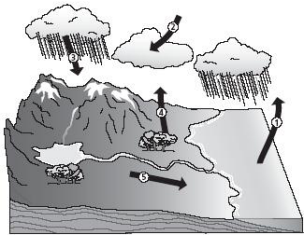


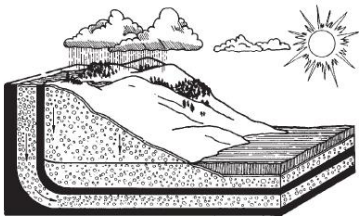


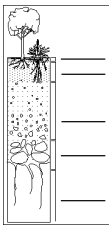


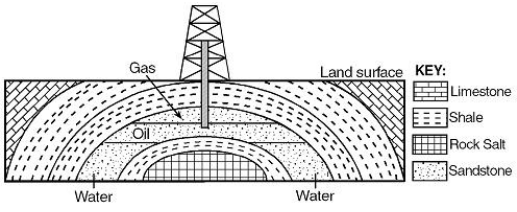


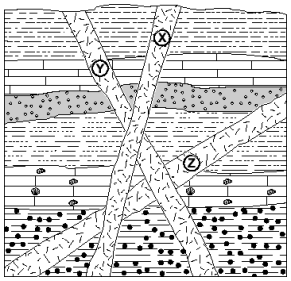


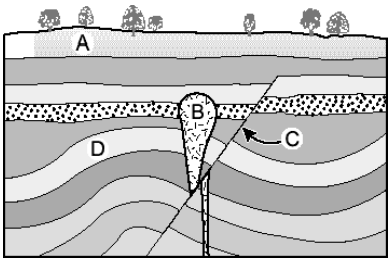


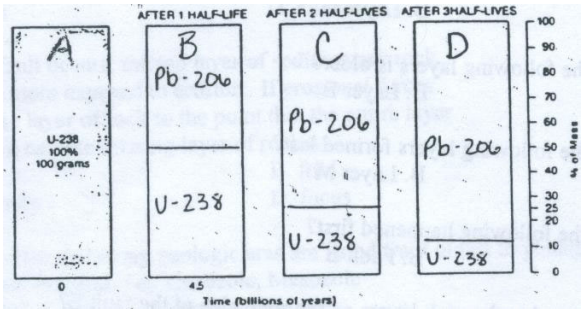




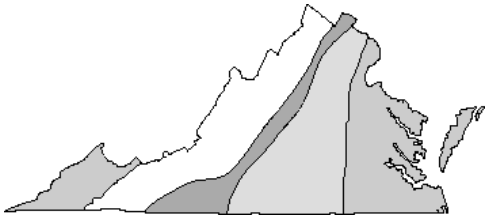


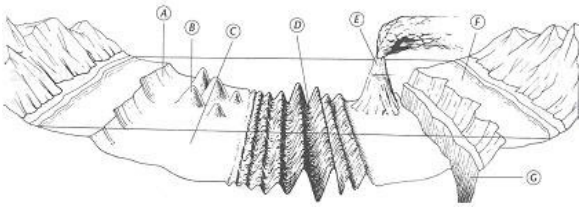



A
B
C
D


AFTER 1 HALF-LIFE
AFTER 2 HALF-LIVES
AFTER 3HALF-LIVES
A
B
C
D
Pb-206
U-238
U-238 100% 100 grams
% of Mass
Time (billions of years)


Map of the Chesapeake Bay




A
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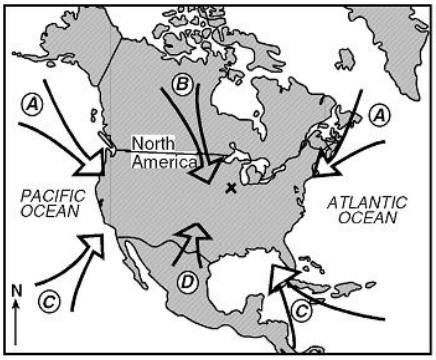
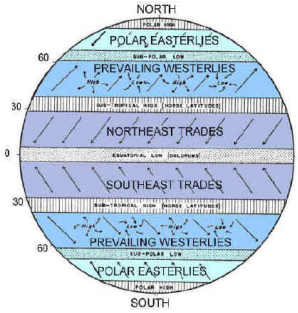
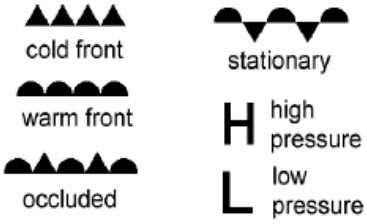

A
B
A
North America
PACIFIC OCEAN
ATLANTIC OCEAN
N
C
D
C


NORTH
POLAR EASTERLIES
PREVAILING WESTERLIES
NORTHEAST TRADES
SOUTHEAST TRADES
PREVAILING WESTERLIES
POLAR EASTERLIES
SOUTH
60
30
0
30
60


cold front
warm front
occluded
stationary
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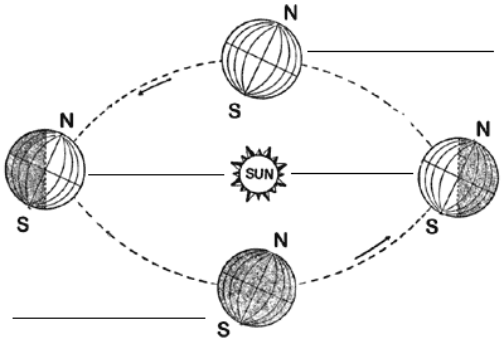
L low pressure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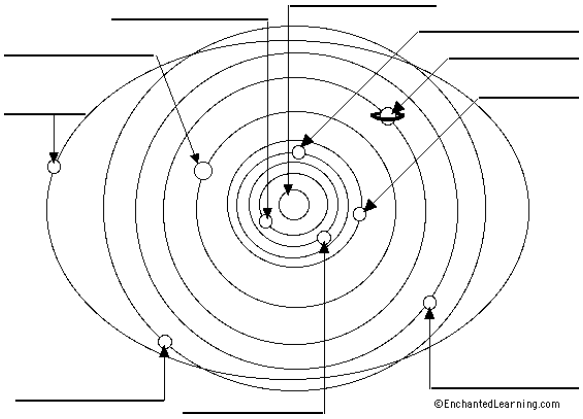
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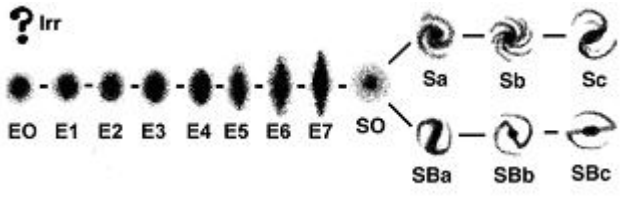
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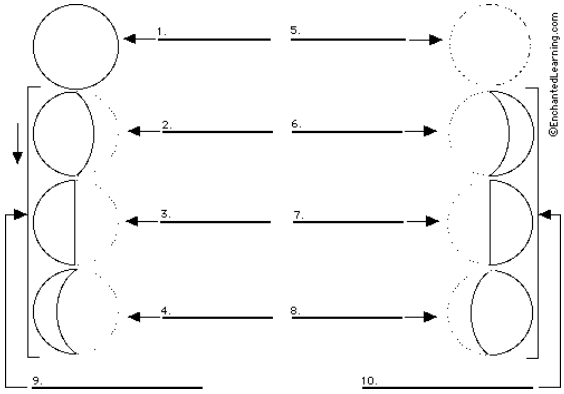
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Top 10

Suggested Strategies to Use During the SOL

These general test-taking strategies can help you do your best during the SOL.

1. **Focus on the test.**  Try to block out whatever is going on around you. Take your time and think about what you are asked to do. Listen carefully to all the directions.

2. **Budget your time.**  Be sure that you allocate an appropriate amount of time to work on each question on the test.

3. **Take a quick break if you begin to feel tired.** To do this, put your pencil down, relax in your chair, and take a few deep breaths. Then, sit up straight, pick up your pencil, and begin to concentrate on the test again. Remember that each test section is only 45 to 60 minutes.

4. **Use positive self-talk.** If you find yourself saying negative things to yourself like, "I can't pass this test," it is important to recognize that you are doing this. Stop and think positive thoughts like, "I prepared for this test, and I am going to do my best." Letting the negative thoughts take over can affect how you take the test and your test score.

5. **Mark in your test booklet.**  Mark key ideas or things you want to come back to in your test booklet. Remember that only the answers marked on your answer sheet will be scored.

6. **Read the entire question and the possible answer choices.** It is important to read the entire question so you know what it is asking. Read each possible answer choice. Do not mark the first one that "looks good."

7. **Use what you know.**  Draw on what you have learned in class, from your study guide, and during your study sessions to help you answer the questions.

8. **Use content domain-specific strategies to answer the questions.** In the TEST CONTENT section, there are a number of specific strategies that you can use to help improve your test performance. Spend time learning these helpful strategies, so you can use them while taking the test.

9. **Think logically.** If you have tried your best to answer a question but you just aren't sure, use the process of elimination. Look at each possible answer choice. If it doesn't seem like a logical response, eliminate it. Do this until you've narrowed down your choices. If this doesn't work, take your best educated guess. It is better to mark something down than to leave it blank.

10. **Check your answers.** ☑ When you have finished the test, go back and check your work.

A WORD ON TEST ANXIETY

It is normal to have some stress when preparing for and taking a test. It is what helps motivate us to study and try our best. Some students, however, experience anxiety that goes beyond normal test "jitters." If you feel you are suffering from test anxiety that is keeping you from performing at your best, please speak to your school counselor who can direct you to resources to help you address this problem.