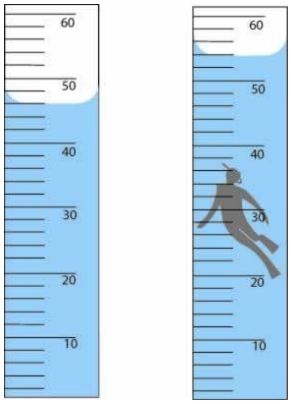
Category: Scientific Investigation and the Nature of Science

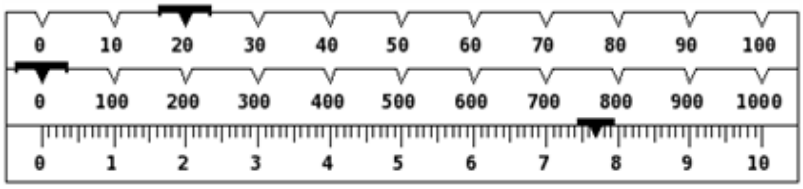
ES.1a-e - Plan and conduct investigations

- What is the volume of the diver?



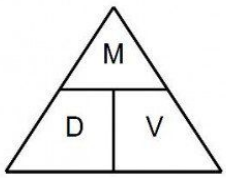
_____ mL

- What is the mass of the diver? _____g



- Use the volume and mass from above, calculate the density of the diver. _____ g/mL

- A helpful trick to remember and use the density formula is the density triangle.



- Use the density triangle to find the answer to the following question. You know the density of a mineral is 2.8 g/mL and you find the mass of the mineral to be 10.3g. What is the volume of the mineral?

- You have an unknown mineral with a mass of 8.22g and a volume of 3.1cm^3. What mineral do you have?

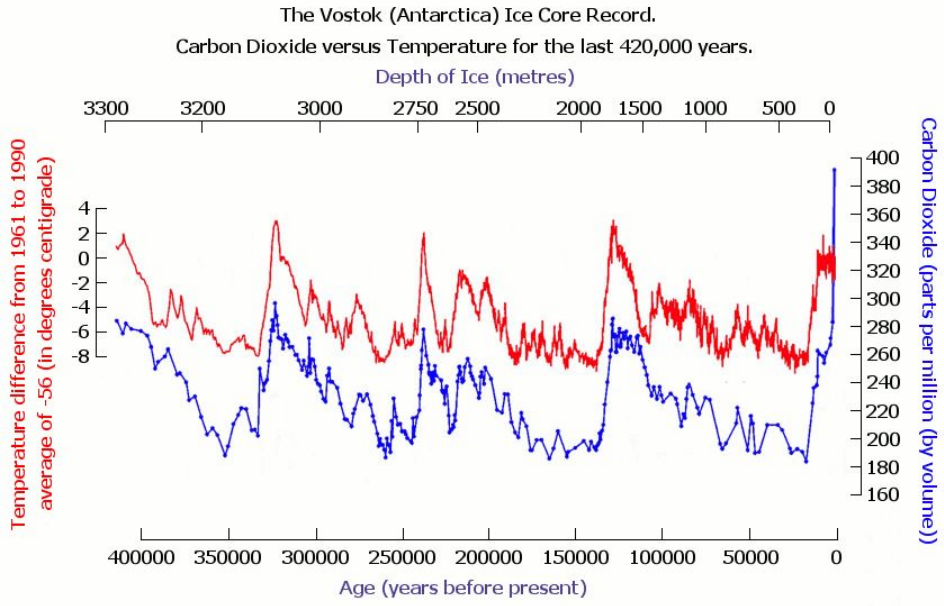
- What would be the mass of a piece of fluorite if it's volume is 5.42 cm^3?

DENSITY CHART

ALL DENSITIES ARE IN GRAMS PER CUBIC CENTIMETER

DENSITY	MINERAL
2 . 16	halite
2 . 32	gypsum
2 . 65	quartz
2 . 72	calcite
3 . 18	fluorite
3 . 4 to 3 . 6	topaz
4 . 1 to 4 . 3	chalcopyrite
4 . 58 to 4 . 65	pyrrhotite
5 . 02	pyrite

- Another important skill is interpreting graphs. Use the graph below to answer the questions. The **top line is temperature** and the **bottom line is Carbon Dioxide**



- Which statement below is correct?
  - As CO^2 increases, temperature increases.
  - As CO^2 decreases, temperature increases.
  - As CO^2 increases, temperature decreases.
  - As CO^2 decreases, temperature stays constant.

- What was the temperature 400,000 ago? _____

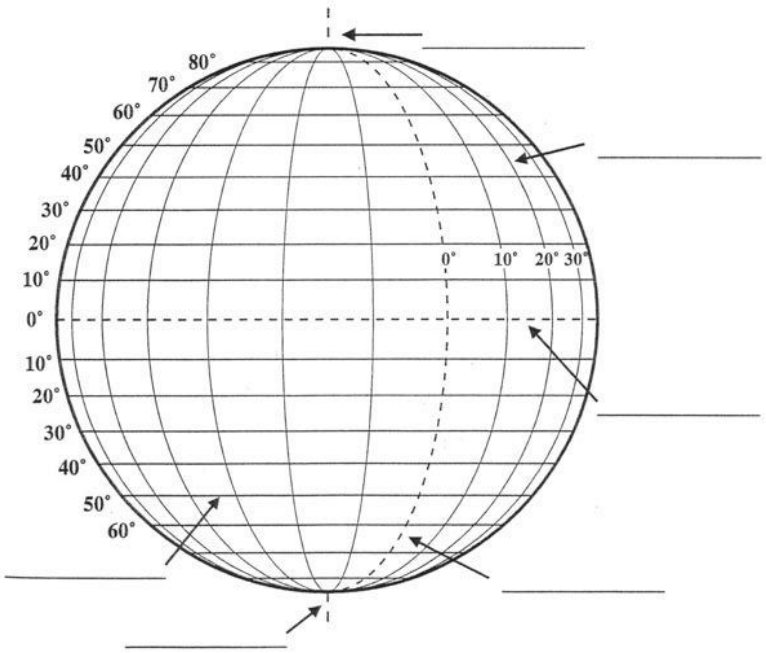
- What's the difference in CO^2 levels from 50,000 years ago to present? _____

- Look at the table below to answer the three questions

Rock Sample	Percentage left after 1 month in acid solution	Percentage left after 2 months in acid solution	Percentage left after 3 months in acid solution	Percentage left after 4 months in acid solution	Percentage left after 5 months in acid solution
A	100%	93%	90%	86%	80%
B	100%	90%	85%	81%	72%
C	100%	99%	98%	97%	96%
D	100%	93%	90%	86%	80%

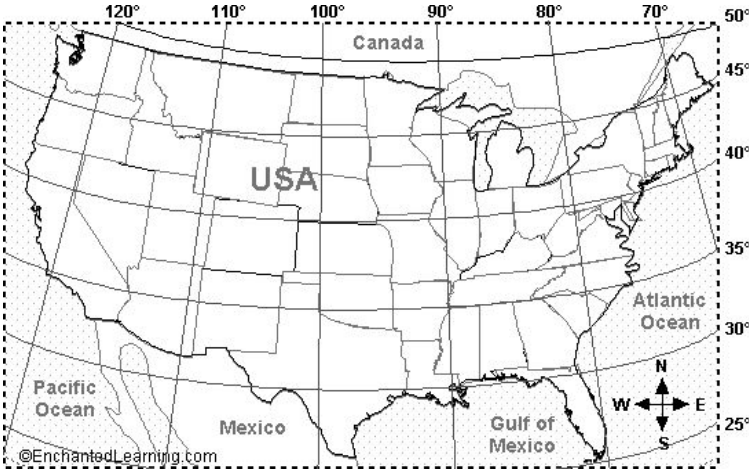
  - In which month where all the samples constant? _____
  - What is the independent variable? _____
  - What is the dependent variable? _____
  - Which sample had the least amount of weathering? _____
  - Which sample had the most amount of weathering? _____
  - Which two samples were consistent with their results? _____

- Latitude and longitude → label the diagram using the word bank



Identify latitude, longitude, North Pole, South Pole, Equator, Prime Meridien

- What is the approximate coordinates for Virginia?

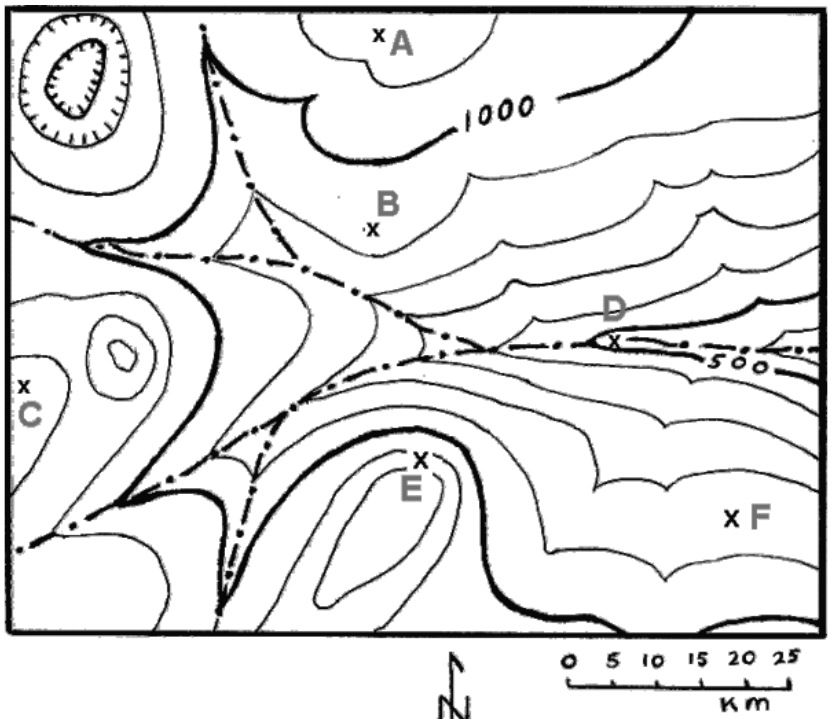


  - 37S, 78W
  - 37N, 78W
  - 78S, 37W
  - 78N, 37W

- Which state would have the coordinates of 32N and 103W? _____

- What directions would you move it you go from Virginia to Maine? _____

- On the map below label a hill, a valley, a hole, and a plateau



- What direction is the river at point D flowing? _____
- Which point is on the steepest slope? _____
- Match the elevation with the point on the map. (the point is the “x”)

945 ft	1150 ft	1250 ft	495 ft	850 ft	1150 ft

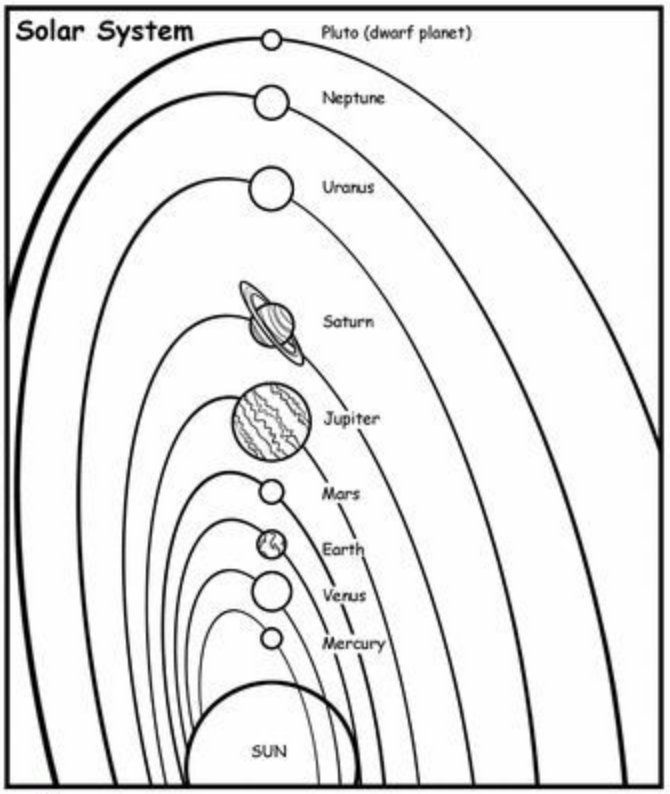
- What is the difference in elevation between points E and D? _____

Category: Earth and Space Systems

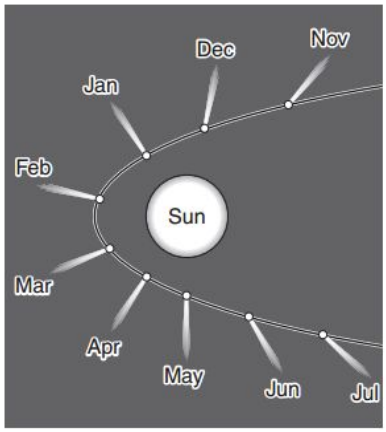
ES.3a-c Investigate and understand the characteristics of Earth and the Solar System.

- Know that Earth is the_____planet from the Sun.

Planet	2 Facts
Mercury	• •
Venus	• •
Earth	• •
Mars	• •
Jupiter	• •
Saturn	• •
Uranus	• •
Neptune	• •
Pluto	• •



- What do we call the objects that orbit between Mars and Jupiter?
  _____



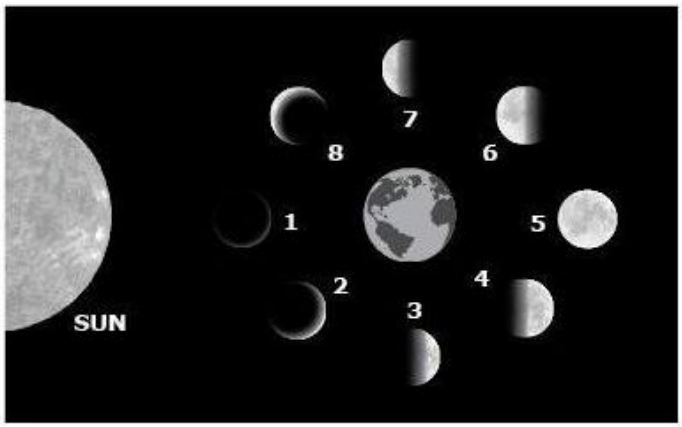
- Comets are large chunks of ice and rock that orbit in our solar system. When they get close to the Sun the ice melts creating a tail behind the comet. <u>Why does the comet's tail always point away from the Sun?</u>

- What do we call the small chunks of rock that burn up in our atmosphere?

- **Lunar Phases** are created as we see different portions of the moon lit up or in shadow. 50% of the moon is lit at any give time and 50% is in shadow.

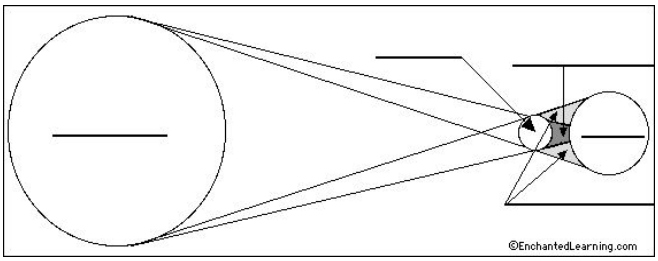
Lunar phases.

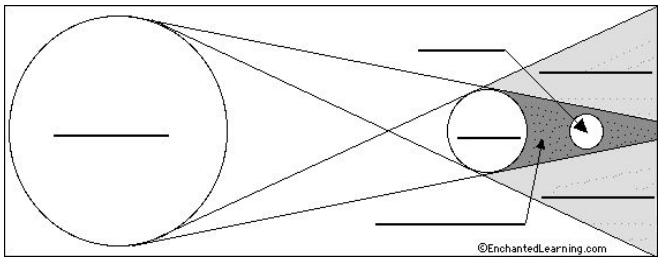
1		5	
2		6	
3		7	
4		8	



- Lunar phases also affect our tides on Earth.
  - **Spring Tides** → Higher tides than normal occur during a _____
  - **Neap Tides** → Lower tides than normal occur during a _____

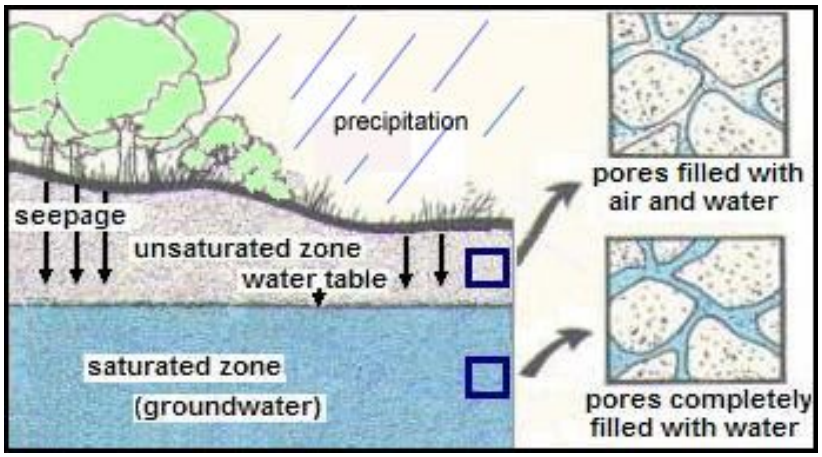
- **Eclipses** are shadows cast by the moon on the Earth, or by the Earth on the moon.





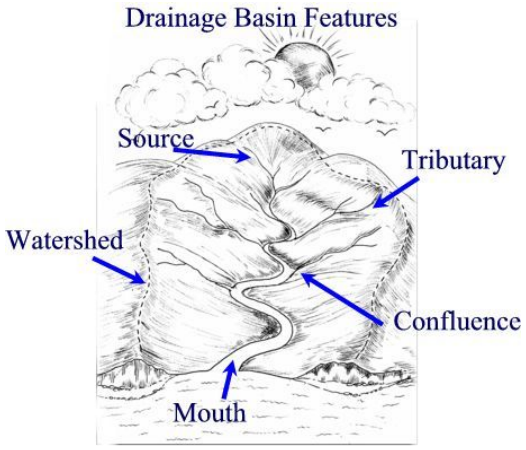
ES.8 c-d Investigate and understand how freshwater resources influenced

- Water can be found not only on Earth's surface but also underground. Water underground is called groundwater and is found in areas called **Aquifers.**



- If you were going to put a well in at your house, which zone would you want your well in? _____

- When there is a lot of rain the _____ will rise, causing the _____ zone to decrease and the _____ zone to increase.
- Where the water table meets the surface a fresh water _____ will flow.
- Surface water is also very important and has many parts:
    - Source (Headwaters) -
    - Tributary -
    - Channel -
    - Mouth -
    - Watershed (Drainage Basin) -



ES.10 a,c-d Investigate and understand that oceans are complex, interactive physical, chemical, and biological systems and are subject to long- and short-term variations.

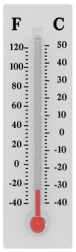
- Our oceans were created 3 billion years ago as water vapor, emitted from volcanoes (Outgassing), condensed and precipitated to fill the basins (low areas) of Earth.
- What three other areas of Earth science have major impacts on the oceans?
    -
    -
    -
- How would changes in the polar ice caps affect the oceans?
- Match the current with how it's created.
- REMEMBER what we do on land can affect the oceans, and what happens in the oceans affects the atmosphere and land.

Type of Current
Surface Current
Upwelling Current
Density Current
Longshore Current

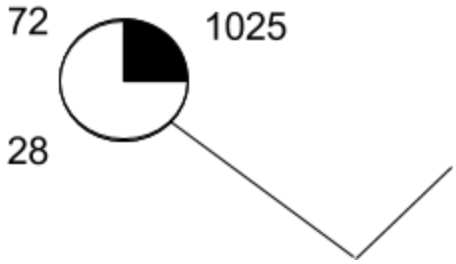
How it's Created
Water sinking
Surface water moving away allowing deep water to move up
Waves come in to shore at an angle squeezing water down shore.
Global winds move ocean water due to friction

ES.12a-d Investigate and understand that energy transfer between the sun and Earth and its atmosphere drives weather and climate on Earth.

- Match the instrument with what it measures: Temperature, Wind speed, Humidity, Barometric Pressure

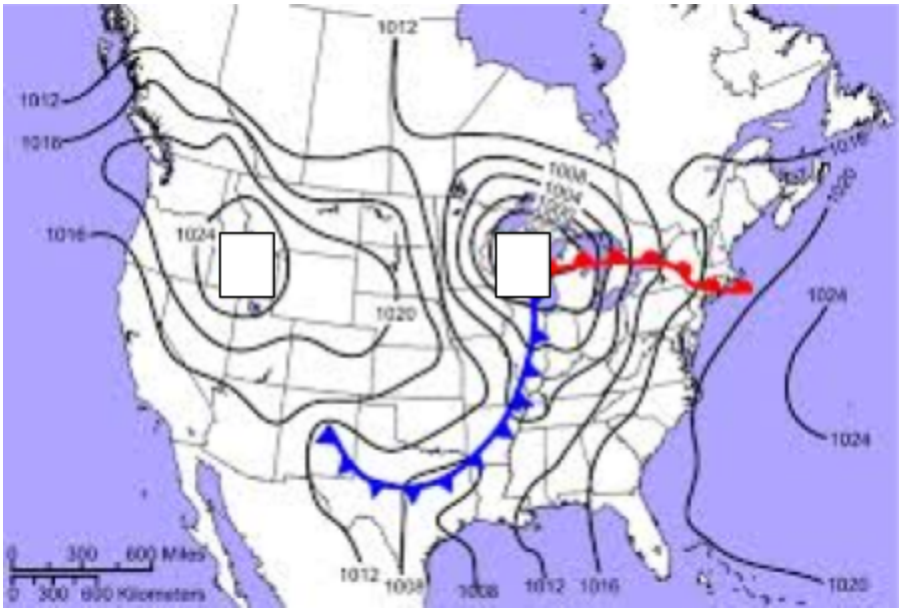
Barometer	Anemometer	Thermometer	Hygrometer
			

- Current weather data is recorded for a station using a group of symbols like the one below. This is called a station model.



- What do each of the parts represent?
  - 72 = _____
  - 28 = _____
  - 1025 = _____
  - The circle = _____
  - The bar off the circle = _____
  - The line off the bar = _____

- Place an “H” where High air pressure would be and a “L” where low air pressure would be.



- In the above map, which of the following states has a warm front?
    - Florida
    - Texas
    - California
    - New York

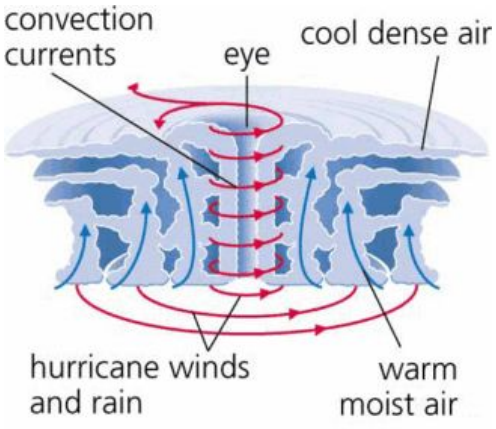
- In the above map, which of the following states has the fastest winds?
    - California
    - Minnesota
    - Florida
    - Virginia

- Which of the following statements is most correct?
    - Winds are blowing from Michigan to Florida
    - Winds are blowing from Ohio to Maine
    - Winds are blowing from Idaho to Michigan
    - Winds are not blowing

- How would you expect the weather in Virginia to change in the next 24 hours?

- A few things to remember;
    - In the United States, ALL weather moves from the _____ to the _____ due to the Prevailing Westerly winds.
    - All storms (including tornadoes and hurricanes) are created by _____ pressure systems.
    - All weather is created by a transfer of the Sun's energy through radiation, and convection.

- Speaking of hurricanes
    - Hurricanes need warm water, and warm rising air to form.
    - What would happen if a hurricane went on land?

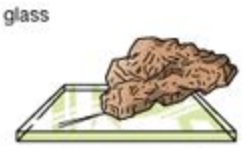


Category: Earth Materials and Processes

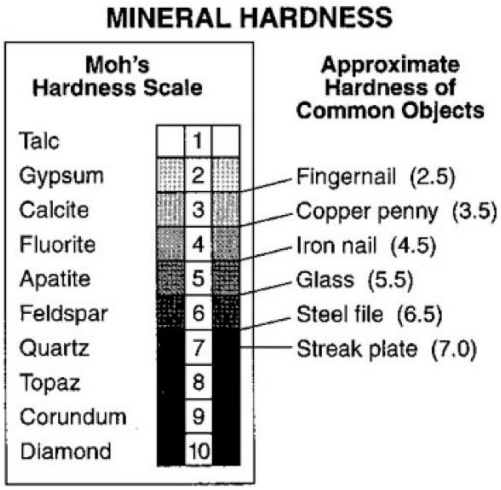
ES.4 Investigate and understand how to identify major rock-forming & ore minerals based on physical and chemical properties.

- A mineral is defined using what five characteristics?
    -
    -
    -
    -
    -

- What identification technique is shown in the picture to the right?



- Using the Moh's Hardness scale to choose the best answer. You have an unknown mineral that can scratch a penny and is scratched by a nail. What else is true about the unknown mineral?
    - It will scratch glass and Apatite
    - It will not scratch glass or calcite
    - It will scratch calcite and quartz
    - It will scratch calcite but not quartz



- When a mineral breaks along flat surfaces creating smaller replicas of the original, the mineral is said to have?

Cleavage **Fracture**

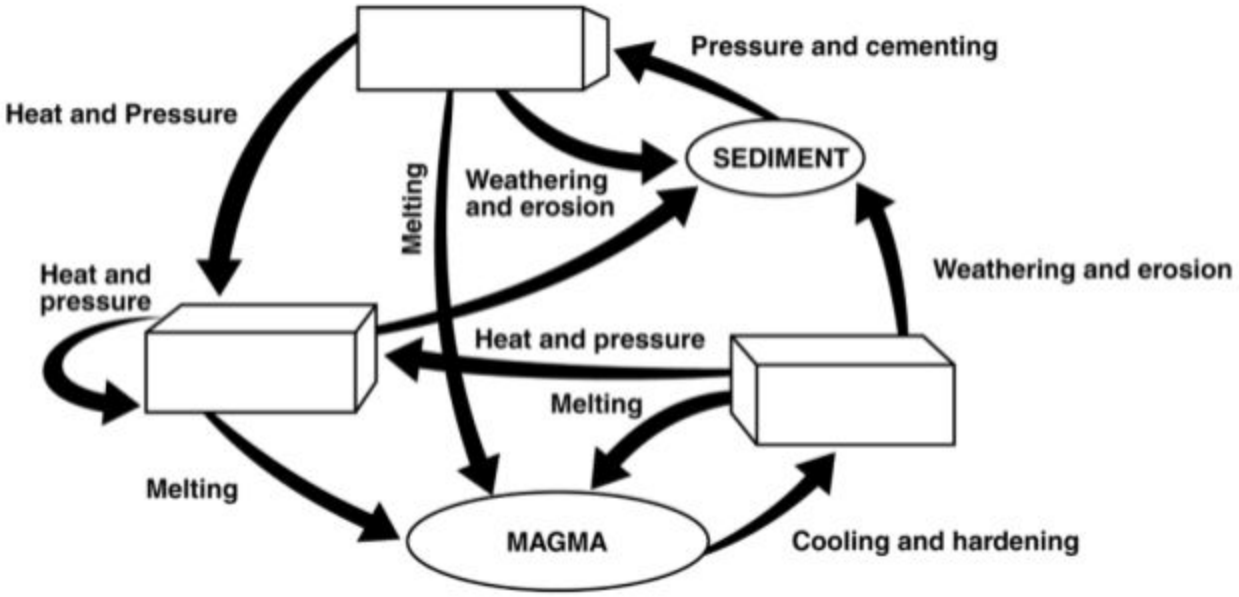
- Which of the following mineral identification test is shown in the diagram to the right?
    - Luster
    - Streak
    - Hardness
    - Fracture

- Match the following minerals with the following common uses: Table salt, glass, sheetrock, gunpowder, pencils, baby powder

Mineral	Gypsum	Halite	Talc	Quartz	Sulfur	Graphite
Use						

ES.5 investigate and understand the rock cycle as it relates to the origin and transformation of rock types and how to identify common rock types based on mineral composition and textures.

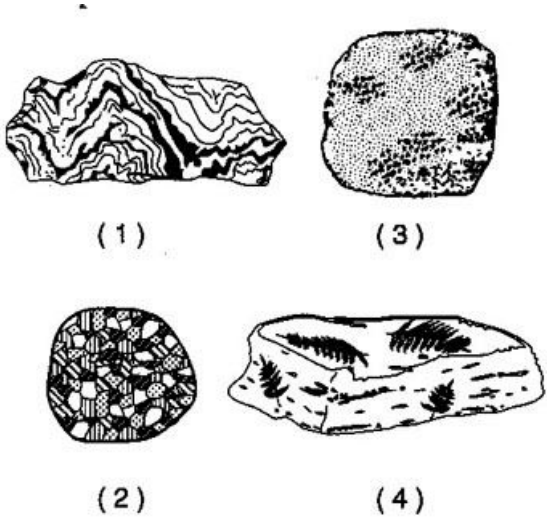
- Complete the rock cycle by placing **Igneous Rock, Sedimentary Rock, and Metamorphic Rock** in the correct box.



- Complete the table deciding if the description is for an igneous (I), sedimentary (S) or metamorphic (M) rock.

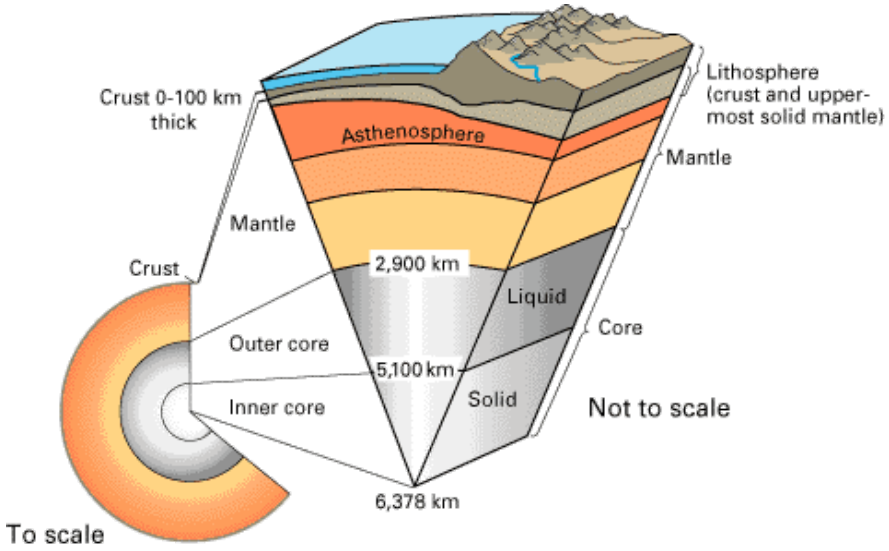
Description	Forms in or around water	Foliated or nonfoliated	Contains fossils	Forms under or around volcanoes	Clastic, Chemical or Organic	Intrusive or Extrusive	Formed during the creation of mountains
Type of Rock							

- Look at the rocks to the right. Match them with their rock type name.
  - Intrusive Igneous _____
  - Foliated Metamorphic _____
  - Extrusive Igneous _____
  - Clastic Sedimentary _____



ES.7 investigate and understand geologic processes including plate tectonics.

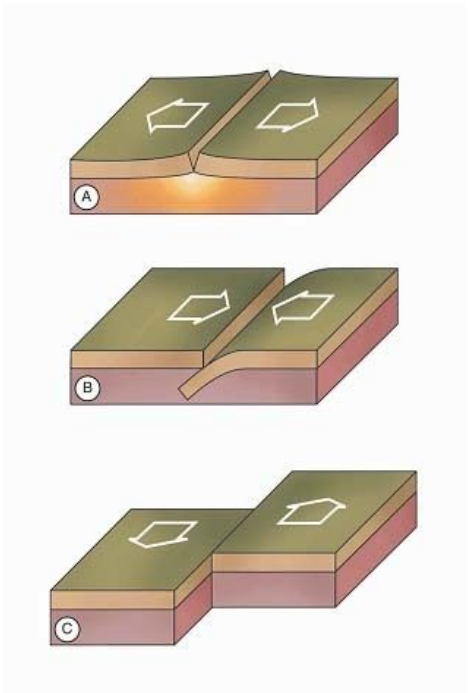
- Know the interior layers of the earth
  - The metal cores create our magnetic field
  - The Lithosphere is broken into plates and floats on the Asthenosphere
  - **Convection** in the asthenosphere causes lithospheric plates to move.



- Match the following descriptions with **Oceanic Lithosphere** or **Continental Lithosphere**

Lithosphere Description	Type of Lithosphere
Relatively thin, dense, basaltic rock	
Thick, less dense, granitic rock	

- Label the following diagrams as either **Divergent**, **Convergent**, or **Transform** boundaries.



  A _____
  (Creates new seafloor)

  B _____
  (Recycles old seafloor)

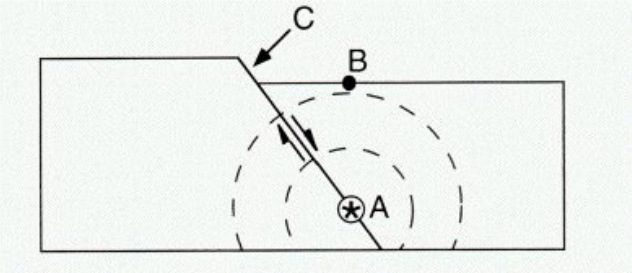
  C _____

- What do scientists use to mark plate boundaries?
  _____
- Which two plate boundaries create volcanoes?
  _____
- If an island is sitting on a divergent boundary it would be getting _____.
  - Bigger Smaller

- Match up the landform with which boundary creates it.

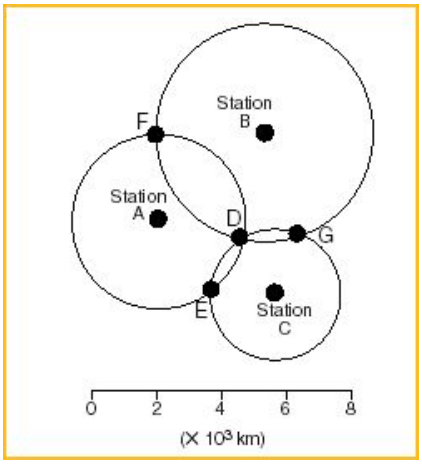
Landform	Trench	Volcanic Island Arc	Rift Valley	Mountains	Volcanic Mountains	Mid-Ocean Ridge	Fault Zone
Boundary							

- Anywhere magma comes to earth's surface a _____ will be created.
- Most of Earth's active volcanoes are found around which ocean? _____
- How many seismic stations is needed to locate the epicenter of an earthquake? _____
- Label A, B, and C as the **Epicenter, Focus,** and **Fault**

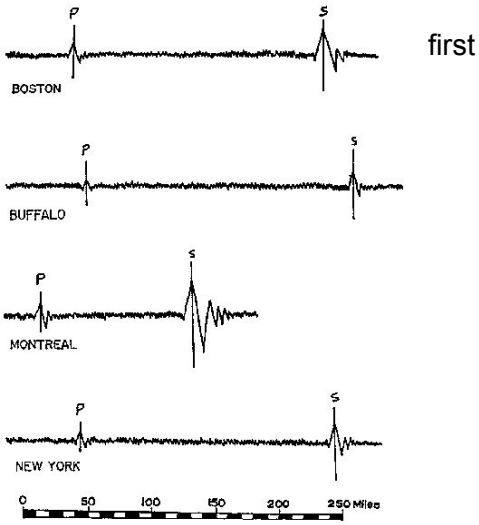


  - A _____
  - B _____
  - C _____

- Use the diagram to the right to answer the following questions.
  - Which station is closest to the epicenter? _____
  - Which station recorded the earthquake last? _____
  - Which letter is the location for the epicenter? _____



- Put the cities in order of who recorded the earthquake first (1) to last (4)
  - 1 _____
  - 2 _____
  - 3 _____
  - 4 _____



- How far away is an epicenter if the time interval between the P-wave and S-wave is 41 seconds? _____

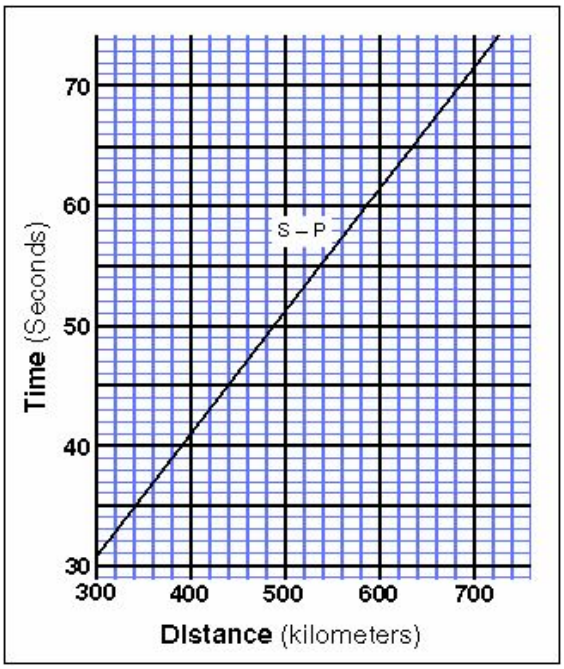
- How long is the S-P interval if a seismometer is 580 km away from the epicenter?

  _____

- As you get farther away from an epicenter what happens to the time between the P and S waves?

  _____

  _____



ES.8 a,b Processes of soil development and karst topography.

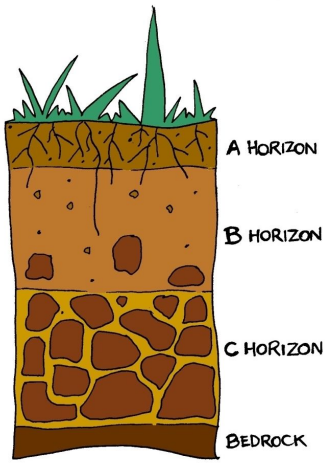
- What four materials make up soil?
  -
  -
  -
  -
- Which soil horizon has the most humus?

  _____

- Which soil horizon is comprised mostly of weathered bedrock? _____

- The older soil is the fewer horizons it will have.

  True False

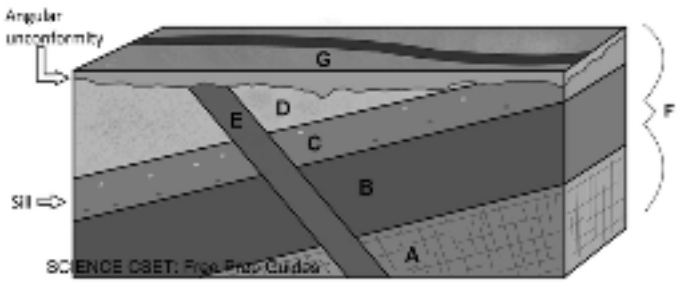


- Karst topography is created by…
  - The deposition of limestone underground
  - Groundwater dissolving limestone underground
  - Wind weathering limestone on the surface

Category: Cosmology, Origins, and Time

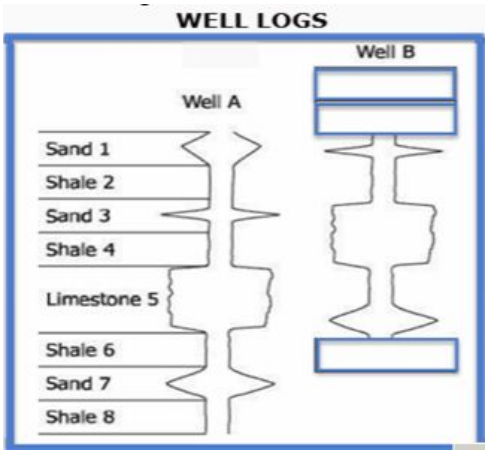
ES.9a-d Investigate and understand that many aspects of the history and evolution of Earth and life can be inferred by studying rocks and fossils.

- What do we call the traces/remains of life preserved in sedimentary rocks? _____
- There are three types of traces or remains of preserved life
  - Altered Remains →
  - Unaltered Remains →
  - Trace →
- Earth is _____ years old.
  - This age has been found by using a combination of absolute and relative dating.
- **Relative dating** → using rocks and fossils to find a sequence of events on earth.
  - Laws of Relative Dating
    - *Law of Superposition* → older rocks below younger rocks
    - *Law of Cross-cutting Relationships* → Anything (faults or igneous intrusions) that cuts across will be younger than what it goes across.
    - *Law of Original Horizontality* → Rock layers are flat and then are tilted or folded.
  - Put the layers of rock in order from oldest (1) to youngest (6)

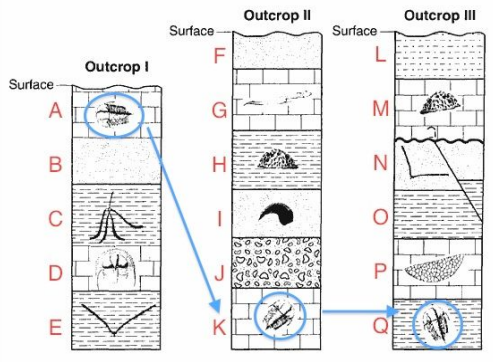


1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6._____

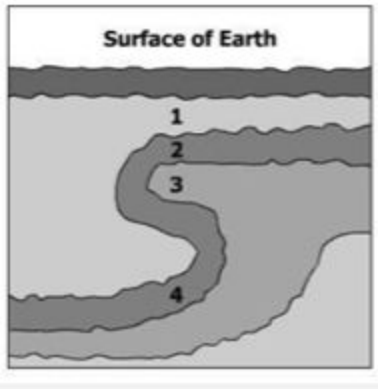
  - Based on the formations in Well A, which geologic formations are missing in Well B?
    -
    -
    -



- Fossils can also be used to obtain a sequence of events and in some cases an actual time of rock formation.
  - Layer A in outcrop 1 was formed at the same time as layer K in outcrop 2 and layer Q in outcrop 3. We know this because we find the same fossils in all three layers.

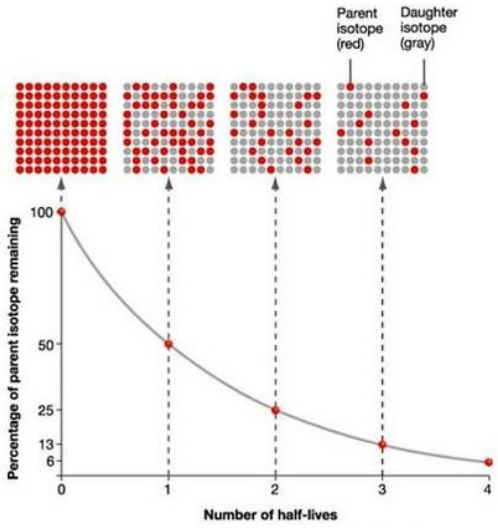


- The diagram below represents layers of Earth, in which fossils have been found. The fossil located in which labeled area is most likely the oldest?

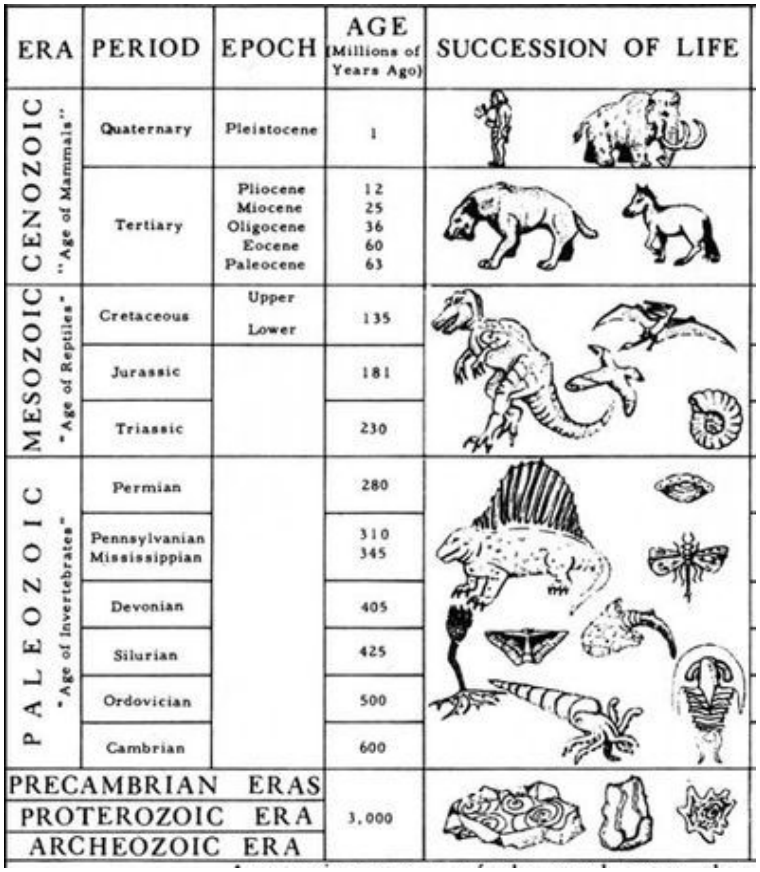


- **Absolute Dating** → Using radioactive particles to find the number age of igneous or metamorphic rocks.
  - Radioactive particles break down at specific rates which allows us to measure how old a rock is.
    - We measure in **half-lives**, which is the time it takes for half of the radioactive particles to break down to a stable element.
      - For instance, if you start with 100 Uranium-235 particles it will take 4.5 billion years before half of them (50 particles) break down to lead.

    - How many half-lives has an isotope gone through if there is only 25% left?
      - 1
      - 4
      - 2
      - 3



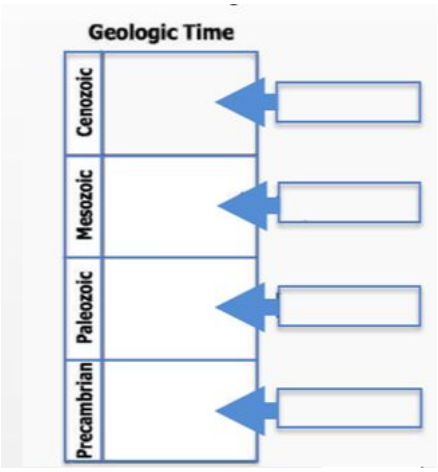
- **The Geologic Time Scale** has been created with all the information we have found by using the above dating methods.
    - The geologic time scale is a **timeline of Earth's geologic and biologic history**

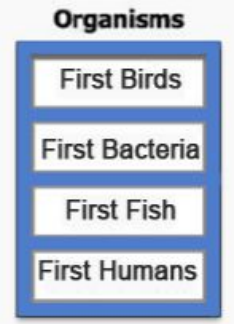


ERA	PERIOD	EPOCH	AGE (Millions of Years Ago)	SUCCESSION OF LIFE
CENOZOIC "Age of Mammals"	Quaternary	Pleistocene	1	
	Tertiary	Pliocene	12	
		Miocene	25	
		Oligocene	36	
		Eocene	60	
		Paleocene	63	
MESOZOIC "Age of Reptiles"	Cretaceous	Upper	135	
		Lower		
	Jurassic		181	
	Triassic		230	
PALEOZOIC "Age of Invertebrates"	Permian		280	
	Pennsylvanian		310	
	Mississippian		345	
	Devonian		405	
	Silurian		425	
	Ordovician		500	
	Cambrian		600	
PRECAMBRIAN ERAS				
PROTEROZOIC ERA			3,000	
ARCHEOZOIC ERA				

    - **<u>As Earth has gotten older life forms have become more complex.</u>** From single cell organisms 2.5 billion years ago to humans that can talk today.

    - Match the organism to the correct geologic era.



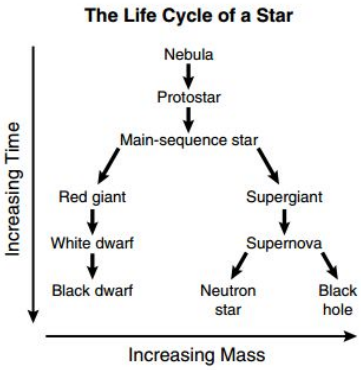


ES.11a-c Investigate and understand the origin and evolution of the atmosphere and the interrelationship of geologic processes, biologic processes, and human activities on the atmosphere's composition and dynamics

- The atmosphere has not always been the same. The evidence for its change comes from…
  -
  -
- Our first atmosphere was created by gasses escaping from _____.
- The process responsible for creating oxygen in our atmosphere is created by _____ from cyanobacteria (blue-green algae)
- As our atmosphere was created it divided into layers because of _____ in the types of gasses.

ES.13a-b Investigate and understand scientific concepts related to the origin and evolution of the Universe

- We believe that the universe is about 14 billion years old. The theory that states how the universe was created is _____
  - This theory states that everything started as a dense ball of matter and rapidly expanded out to form the galaxies, stars, and planets we have today.
  - **Evidence for this is redshift of galaxies**
- Stars go through a life cycle just like animals and planets

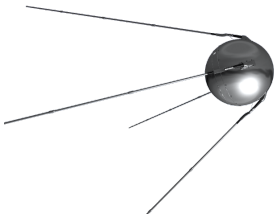
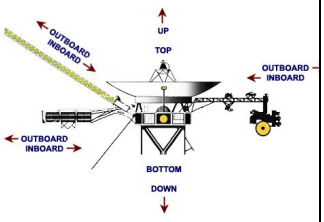
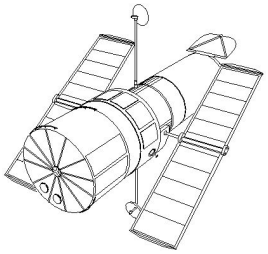
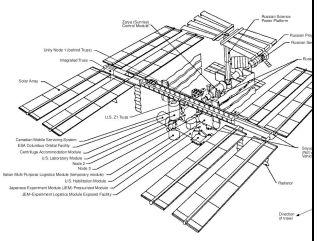


- Put the following in the correct order.

Category: Earth Resources and Human Interactions

ES.3d - History and contributions of space exploration

- Technology becomes more complex and advanced over time.

Sputnik	Voyager	Hubble Telescope	International Space Station
			

- What country put the first object, living thing, and human into space? _____
- What country put the first person on the moon? _____
- What was the point of the Apollo missions? _____
- What planet does the US have probes on? _____

ES.4b - Uses of minerals

- Earth contains over 6000 different species of minerals. They can all be identified using specific properties and most of them have economical uses.

Mineral	Quartz	Mica Group	Feldspar	Oxide Group	Graphite	Sulphur
Description						
Use						

ES.6a,b,c,d - Investigate & Understand the differences between renewable and nonrenewable resources

- Renewable Resource -

- Nonrenewable Resource -

- Label each of the following as either renewable (R) or nonrenewable (NR)

Coal	Water	Solar	Oil	Natural Gas	Biomass	Rocks/minerals	Wind	Nuclear	Tidal

- What are advantages and disadvantages of renewable and nonrenewable resources?

	Renewable Resources	**Nonrenewable Resources**
Advantages		
Disadvantages		

- Resources found in Virginia by physiographic Province

Province	**Coastal Plain**	**Piedmont**	**Blue Ridge**	**Valley & Ridge**	**Appalachian Plateau**
Resource					

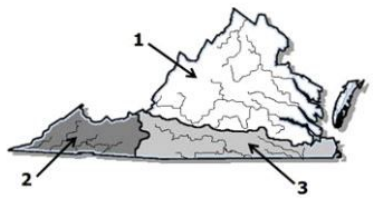
ES.8e,f - Dependence on freshwater & the effects of human usage on water quality; major watersheds of Virginia.

- Less than 1% of all water on our planet is usable by humans. Freshwater can be found in…
  -
  -
  -
  -
  -

- There are two main types of water pollution
  - Point source →
    - Examples →
  - Nonpoint source →
    - Examples →
  - Before the 1980's, 90% of all US waterways (Rivers, lakes, swamps) were so polluted, they were unfit for use.

- In 1978 the **Clean water Act** passed as law.
  - What did the Clean Water Act do?

- Virginia Watersheds

	1	
	2	
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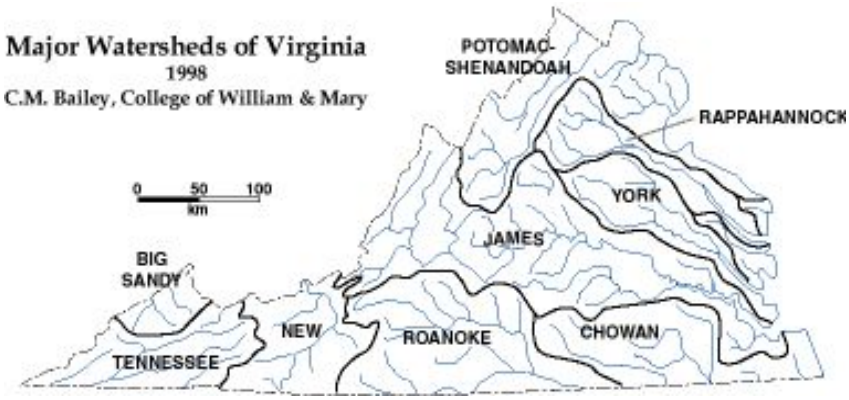


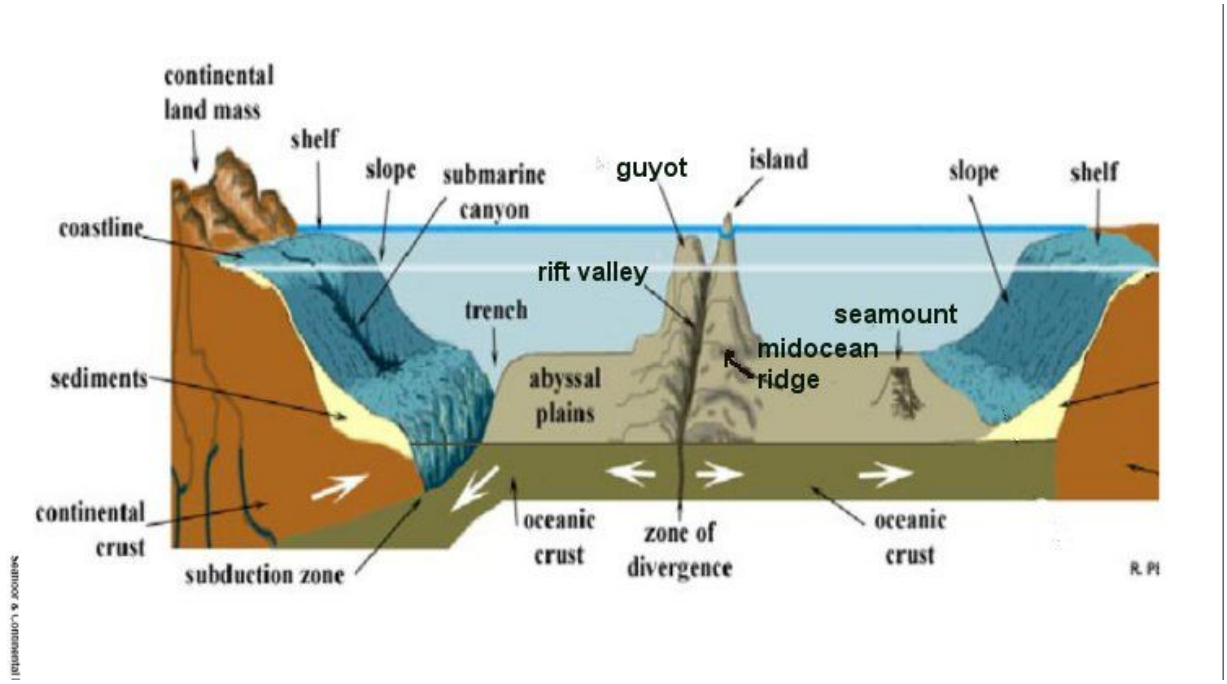
ES.10b,e - The importance of environmental and geological implications on the Oceans; Economic and public policy issues concerning oceans and coastal zones including the Chesapeake Bay

- The oceans were created 4 billion years ago as water filled the basins (low spots) of Earth.
- Ocean currents can affect the land they boarder.

Current	Effect on land
Warm Surface Currents	
Cold Surface Current	
Upwelling Currents	
Longshore Currents	

- How do humans affect the oceans/Chesapeake Bay?

- Plate Tectonics creates/destroys the ocean floor.



ES.11d - What are the potential changes to the atmosphere and climate due to human, biologic, and geologic activity?

- How do the following things affect Earth's atmosphere?

Cause	Effect
Humans Burning Fossil Fuels	
Photosynthesis	
Volcanic Eruptions	

- What is the Greenhouse Effect?

- What are the problems caused by global warming/climate change?