Name _____
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Notes Unit 1 Introduction
Earth Science

I. Some Definitions

A. Observation - using your senses

B. inferences are assumptions/explanations based on observations.

C. Classification is grouping on the basis of common properties. Why do we do this?

to make study easier

D. Mass the amount of matter in a _____. It is measured in grams.

E. Volume the amount of space an object occupies _____ It is measured in ml or cm3.

A prediction of next winter's weather is an example of

(1) a measurement - comparison to a known standard
(2) a classification
(3) an observation
(4) an inference

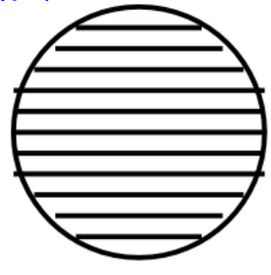
II. Locating positions on the Earth's surface

- Humans have established a system to locate positions on Earth.
- Longitude and Latitude are based on the Earth's rotation and our observations of the Sun and stars.
- Navigation: Science of locating your position
- Coordinate systems assign a pair of numbers to every position on the Earth's surface.
- Latitude: a measure of how N or S of the Equator

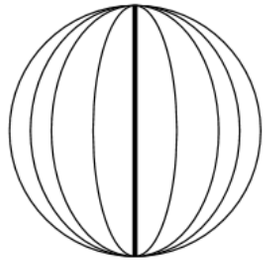
Equator = reference Line = 0°

Parallel = line of latitude

Highest # = 90° N : 90° S



- longitude - degree E or W of prime meridian



0 degrees = Prime Meridian

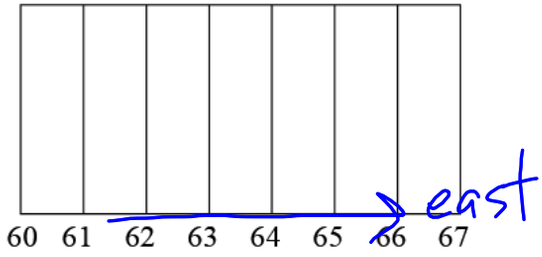
Meridian = line of longitude

Highest # is 180 degrees

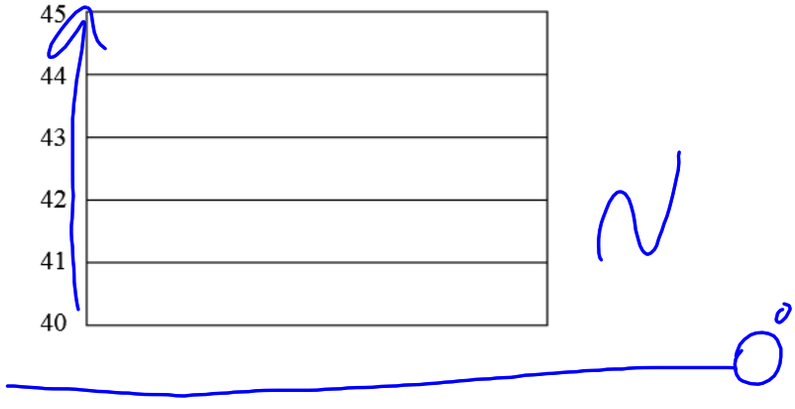
International Date Line

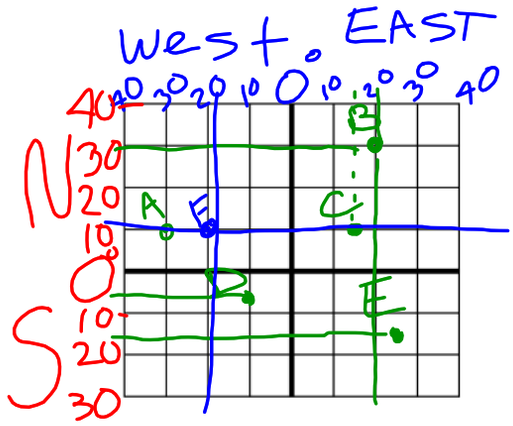
III. Using latitude and longitude

- These are lines of Longitude.
- Is this map area in the Eastern or Western Hemisphere?

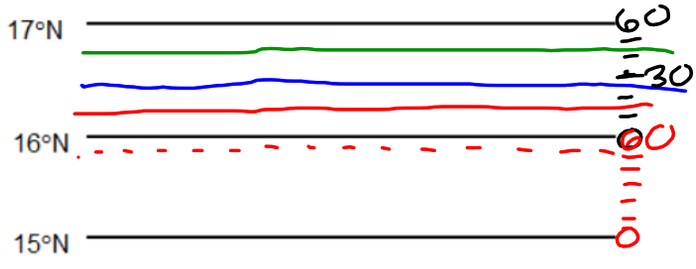


- These are lines of Latitude.
- Is this map area in the Northern or Southern Hemisphere?





	Latitude	Longitude
A	10°N	30°W
B	30°N	20°E
C	10°N	15°E
D	5°S	10°W
E	15°S	25°E
F	10°N	20°W



Using a BLUE colored pencil, draw the 16°30'N line.
Using a RED colored pencil, draw the 16°15'N line.
Using a GREEN colored pencil, draw the 16°45'N line.

Which latitude and longitude coordinates represent a location on the continent of Australia?

(1) 20° N, 135° E
(2) 20° N, 135° W
(3) 20°S, 135° E
(4) 20° S, 135° W

An observer in New York State measures the altitude of Polaris to be 44°. According to the *Earth Science Reference Tables*, the location of the observer is nearest to

(1) Watertown
(2) Elmira
(3) Buffalo
(4) Kingston

Altitude of Polaris = latitude of observer.

Base your answer to the following question on the *Earth Science Reference Tables*.

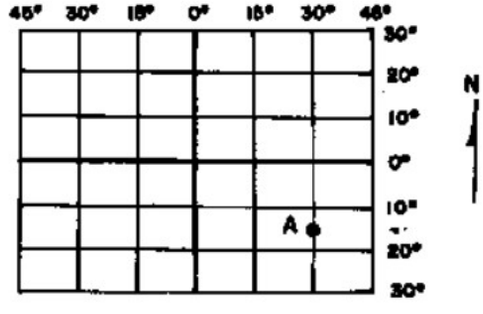
What is the location of Binghamton, New York?

(1) 42° 06' N. lat., 75° 55' W. long.
(2) 42° 06' N. lat., 76° 05' W. long.
(3) 42° 54' N. lat., 76° 05' W. long.
(4) 42° 54' N. lat., 75° 55' W. long.

The latitude of a point in the Northern Hemisphere may be determined by measuring the

(1) apparent diameter of Polaris
(2) altitude of Polaris
(3) distance to the Sun
(4) apparent diameter of the Sun

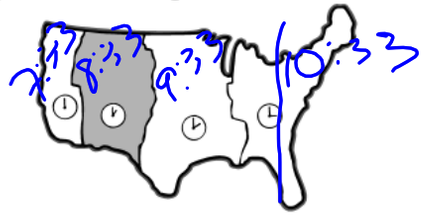
The diagram below represents a portion of a map of the Earth's grid system. What is the approximate latitude and longitude of point *A*?



(1) 15°N. 30°W.
(2) 15°S. 30°W.
(3) 15°N. 30°E.
(4) 15°S. 30°E.

IV. Time and Longitude

- People have used the stars to note the passage of time
- The earth rotates spins:
  - 360° in 24 hrs.
  - 15° every hour
  - 1° every 4 minutes
- Humans divided the E into 24 time zones
- Meridians of longitude are the basis of time
- If you move one time zone to the West, the time is 1 hour earlier
- If you move one time zone to the East, the time is 1 hour later
- Why did humans put time zones on earth?



4pm 3pm

15° E

The time required for one Earth rotation is about
(1) one hour
(2) one day
(3) one month
(4) one year

Cities located on the same meridian (longitude) must have the same
(1) altitude
(2) latitude
(3) length of daylight
(4) solar time

A person knows the solar time on the Prime Meridian and the local solar time. What determination can be made?
(1) the date
(2) the altitude of Polaris
(3) the longitude at which the person is located
(4) the latitude at which the person is located

Upon which frame of reference is time based?
(1) the motions of the Earth
(2) the longitude of an observer
(3) the motions of the Moon
(4) the real motions of the Sun

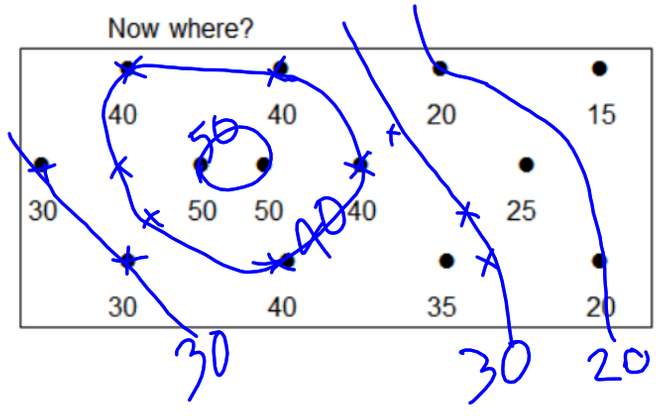
What is the total number of degrees that the Earth rotates on its axis during a 12-hour period?
(1) 1°
(2) 15°
(3) 180°
(4) 360°

V. Drawing Maps of the Earth

- Humans can map just about anything.
- Field- a region of space in which a similar quantity can be measured.
- The values (numbers) can change with time.
- Types of fields: elevation, temp., pressure
- Once we measure an area we can make a map of what we were measuring:

Draw isotherms at a 10° interval.

Start at the left and work right.



- We then connect the points that have equal values so that the map is more meaningful to us.
- isolines connect points of = value.
  - isotherms - connect points of = temperatures
  - isobars - connect points of equal pressure
  - contour lines - connect points of equal elevations
    - elevation: distance above or below sea level.

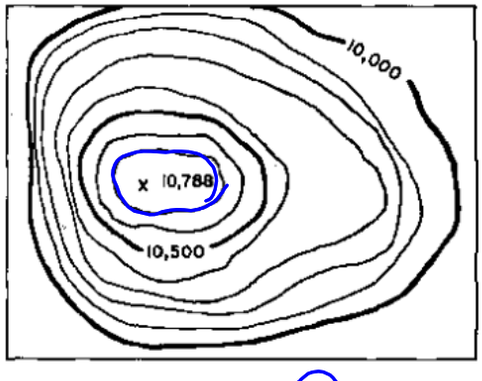
Which statement is true about an isoline on an air temperature field map?

(1) It represents an interface between high and low barometric pressures.
(2) It indicates the direction of maximum insolation.
(3) It increases in magnitude as it bends southward.
(4) It connects points of equal air temperature.

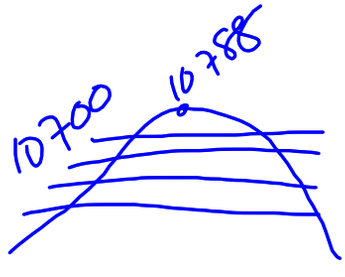
VI. Topographic Maps

- also called contour maps
- They are two-dimensional models that use contour lines to represent places of equal elevation.
- They represent landforms through the use of contour lines
- Technology has both created changes and accelerated natural changes in the landscape that can be recorded with topo maps.
- You **HAVE** to know how to read, interpret, and topo maps.
- Contour lines are isolines that connect points of = elevation
- contour interval is the distance in between contour lines.

What is the elevation of the highest contour line shown on the map below?



(1) 10,000 feet
(2) 10,688 feet
(3) 10,700 feet
(4) 10,788 feet

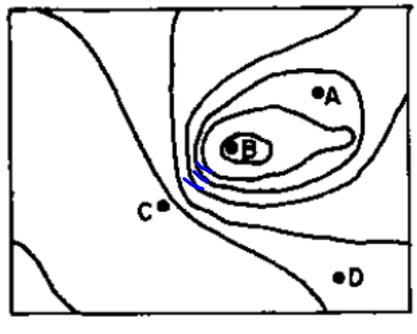


VII. Topographic Map Rules

1. All points on a contour line have the same elevation.
2. Every fifth line is called an index line. It is usually darker and helps you count.
3. All contour lines are closed (make a circle), but they might not look like they are closed because the map might be too small.

4. Two contour lines of different elevations may not cross each other. Exceptions: cliffs and waterfalls escarpment
5. The spacing of contour lines indicates the nature of the slope.
   - Closer together = steep
   - Farther apart = gentle
   - No lines = flat

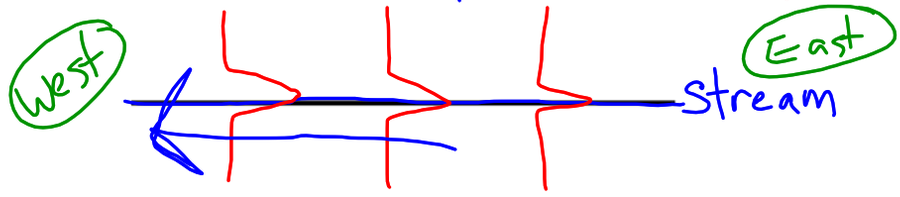
The diagram below is a contour map. Between which two points is the slope of the hill steepest?



(1) *A* and *B*
(2) *B* and *C*
(3) *C* and *D*
(4) *A* and *D*

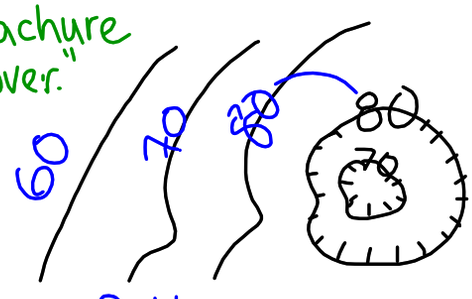
6. When contour lines cross a stream, they always form a V shape.

- The V's point upstream (uphill) against the water flow ← opposite



7. Hachure Lines indicate a depression.

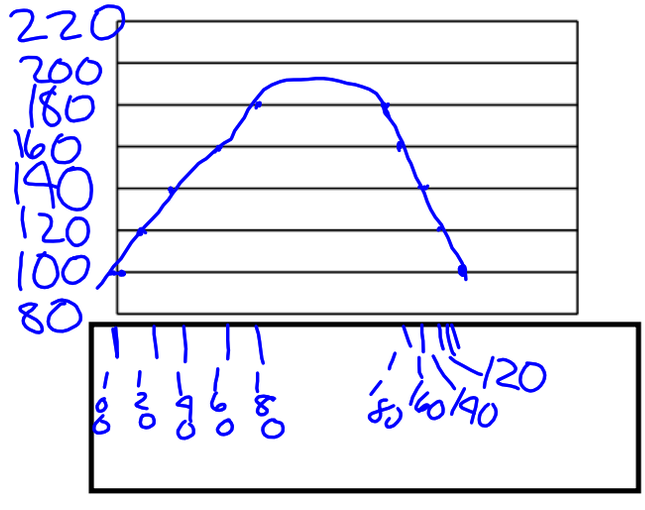
Special Rule: The first hachure line is a "do-over."



8. Gradient is the slope of the land. It is possible to calculate the gradient of a slope using the formula on page 1 of your reference tables.

$$\text{Gradient} = \frac{\text{change in field value}}{\text{distance}}$$

- 1. Find the contour interval. (What you are counting by.)
- 2. Label the elevation on each contour line. (On the top where you can see it.)
- 3. Bring the edge of a piece of paper to line _____.
- 4. Put a mark on the paper where the contour lines cross the edge.
- 5. Label the elevations on the edge of the paper.
- 6. Label the elevations on the graph.
- 7. Bring the edge of the paper to the bottom of the graph.
- 8. Make a dot on the graph directly above each mark on the edge of the paper. The dot must be at the correct elevation.
- 9. Connect the dots with curved lines. Curve the tops of hills and the bottoms of valleys. Only connect the dots that you drew.



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Unit 2 Density Notes
Earth Science

Density

the concentration of matter in an object.

- Which of the following is the most dense?

A B C D

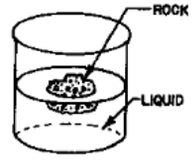
Base your answer to the following question on the *Earth Science Reference Tables*.

Water has its greatest density at a temperature of

(1) -6° C
(2) 10° C
(3) 32° C
(4) 4° C

- most substances are most dense as solids.
  - * Exception: Water is most dense as a liquid ~4° C
- **As the temperature of a substance increases,** the density decreases. (molecules become farther apart)
- **As the temperature of a substance decreases,** the density increases. (molecules become closer together.)
- Floating and Sinking
  - Less dense objects float.
  - More dense objects sink.
- If the object and the fluid are equally dense, the object will stayed suspended below the surface.
- For a floating object, the lower the density, the higher the object will float in the liquid.
- **Ice** floats **in water because** ice is less dense than water.

The diagram below shows a glass jar containing a clear liquid and a floating rock.



Which conclusion about the relative density of the rock and the liquid is true?

(1) The rock is less dense than the liquid.
(2) The rock is more dense than the liquid.
(3) The rock and the liquid have the same density.

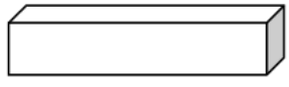
- Calculating Density
  - The higher the number the more dense it is.
  - You do not have to remember the formula because it is on page 1 of ESRT.
  - **Example # 1** The mass of an object is 13.5 grams and its volume is 4.2 milliliters. Round your answers to the nearest tenth.

1. Write the formula: $\text{Density} = \frac{\text{mass}}{\text{volume}}$
2. Substitute the numbers: $= \frac{13.5\ g}{4.2\ mL}$
3. Do the math: $= 3.214285\ldots$
4. Units/Rounding: $= 3.2\ g/mL$

Density (continued)

- KEY IDEA: Density does NOT depend on size or shape.
- If you cut an object in half its density will remain the same.
- Prove it to yourself and calculate the densities of a wood block and half of the wood block:

- Whole Wood Block
  Mass = 20.0 grams
  Volume = 40.0 milliliters

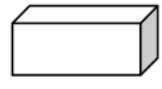


$D = \frac{m}{V}$

$= \frac{20\ g}{40\ mL}$

$= 0.5\ g/mL$

Half a Wood Block
Mass = 10.0 grams
Volume = 20.0 milliliters



$D = \frac{m}{V}$

$= \frac{10\ g}{20\ mL}$

$= 0.5\ g/mL$

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Unit 3 Weather Variables
Earth Science – Weiler

I. Describing Weather

a. Weather

b. It is the short-term condition of the atmosphere and the changes that occur within the atmosphere or troposphere.

c. Changes are mainly the result of unequal heating by solar radiation (sunlight) of the Earth's landmasses, oceans and atmosphere.

d. Atmospheric variables – temperature, cloud cover, rain, air pressure, wind, humidity

   i. Atm. variables are interrelated and interactions are complex.

e. Meteorologists (scientists that study the weather) make field charts of these variables and then can make predictions (forecasts).

II. Atmospheric Variables

a. Temperature – the amount of heat

   i. More heat energy = greater temperature

   ii. Solar radiation (sunlight) is the source of energy in the atmosphere.

   iii. The amount of heat energy emitted from the sun is fairly constant but the amount that reaches the earth varies because of the following:

      1. The angle at which solar radiation strikes the earth.
         a. Sun at a high altitude: hotter
         b. Sun at a low altitude: cooler
      2. The duration of solar radiation per day.
         a. Sun shines ~15 hrs in summer = hotter
         b. Sun shines ~9 hrs in winter = cooler
      3. The amount of cloud cover.
         a. Solar radiation is reflected, refracted or absorbed.
         b. more cloud cover during the day = cooler
         c. more cloud cover at night = warmer ← acts like a blanket
      4. The type of surface that absorbs solar radiation
         a. dark + rough = heat/cool faster
         b. light + smooth = heat/cool slower

iv. Daily temperature usually varies because of the E's rotation and the amount of cloud cover.

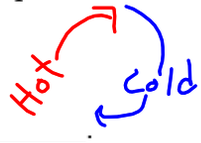
v. Seasonal temperature usually varies because of the ① tilt of E's axis ② revolution of E around the Sun.

vi. Temperature is measured with a thermometer.

vii. Continuous temperature readings are made with a thermograph.

viii. Temperature differences within the atmosphere cause density differences.

b. Differences in density cause convection currents.



c. As air temperature increases, the air pressure decrease.
   i. Temp increases, faster, spread out, less dense

d. As air temperature decreases, the air pressure increases.
   i. Temp decreases, slower, closer, more dense

III. Air pressure

a. Air Pressure – the force of the air above you.
Atmospheric Pressure Barometric Pressure

b. Air is a mixture of gases.

c. A gas contains many tiny individual molecules that are far apart and moving rapidly.

d. As they move about, they are kept from escaping the atmosphere because of the Earth's gravity.

e. You can NOT sense the changes in the air pressure but a barometer can.

f. There are two main types of barometers:

   i. Mercury barometer - air pushes down on mercury then the mercury will rise up a tube.

   ii. Aneroid barometer – no air, the can has a spring scale. As the air pushes against it the spring records how much pressure.

g. One atmosphere is the average pressure at sea level = 1013.2 millibars.

h. In general, rising pressure means fair weather
falling pressure means stormy weather

i. Air pressure gradient controls the velocity of the wind.
closer the isobars, the greater the wind velocity

j. velocity = speed

k. As air pressure increases, the air temperature increases
   i. Closer, hit each other more, more heat

l. As air pressure decreases, the air temperature decreases
   i. Farther, don't hit each other, less heat

IV. Humidity- the amount of moisture in the air.

a. water vapor is water as a gas.

b. It is an important factor because this is where all the water comes from to form clouds and precipitation.

c. There are two ways to express humidity:
   i. Absolute humidity is the number of grams of water vapor in 1 cubic meter of air. This is seldom directly measured.
   ii. Relative humidity is the percent of water vapor the air is holding compared to the maximum.
      1. (The air is holding __% of the water vapor that it can hold.)

d. * Warm air can hold more water vapor.

e. * Cold air can hold less water vapor.

f. 100 relative humidity = rain or fog

g. 0 relative humidity = desert

h. Relative humidity can be calculated by using a Sling Psychrometer
   i. Wet bulb measures temp. of evaporation
   ii. Dry bulb measures air temperature

i. SKILL: You need to be able to determine the relative humidity by using information on a sling psychrometer.

j. Dew Point a temp. at which water vapor condenses

k. Dew Point a temp. at which dew forms

l. Water vapor is lighter than the other gassen in our atmosphere.

m. The higher the humidity, the lower the air pressure.

i. Increase water vapor, lower weight molecules push out heavier molecules, lower pressure

n. The lower the humidity, the greater the air pressure.

o. Warm air can hold more water vapor.

p. Cold air can hold less water vapor.

q. If the temperature increases, the relative humidity will decrease
   i. Hotter, has the capacity to hold more, % decreases.

r. If the temperature decreases, the relative humidity will increase
   i. Hotter, less capacity to hold, % increases.

s. * As air temp. approaches the dew point, precipitation is more likely.

t. SKILL: You need to be able to determine the dew point by using information on a sling psychrometer.

V. Air movements

a. Air in the atm. circulates because of density differences.
   i. unequal heating,
   ii. density differences

b. air currents are vertical movements of air.

c. ~~Wind~~ - horizontal

d. Wind is described by both air velocity and direction.

e. A wind is named for the direction from which it blows

f. A wind vane is a pointer that shows the direction.

g. An anemometer is an instrument that measures wind speed.

h. Circulation of air is affected by the E's rotation.

VI. Atmospheric transparency

a. All of the gases in our atmosphere are transparent.

b. There are many substances that become suspended in the atmosphere which are not transparent: fog, snow, rain, dust

c. visibility is the horizontal distance through which the eye can distinguish objects in miles.

d. Cloud cover is the fraction of the sky that is blocked by the clouds.

VII. Weather Stations

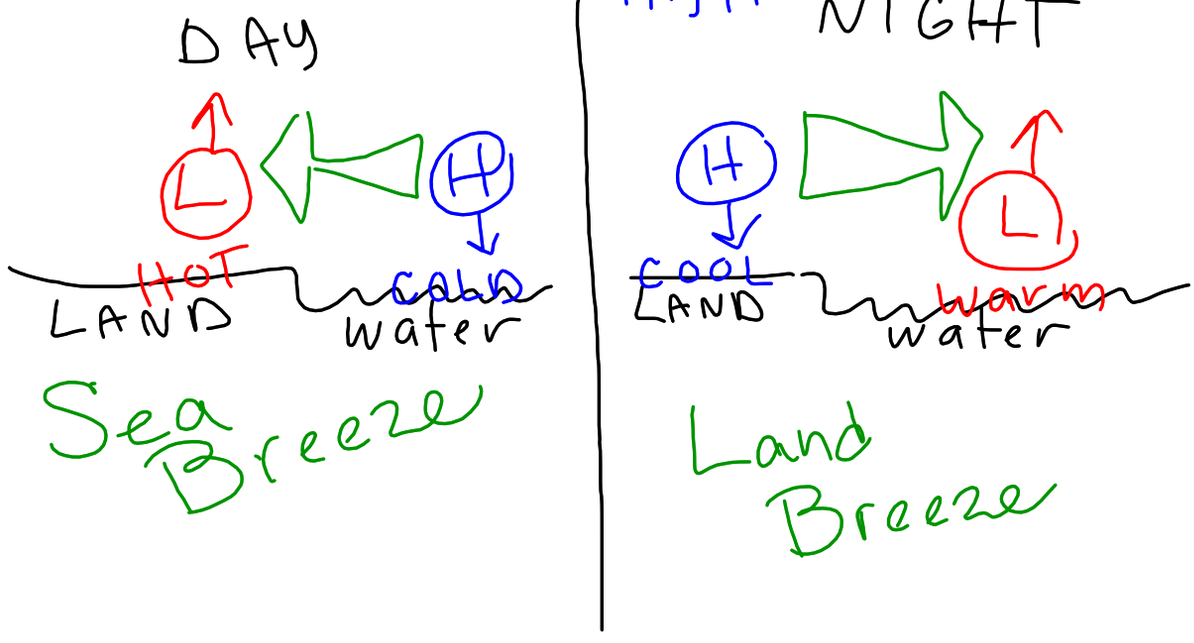
a. SKILL: Know how to read weather stations.

- Fill in the following data from the sample weather station.

Wind direction: ~~E~~ ~~ASD~~
Wind speed: 15 Knots
Temperature: 44°F
Dew point: 42°F
amount of precip: .15 inches
barometric pressure: ~~1~~234 mb
cloud cover: 50%

VIII. Air pressure and winds.

a. Winds blow from High to Low Pressure



IX. Global Winds/ Planetary Winds

a. Air currents are made from rising warm air and sinking cold air around the Earth.

b. Global/Planetary winds are created by convection currents and the rotation of the Earth.

c. Coriolis Effect is the curving path of winds because of the Earth's rotation.

- ***i.*** deflected to right in N. Hemisphere
- ***ii.*** deflected to left in S. Hemisphere

X. Cloud and Precipitation Formation.

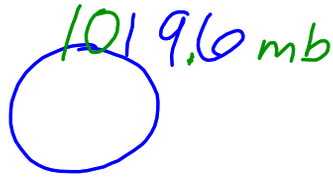
a. Clouds and precipitation are formed when air is cooled to dewpoint. and water vapor condenses forming clouds or ice crystals.

b. Fog = cloud at ground level

c. Precipitation cleans the air

d. 3 Things to make a cloud.

1. Water Vapor
2. Cool temps.
3. condensation nuclei (smoke, dust)



976.8 mb

0 - 499

1) write a 10 in front
2) write a decimal before last #
3) mb

500 - 999

1) write a 9 in front
2) put decimal
3) mb

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Unit 4 Weather Forecasting Notes
Earth Science

A. Synoptic forecasting is based on looking at a summary of the total weather picture at a particular time.

- A Synoptic weather map is made by measuring atmospheric weather variables at thousands of weather stations around the world 4 times a day.

B. A Field is a region of space that has a measurable quantity at every point.

- Field maps that measure elevation are called topographic
- Contour lines connect points of equal elevation.
- Some field maps measure temperature. Lines that connect points of equal temperature are called isotherms.
- Some field maps measure air pressure. Lines that connect points of equal pressure are called isobars.
- isolines is a generic term that means a line that connects points of equal values on a field map. Isolines can measure anything.

C. Air Masses are large regions of air with fairly uniform characteristics like temperature, humidity, winds, and air pressure.

- Air masses are identified by the temp. and the moisture content:
  - Polar – over cold areas Maritime – over water, moist
  - Tropical – over warm areas Continental – over land, dry
  - Arctic – over very cold areas frigid
  - mP = moist and cold cP = dry and cold mT = moist and warm
  - cT = dry and warm cA = dry and frigid mA = moist and frigid
- The boundaries between air masses are called frontal boundaries (fronts).
- Are masses are moved by planetary winds.

18.0 180

82.2 822

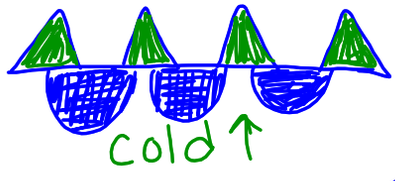
D. Weather Fronts

- There are usually several different air masses moving across the United States.
- When different air masses meet, very little Mixing of air takes place and a sharp transition zone (weather front) forms between them.
- When the different air masses meet there is a rapid change and the weather is unsettled and rainy.
- There are four main types of frontal boundaries:

1. COLD Fronts occur when cold air moves in on warmer air.

   - The cold air is dense and stays near the ground as it pushes up the warmer air in its way.
   - The warmer air that is pushed up cools. It can no longer hold as much water vapor and heavy Precipitation occurs.

2. WARM Fronts occur when a warm air mass runs into a cold air mass.
   - The warmer air is forced up and it cools. It can no longer hold as much water vapor and heavy Precipitation occurs.

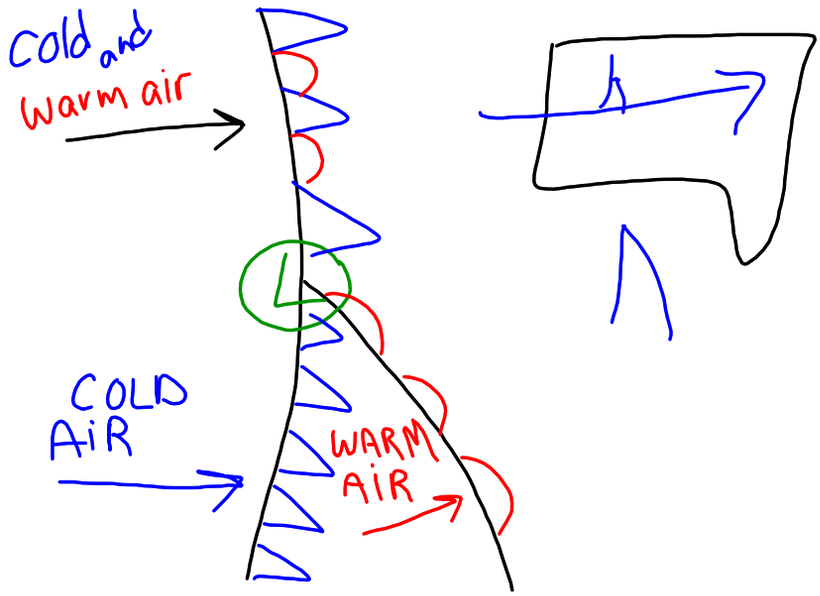


3. Stationary Fronts occur along the boundary between a warm air mass and a cold air mass when neither move.
   1. The warm air will eventually move on top of the cold and there will be Precipitation for days until a new front moves in.

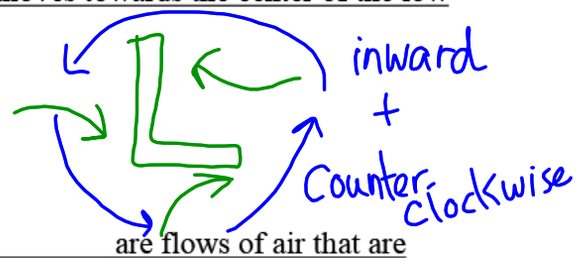
4. Occluded fronts occur when a cold air mass runs into another cold air mass (a warm air mass might be stuck between them).

   1. Since cold air masses are more dense the travel faster.
   2. Large scale Precipitation can occur.

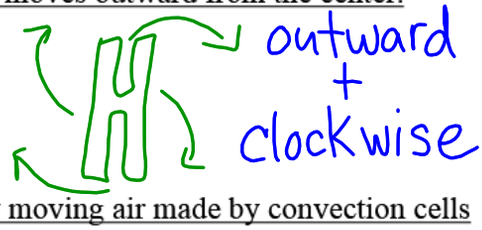
TYPICAL Low Pressure System



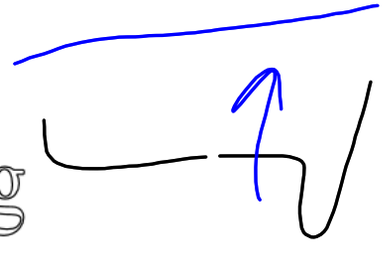
E Low Pressure Systems (Cyclones) are flows of air that are counter clockwise that move in a curved path. The air moves towards the center of the low pressure.



F High Pressure (Anti-cyclones) are flows of air that are clockwise that move in a curved path. The air moves outward from the center.



G Jet Streams are bands of easterly moving air made by convection cells within the atmosphere. The winds can blow up to 200 mph. Jet streams help steer weather patterns across our continent.



II. Weather Forecasting

- Synoptic weather forecasting using charts, maps, and computers.
- Statistical weather forecasting by looking at past weather.
- Weather patterns become evident when weather variables are observed, measured, and recorded.
- Atmospheric moisture, temperature and pressure distributions, jet streams, wind, air masses, and frontal boundaries, and the movement of cyclonic systems and associated tornadoes, thunderstorms, and hurricanes occur in observable Patterns
- RADAR is Radio Detection And Ranging bounces electromagnetic energy off of clouds to get images on a computer.
- Doppler RADAR is a special type of radar that gives accurate readings and is able to determine the conditions necessary for tornadoes.
- Satellite images show the position of clouds and storms as they travel over the earth.

III. Energy in the Atmosphere

- Earth's systems have internal and external heat engines, which create heat.
  - Internal: friction, radioactivity, heat left over from formation.
  - External: SUN
- Weather results from the heating of the atmosphere from the sun.

- The transfer of energy from the atmosphere, hydrosphere, and the Earth's interior results in the formation of regions with different densities.
- Density differences between regions results in motion of air and weather.

IV. Hazardous Weather

- Loss of property, personal injury, and loss of life can be reduced by effective emergency preparedness.
- Thunderstorms - updrafts and downdrafts of air occur because of unequal heating.
  - Strong up and down drafts keep water droplets up in the air longer. Because of the up and down movements electrical charges build up.
  - Sparks are given off in the form of lightning.

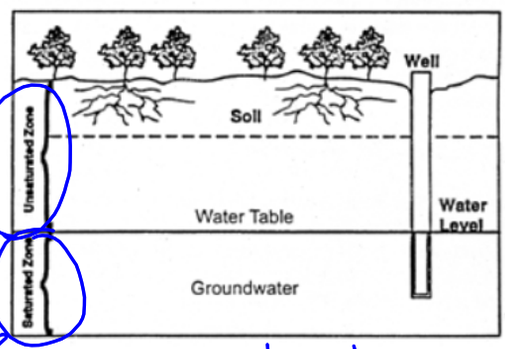
- Tornadoes are small, brief disturbances that usually develop over land from intense thunderstorms (from hot/wet air mixing with cold/dry air).
  - Narrow – 100 feet in diameter, can last up to an hour, wind speeds up to 320 mph
  - Go into basement, cover head + body, stay away from windows
  - Occur in the Spring and Summer in the plains and in the SE.
- Hurricanes regions of very low pressure, cyclones, that form over open water, huge swirling wind mass.
  - Lose energy as they travel over land.
  - Have high winds 74 mph or more, storm surges, causes massive flooding
  - Occur from June to Nov along the SE coastlines.
  - Evacuate, have an emergency kit ready.

Name _____ Unit 5 Climate
Period _____ Date _____ Earth Science

I. The Water Cycle

a. Also called the hydrologic cycle
b. It is the recycling of water between the atmosphere and lithosphere
c. The Earth has a limited supply of water.
d. Approximately 75% of the Earth's surface is covered with water (salt water).
e. The amount of precipitation that seeps into the ground or runs off is influenced by: slope of land, pore space in soil, frozen ground, rate of precipitation
f. Precipitation returns water to the land and oceans.
g. evaporation returns water to the atmosphere.
h. transpiration is the evaporation of water from vegetation, this also returns water into the atmosphere.
i. Infiltration is water soaking into the ground, moving downward
   i. This water becomes stored in the soil as groundwater
j. Run off is water running along the E's surface
k. groundwater is water below the water table.
l. Ground water is filtered as it moves through the rocks
m. Groundwater Zones

Diagram 1
Groundwater Zones



dry ← level of water underground

II. Factors Affecting Water Movement

a. The slope of the land
   i. The steeper the slope, the greater the runoff.
b. The degree of saturation
   i. The more saturated the land, the less infiltration.
c. Porosity - is the percentage of pore space (pores/cracks) in a material compared to its total volume.
   i. The greater the porosity, the greater the infiltration

ii. These things affect porosity:
1. shape - well-rounded particles have more porosity than angular or plate-shaped particles.
2. Packing - the more closely packed the particles, the less the porosity.
3. Sorting - If all the particles in a material are about the same size, they are said to be sorted. The more sorted the particles, the greater the porosity.

d. Permeability is the ability of a material to allow fluids such as water to pass through.
i. This depends on
1. The shape of the pores.
2. How well they are sorted.
3. If the rock is frozen.
4. How well the particles are connected
ii. Impermeable means: fluids can not flow through

e. Capillarity is an attractive fore between water molecules and the soil or rock surrounding it.
i. This works against gravity and moves water upwards to the plant roots.
ii. The smaller the soil/rock particle, the greater the capillarity.

f. Vegetation are the plants, shrubs, trees and grass growing on the ground.
i. The more the vegetation, the more the infiltration.

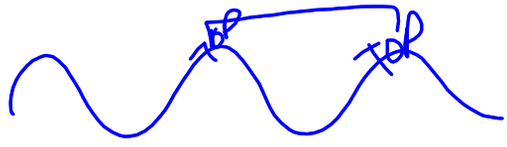
g. Land Use is how the land is used by people.
i. Roads, parking lots and buildings cover the ground and water cannot infiltrate

III. Runoff and Stream Discharge

a. Surface runoff can occur when:
i. The rate of precipitation exceeds the permeability rate.
ii. The pore spaces of loose material or rock is already filled with water. Saturated
iii. The slope of the surface is too great to allow infiltration to occur.
iv. The water on the surface has not infiltrated
b. Most runoff will eventually flow into a stream.
c. The greater the runoff, the greater the amount of stream discharge.
d. Stream discharge is the volume of water flowing past a certain spot in a stream in a specific amount of time (cubic meters a second)
e. Flooding occurs when:
i. A stream overflows from its normal channel.
ii. When the rate of precipitation exceeds the rate of infiltration.
iii. There is storm surge from a hurricane.
iv. Coastal Storms

v. Rising sea level or sinking land
vi. Tides moving water onto the land

f. Flooding Safety:
move to higher ground.



IV. Insolation means
incoming solar radiation

a. It means the same thing as
sunshine, electromagnetic radiation.
b. It is the sun's electromagnetic energy that reaches the Earth.
c. This type of energy has relative short wavelengths and is called short-wave.
d. Energy from insolation is transferred to the atmosphere and the Earth's lithosphere
   i. This energy transfer in influenced by
   cloud cover, E's rotation. mountain ranges, proximity to oceans.
e. See the Electromagnetic Spectrum Chart on page 14 of your ESRT.

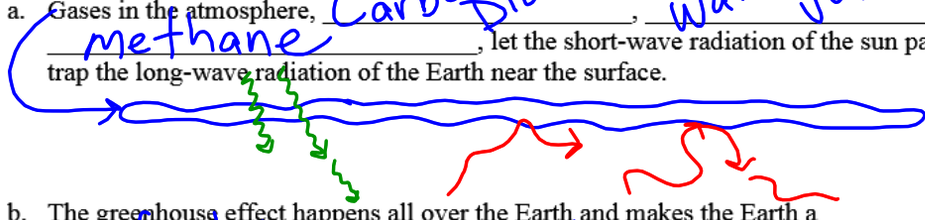
V. Intensity of Insolation (strength of sunlight) depends on the following:
a. The ANGLE of the Sun in the SKY
   i. The more perpendicular the sun is to the Earth (the higher it is the sky, the greater angle above the horizon), the hotter it will be.
      1. The angle of the sun in the sky changes E's Rotation
      2. The position of the sun in our sky changes with the seasons.
   ii. Duration of insolation is the length of time that the sun appears in the sky
      1. The longer the duration of insolation, the greater the temp.
      2. We (in the Northern Hemisphere) have the greatest duration of insolation on June 21st (ish).
      3. We (in the Northern Hemisphere) have the least duration of insolation on Dec 21st (ish).
   iii. Absorption of Insolation
      1. Higher energy radiations (gamma, x…) are absorbed by ozone, carbon dioxide and water vapor in the atm.
      2. visible light readily penetrates the Earth's surface.
      3. At the surface visible light is scattered, reflected, and refracted.
      4. Water heats up (and cool down) slower than and does because:
         a. Water has a higher specific heat.
            i. specific heat is the amount of energy it takes to raise one cubic centimeter one degree of Celsius.

b. Water reflects more light.
c. Since light can penetrate into a depth of water, it is heating a greater volume of water than it would of land.

iv. Reflection of Insolation
1. Clouds reflect 20-25 % of insolation.
2. Clouds can also absorb 15-30 % of insolation.
3. The lower the angle of insolation (the lower the sun is in the sky), the greater the reflection.
4. More reflection occurs when the land is light in color or covered by snow or ice.

VI. Terrestrial Radiation
a. the energy that the Earth gives off.
b. The part of the Earth that has sunlight receives more energy than it gives off.
c. The part of the Earth that has night time, gives off more energy.
d. This type of energy given off from the Earth has relatively long wavelengths.
e. It is called long-wave radiation.

VII. Greenhouse Effect
a. Gases in the atmosphere, Carbon Dioxide, water vapor, methane, let the short-wave radiation of the sun pass through but trap the long-wave radiation of the Earth near the surface.



b. The greenhouse effect happens all over the Earth and makes the Earth a comfortable place to live
c. Scientists believe that there is too much CO2 in the atmosphere and that the temperature on earth will become higher. This is called: global warming & climate change
d. Why would there be too much Carbon Dioxide in the atmosphere? burning fossil fuels, deforestation

VIII. Climate
a. What is climate? atm. conditions over a large area & a long time.
b. Climate can be classified by looking at the temperature and the amount of precipitation (The amount of water is coming down to Earth compared to the amount of water going back up into the atmosphere.)
c. The average temperature on Earth is the result of the total amount of insolation absorbed and the amount of long-wave radiation radiating back out into space.
d. Global climate is effected by the interaction of Solar energy with the Earth's surface and atmosphere.
e. The seasons are: opposite in the Southern Hemisphere
f. Oceans have a moderating effect on the climate.
i. The summers are cooler.
ii. The winters are warmer.
iii. Why does this happen? Water has a higher specific heat.

IX. Factors Affecting Climate
a. Latitude and Climate

i. Lower latitudes have higher temps.

ii. Lower latitudes have a lower yearly range in temp.

iii. Lower latitudes have a lower daily range in temp.

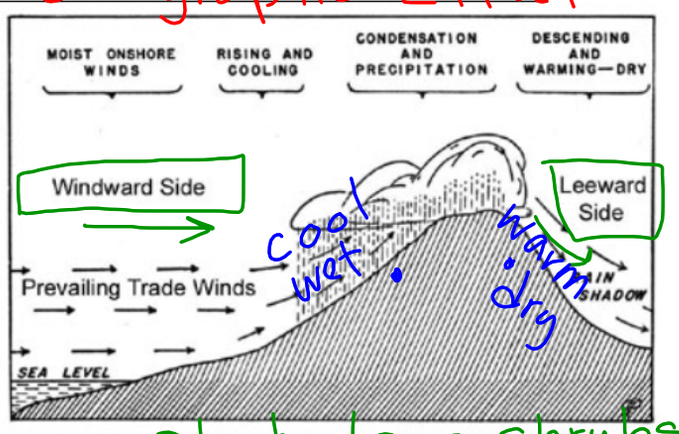
b. Large Bodies of Water influence the climate
   i. If a landmass is near a body of water its temperature will be moderated by the slow heating and cooling of water.
      1. Water stays cooler longer (in the spring) so the land near it will be cooler.
      2. Water stays warmer longer (in the Fall) so the land near it will be cooler.

c. Prevailing Winds
   i. Prevailing winds are movements of air over the Earth's surface that blow in the same direction most of the time.
   ii. Make weather systems move from the West to the East across the U.S.
   iii. The West Coast (California, Oregon and Washington) has a more marine climate because they get wind coming from the ocean.
   iv. These winds make us get lake effect snow coming from Lake Ontario and Lake Erie.
   v. Also causes warm southern air to come our way in the summer.
   vi. Monsoons are the weather changes caused by the seasonal shifts as the prevailing winds shift with the seasons. They are usually associated with the wet, warm summers in Asia.

d. Surface Ocean Currents
   i. Surface ocean currents flowing away from the equator carry warm water and air to higher latitudes.

e. Elevation above sea level
   i. Higher elevations have lower temperatures
   ii. Higher elevations have a greater chance of precipitation

f. Mountains can change the climate by affecting the wind patterns.
   i. Orographic Effect



   ii. Vegetation plants, trees, shrubs

1. When rainforests are cut down, there is less water transpiring into the atmosphere and the area become warmer and drier.

iii. Cloud Cover

1. Areas with a lot of clouds (like the Equator) are cooler than areas without a lot of clouds (like the deserts at about 30 degrees latitude).

X. Climate and Change

a. Periods of warmer and cooler temperatures suggest that the Earth had climate changes in the past that were probably caused by long periods of heating imbalances.

b. Average temperatures may have been significantly warmer at times in the distant past.

c. Throughout geologic time, ice ages occurred in the middle latitudes.

d. Human influences have changed our climate: deforestation, urbanization, burning fossil fuels.

XI. Energy and Climate

a. The Earth may be considered to be a huge machine that is driven by two engines.

i. An internal heat engine: radioactivity, friction, left over heat

ii. An external heat engine: sun

b. Both heat engines convert heat energy into radient energy.

c. Energy is transferred between the Earth's surface and atmosphere by:

i. Radiation
ii. Conduction
iii. Convection

movement of energy

iv. Evaporation – liquid to a gas, absorbs heat

v. Condensation

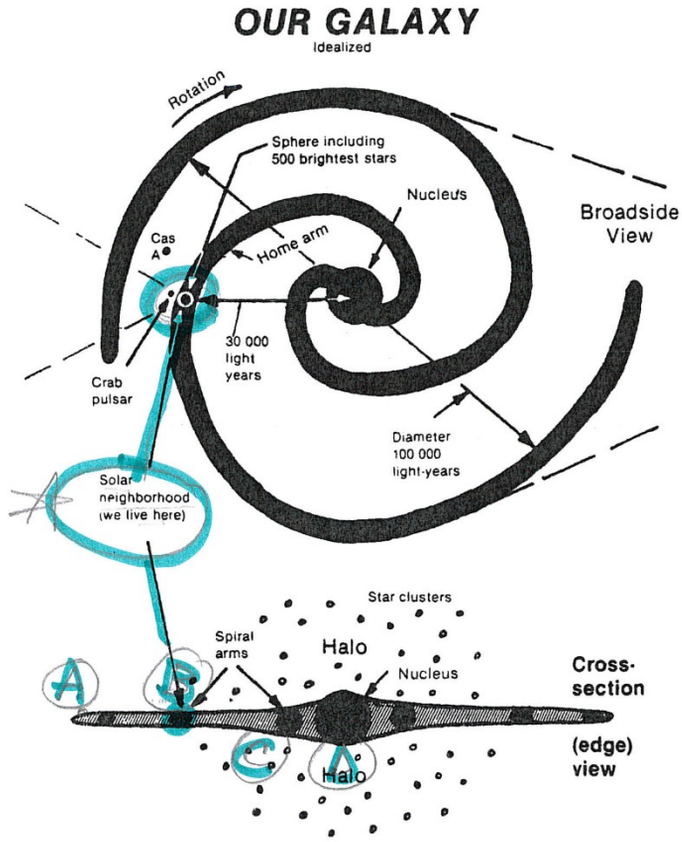
gas to liquid, gives off heat

space

solid

water

air



http://pics-about-space.com/galaxy-and-planets-sketch?p=1#

III. Stars

a. A star is a large ball of gas held together by gravity that produces tremendous amounts of energy and shines.

b. Most of the energy of stars comes from nuclear fusion.

i. nuclear fusion is the combining of the nuclei of smaller elements for form the nuclei of larger elements with some of the mass being converted into energy.

1. The sun converts Hydrogen into Helium.

ii. The Energy of nuclear fusion is eventually radiated into space as types of electromagnetic energy.

iii. Luminosity a measurement of energy/brightness of a star in relation to the Sun if they were the same distance away

Name Weiler

Date _____ Period _____

Unit 5 Astronomy

Earth Science

I. Origin and Age of the Universe

a. The universe anything that exists in any place (includes: space, matter, energy)

b. It is extremely vast (large). It is over 14 billion years old.

c. The Big Bang Theory says the Universe started from a small area that exploded and is still moving outward.

(2)

i. The universe is still expanding today

ii. Evidence of the Big Bang Theory

1. There is microwave radiation (background) from the explosion coming from all areas.
2. The apparent red shift of most galaxies

a. The Doppler effect is the shifting of wavelengths as an object passes. blue - has shorter wavelengths and the object is coming towards you. Red - has longer wavelengths and is moving away.

II. Galaxies

a. Galaxies are collections of billions of stars, gas and dust held together by gravity.

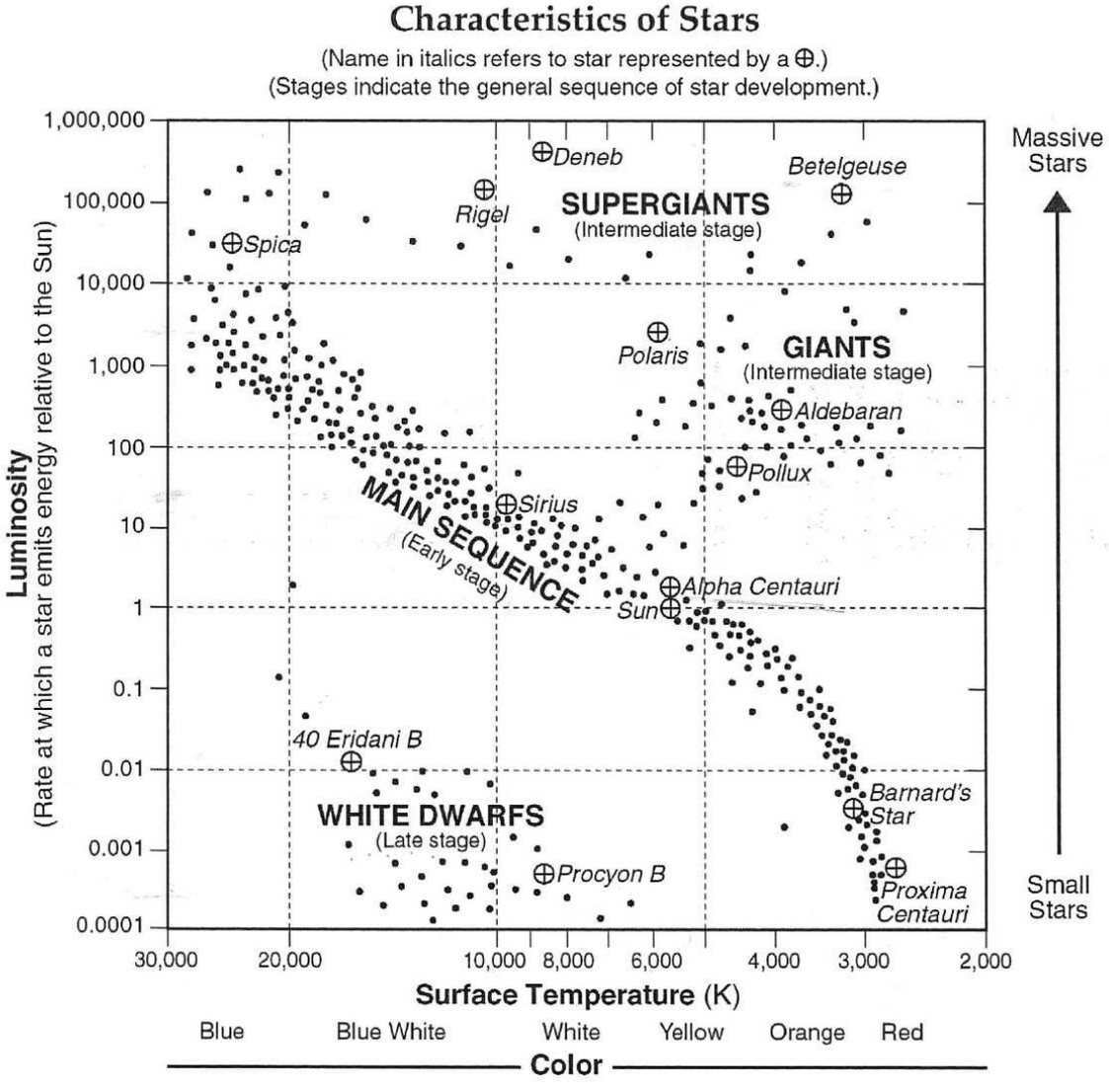
b. An average galaxy has over 100 billion stars and there are over 100 billion galaxies.

c. There are three types of galaxies based on shape:

i. spiral ii. elliptical (oval) III. irregular

d. Our solar system is part of the Milky Way Galaxy

i. It is a spiral galaxy and we are located in one of the arms.



c. **Star Types**

i. Main Sequence are 90% of stars.

1. average sized stars

2. As the size increases, the temperature increases.

3. As the size increases, the color changes from red to blue.

4. Our Sun is main sequence, yellow, average temp and brightness

ii. Giant Stars

1. really big rare stars, extra bright dying → using up fuel.

a. Have low temperatures because of their large size.

3

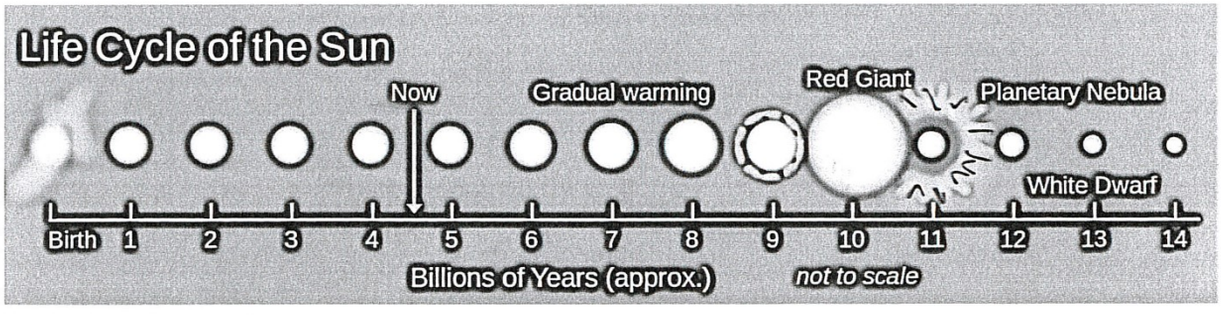
iii. Super Giants stars are very big stars that are very luminous.
   1. They sometimes explode in a tremendous even called a Super Nova.

iv. White dwarf are small, about the size of the Earth.
   1. They can be other colors besides white.
   2. They are the last luminous stage (shining)
   3. They are hot on the surface and low in luminosity

v. Black dwarfs happen when a white dwarf cools and no longer emits electromagnetic radiation
   1. They are dead stars.

IV. Star Origin and Evolution

a. Stars have an evolution (life-cycle)
b. Stars originate from clouds of gas and dust molecules left over from the bang big bang
c. Gravity causes the stars to clump together (forming stars).
d. When the mass is high enough, nuclear fusion starts and the star begins to shine.
e. Most of the "life" of a star is as a main sequence star.
f. Several things can happen once the star has spent its energy (depending on size



https://en.wikipedia.org/wiki/Formation_and_evolution_of_the_Solar_System

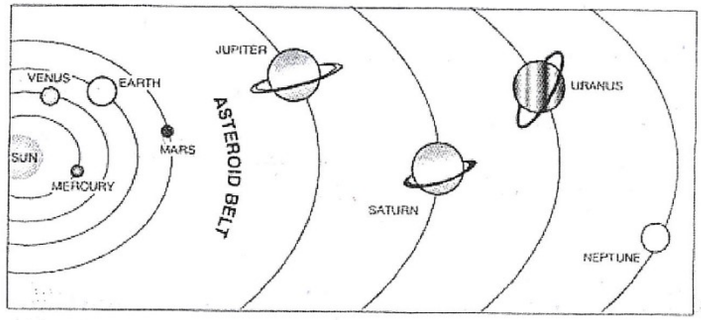
i. Stars with masses similar to the Sun's mass
become red giants, white dwarfs, black dwarfs

ii. Stars with masses greater than the Sun's mass
become Super Giants, super nova, neutron stars

iii. Stars that are extremely massive
become large Super Giants and then collapse into being a black hole
   1. Black holes are extreme gravity fields that allow no visible light or energy to escape

4

V. **Solar System** http://cdn.yourarticlelibrary.com/wp-content/uploads/2013/11/image5.png



Solar system showing inner and outer planets.

a. The Solar System is
the Sun and all the objects that orbit the sun under its gravitational influence

b. 99 of the mass in the solar system belongs to the sun

c. A satellite is
any object that orbits (revolves around) another object

d. There are 8 planets that orbit the Sun.

e. An asteroid
is a solid rocky/metallic body that orbits the sun
   i. Have irregular shapes
   ii. There is a known asteroid belt between Mars and Jupiter.
   iii. Are smaller than planets.

f. A moon is
a body that orbits a planet or an asteroid
   i. There are over 63 known moons in our solar system.
   http://ssd.jpl.nasa.gov/?sat_discovery

g. A comet is
often compared to a dirty snowball. Composed of solids that turn into gases.
   i. They are made of substances like ice and water
   ii. When comets get near the sun, their ice turn to gas.
   iii. Some solids are released – forming spectacular tails visible in the Earth's sky.

h. Meteoroids are very small fragments that orbit the sun.
   i. Most are very small.
   ii. They leave a visual streak in the sky when they enter the atmosphere and are called meteors.
   iii. If it actually touches the Earth's surface it is then called a meteorite.
   iv. impact craters are depressions in the E's crust

5

i. Evolution of the Solar System

i. Scientists think that
Our solar system started to form ~5 billion years ago

ii. Everything formed from a giant could of gas and dust that condensed into a star and several planets.

iii. Planets and moons have experienced impact events.

1. impact events happen when meteoroids, asteroids and comets crash onto the surfaces of planets and moons.

VI. Planet Characteristics

a. A planet's distance from the sun has a major effect on its characteristics

b. Inner Planets (terrestrial) are like Earth, close to Sun

i. Have relatively small diameters.

ii. Have relatively high densities.

iii. rocky surfaces with impacter craters

iv. Have few or no moons.

v. have no rings.

vi. similar to Earth
mercury, Venus, Earth and Mars

c. Outer Planets (Jovian) are like Jupiter, far from sun.

i. Have relatively large diameters.

ii. Have relatively small densities.

iii. have no solid surfaces.

iv. Have many moons.

v. Have many rings

vi. similar to Jupiter.

vii. Jupiter, Saturn, Uranus, Neptune

year day O-circle

Solar System Data

Celestial Object	Mean Distance from Sun (million km)	Period of Revolution (d=days) (y=years)	Period of Rotation at Equator	Eccentricity of Orbit	Equatorial Diameter (km)	Mass (Earth = 1)	Density (g/cm³)
SUN	—	—	27 d	—	1,392,000	333,000.00	1.4
MERCURY	57.9	88 d	59 d	0.206	4,879	0.06	5.4
VENUS	108.2	224.7 d	243 d	0.007	12,104	0.82	5.2
EARTH	149.6	365.26 d	23 h 56 min 4 s	0.017	12,756	1.00	5.5
MARS	227.9	687 d	24 h 37 min 23 s	0.093	6,794	0.11	3.9
JUPITER	778.4	11.9 y	9 h 50 min 30 s	0.048	142,984	317.83	1.3
SATURN	1,426.7	29.5 y	10 h 14 min	0.054	120,536	95.16	0.7
URANUS	2,871.0	84.0 y	17 h 14 min	0.047	51,118	14.54	1.3
NEPTUNE	4,498.3	164.8 y	16 h	0.009	49,528	17.15	1.8
EARTH'S MOON	149.6 (0.386 from Earth)	27.3 d	27.3 d	0.055	3,476	0.01	3.3

6

i. Have relatively _____ diameters.
ii. Have relatively _____ densities.
iii. _____.
iv. Have many moons.
v. Have many rings
vi. _____.
vii. _____
_____

Solar System Data

Celestial Object	Mean Distance from Sun (million km)	Period of Revolution (d=days) (y=years)	Period of Rotation at Equator	Eccentricity of Orbit	Equatorial Diameter (km)	Mass (Earth = 1)	Density (g/cm^3)
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VII. Planet Rotation

a. Rotation is _____.
b. The Period of Rotation is
_____
_____.

VIII. Planet Revolution

a. Revolution is
_____
_____
_____
b. An Ellipse is
_____.
i. Within the ellipse are two fixed points called _____.
ii. The sun is ate one foci and
_____
_____.
c. Eccentricity is
_____.
i. You can calculate the eccentricity of an ellipse.
ii. If the eccentricity equals 0
_____.

VII. Planet Rotation

a. Rotation is Spinning on an imaginary axis.

b. The Period of Rotation is the amount of time for a planet to rotate (spin) 360°.

VIII. Planet Revolution

a. Revolution is the movement around the Sun in a path in a shape of an Ellipse.

b. An Ellipse is the oval shape of a planet's orbit.

i. Within the ellipse are two fixed points called foci.

ii. The sun is at one foci and nothing is at the other foci.

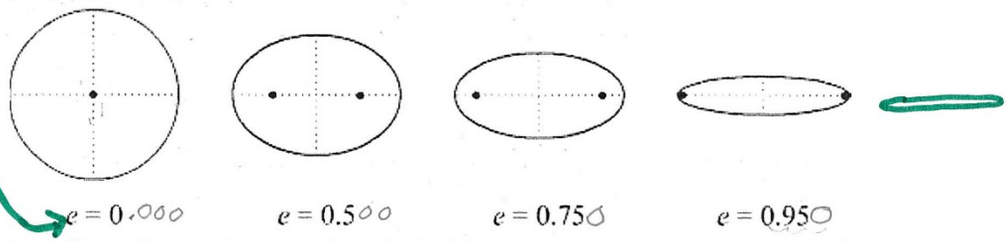
c. Eccentricity is the degree of ovalness of an ellipse.

i. You can calculate the eccentricity of an ellipse.

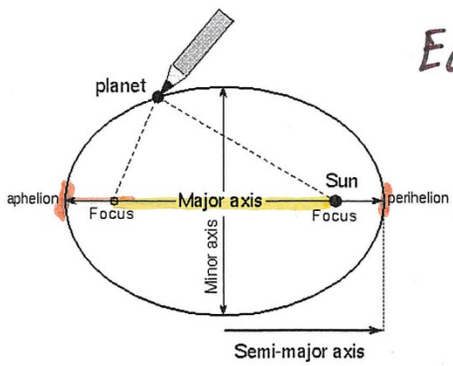
ii. If the eccentricity equals 0 the orbit is a perfect circle.

iii. If the eccentricity equals 1 the orbit is a straight line.

$$b^2 = a^2(1 - e^2)$$



https://perseshow.wordpress.com/2014/12/06/14-johannes-kepler-and-planetary-motion/



$$\text{Eccentricity} = \frac{\text{distance between foci}}{\text{length of major axis}}$$

$$= \frac{3.5\ \text{cm}}{5.0\ \text{cm}}$$ Cancel

.700

Drawing an **ellipse**: loop string around thumb tacks at each **focus** and stretch string tight with a pencil while moving the pencil around the tacks. The Sun is at one focus.

http://kaffee.50webs.com/Science/activities/Astro/Activity-Ellipses.Orbits.htm

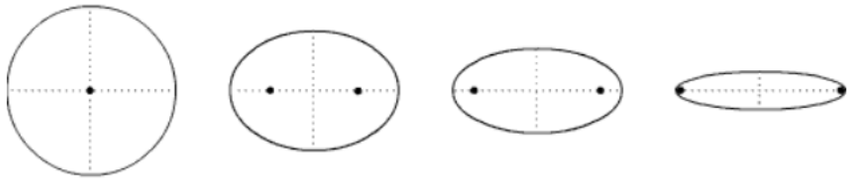
000'C

7

iii. If the eccentricity equals 1

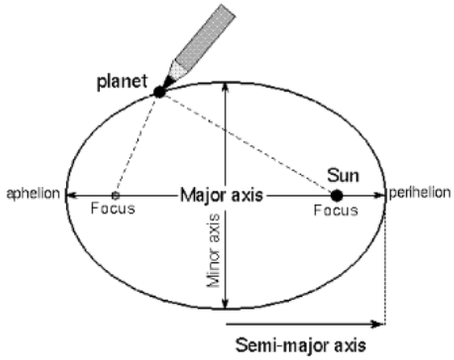
_____.

$$b^2 = a^2(1 - e^2)$$



$e = 0$ $e = 0.5$ $e = 0.75$ $e = 0.95$

https://perseshow.wordpress.com/2014/12/06/14-johannes-kepler-and-planetary-motion/



Drawing an **ellipse**: loop string around thumb tacks at each **focus** and stretch string tight with a pencil while moving the pencil around the tacks. The Sun is at one focus.

http://kaffee.50webs.com/Science/activities/Astro/Activity-Ellipses.Orbits.htm

iv. The elliptical shape of planetary orbits causes

_____

_____

1. The Earth is closer to the Sun in the

   _____

   _____

   _____

2. The Earth is farther from the Sun in the

   _____

   _____

   _____

3. What causes the seasons?

   _____

   _____

   _____

d. Why doesn't the Earth fly into the Sun because of the Sun's gravity?

iv. The elliptical shape of planetary orbits causes the planets to (change/vary) in distance from the Sun.

1. The Earth is closer to the Sun in the Winter (147,000,000 km) ~January 5th
2. The Earth is farther from the Sun in the Summer (152,000,000 km) ~July 5th
3. What causes the seasons?
   ① tilt of the Earth's axis
   ② revolution of the E. around the Sun.

d. Why doesn't the Earth fly into the Sun because of the Sun's gravity?
   i. Gravity keeps the planet near the Sun while inertia keeps the planet moving.

inertia

1. Inertia is an object in motion will tend to stay in motion
2. Gravity is the attractive force that exists between any two objects in the Universe.
   a. The greater the masses of objects, the greater the gravity
   b. The closer the objects are, the greater the gravity.

revolution

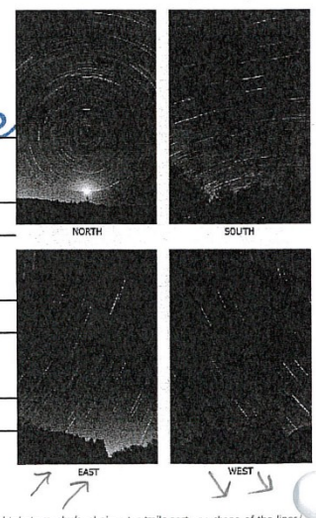
e. The Period of ~~Rotation~~ is the amount of time it takes for a planet to revolve around the Sun.
   i. It is equal to one year on that planet.
   ii. The closer a planet is to the Sun,
      1. The smaller its orbit
      2. The smaller the period of revolution
      3. The shorter its years are.

7+9

4

IX. Apparent Motions of Celestial Objects

a. Apparent motion is a motion that an object appears to make
b. Celestial objects are objects in the sky outside the E.'s atmosphere
c. Celestial sphere is an imaginary sphere encircling the E.
d. An arc is a curved line, part of a circle
e. Most celestial objects appear to move across the sky.
   i. Rising in the EAST.
   ii. Setting in the WEST.



http://www.kadamsphoto.com/nightphotography/analyzing-star-trails-part-one-shape-of-the-lines/

f. All motion appears to move at a constant rate.
   i. 360° in one day, 15° in one hour, 1 degree every 4 minutes

8

g. Circumpolar stars are
STARS THAT COMPLETELY CIRCLE POLARIS (NORTH STAR) EVERY 24 HOURS.

h. Daily motion is
THE MOVEMENT OF CELESTIAL OBJECTS OVER A 24 HOUR PERIOD.

X. Apparent Motions of the Planets

a. As seen from the Earth the planets
EXHIBIT DAILY MOTION SIMILAR TO THAT OF STARS

b. Over extended period of time the planets seem to
CHANGE DIRECTION IN THE SKY.

c. The motions of the planets are not uniform and are COMPLEX.

d. The planets seem to make LOOPS AND BACK-AND-FORTH MOTIONS

XI. Apparent Motions of the Sun

a. Like all other celestial objects THE SUN APPEARS TO MOVE ACROSS THE SKY.

LAB (b.) Its path across the sky is in the shape of an ARC.

c. THE SUN'S PATH CHANGES IN BOTH LENGTH AND DIRECTION WITH THE SEASONS

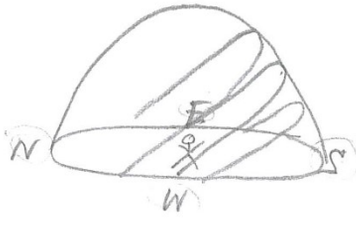
d. Within the continental United States,
   i. The sun is HIGHER in the sky (72 degrees in altitude) in the summer.
   ii. The sun is LOWEST in the sky (28 degrees in altitude) in the winter.
   iii. THE NOON SUN IS NEVER DIRECTLY OVERHEAD.

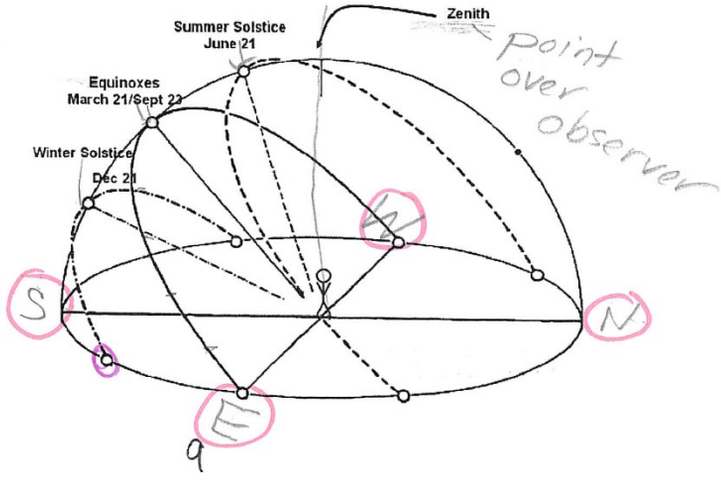
e. The sun is always at its HIGHEST position in the sky at noon.

f. Solar noon is
THE TIME AT WHICH THE SUN REACHES ITS HIGHEST POINT IN THE SKY.

g. Solar time is
TIME BASED ON THE ROTATION OF THE E.

h. THE NOON SUN IS ONLY DIRECTLY OVERHEAD FOR AN OBSERVER WITHIN THE TROPICS.





XII. Geocentric Model of the Solar System

EARTH-CENTERED

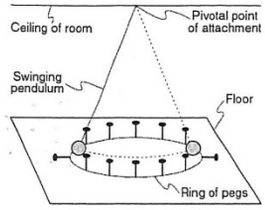
INCORRECT!

XIII. Heliocentric Model of the Solar System

SUN-CENTERED

XIV. Evidence of the Earth's Rotation

a. The Foucault Pendulum



i. WHEN THE PENDULUM IS ALLOWED TO SWING FREELY, ITS PATH WILL APPEAR TO CHANGE

1. This is an evidence of the Earth's rotation because the pendulum (due to inertia) would continue to swing in the original path if the Earth didn't rotate.

b. The Coriolis Effect

i. THE TENDENCY OF ALL PARTICLES OF MATTER AT E's SURFACE TO BE DEFLECTED (CURVED)

1. This deflection occurs because the Earth is rotating and therefore, the Earth's surface is moving with respect to the path of the particles.

XV. Evidence of the Earth's Revolution

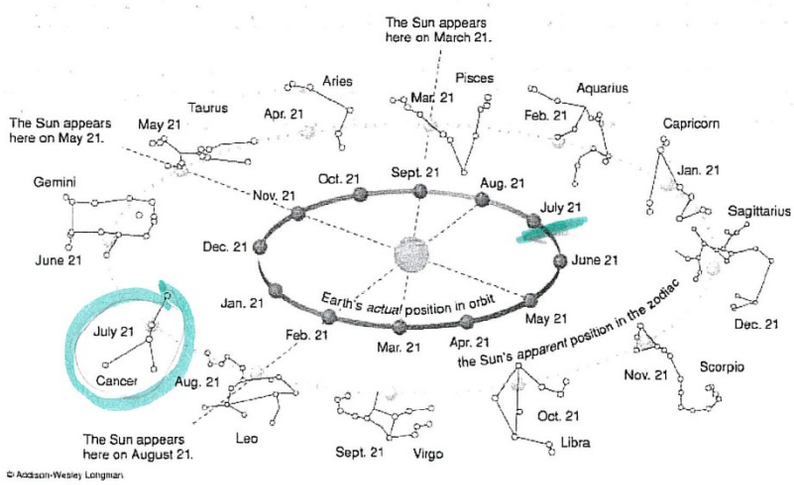
a. THE SEASONS CHANGE

i. Because we REVOLVE around the sun, our two poles (N and S) are tipped towards the sun at different times of the year.

b. WE SEE DIFFERENT CONSTELLATIONS THROUGHOUT YEAR.

i. A constellation is A GROUP OF STARS THAT FORM A PATTERN AND ARE USED TO DETERMINE LOCATION.

ii. We can see



DIFFERENT constellations each season because we are in different parts of the solar system.

10

3. THE ANGULAR DIAMETER OF SUN APPEARS TO CHANGE.
   i. ANGULAR DIAMETER is how big the object appears to be
4. d. SMALL CHANGES IN THE COLOR OF STARS.
   i. RED means we are moving away
   ii. BLUE means we are moving towards.

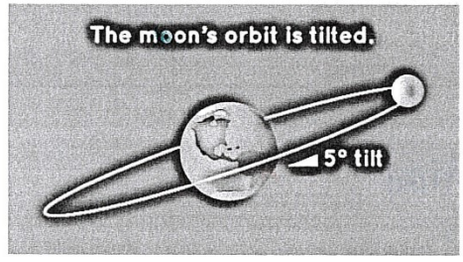
XVI. Actual Motions of the Earth's Moon

a. The REVOLUTION of the moon around the Earth (as the Earth revolves around the sun) results in many common observable events.

b. THE MOON IS TILTED 5° ON ITS AXIS.
THE MOON'S ORBIT IS AN ELLIPSE.

c. The moon orbits the Earth (360 degrees) in 27 1/3 days.

d. The moon returns to its original location in 29 1/3 days. An extra 2 days is needed to catch up to the same spot on the Earth.



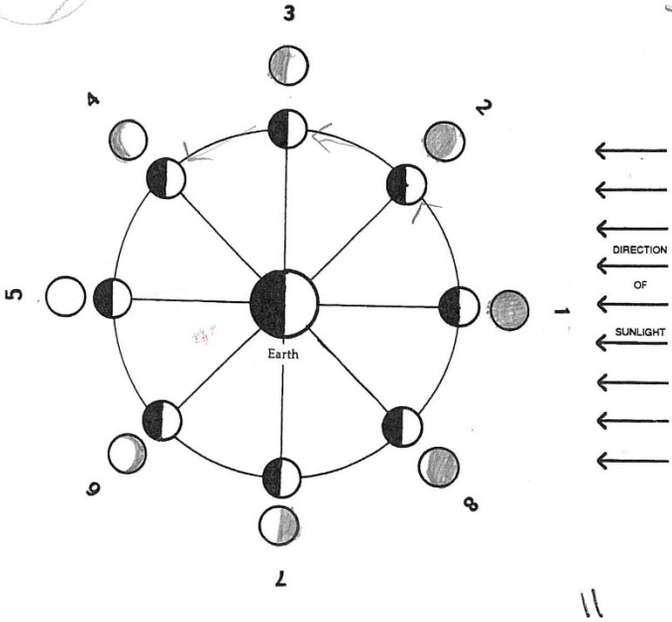
http://www.space.com/31219-moon-mysterious-tilt-solved.html

XVII. Phases of the Moon

a. Definition: THE PARTICULAR APPEARANCE OF THE MOON TO AN OBSERVER.

b. Since the moon revolves around the Earth, an observer on Earth sees VARIOUS AMOUNTS of this lighted-half.

http://kvmagruder.net/bcp/zodiacal/moon/lab.htm



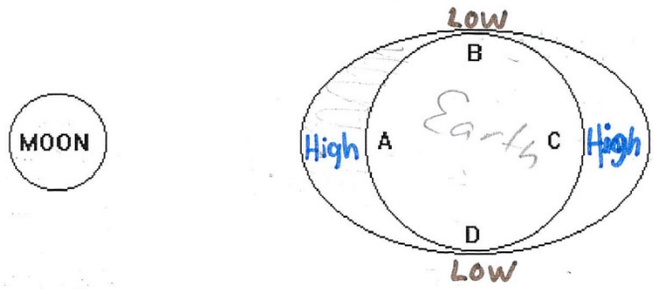
1. NEW
2. WAXING CRESCENT
3. FIRST QUARTER
4. WAXING GIBBOUS
5. FULL
6. WANING GIBBOUS
7. THIRD QUARTER
8. WANING CRESCENT

XVIII. Tides

a. TIDES ARE THE CYCLIC RISE AND FALL OF OCEAN WATER.

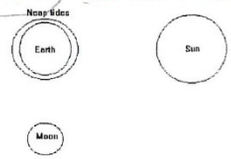
b. They are caused by
THE GRAVITATIONAL ATTRACTION OF THE MOON AND EARTH

c. Ideally, there should be 12 hours and 50 minutes between each high tide.



SPRING - EXTRA HIGH

NEAP - EXTRA LOW



http://www.cmdowns.com/tides-notes.htm

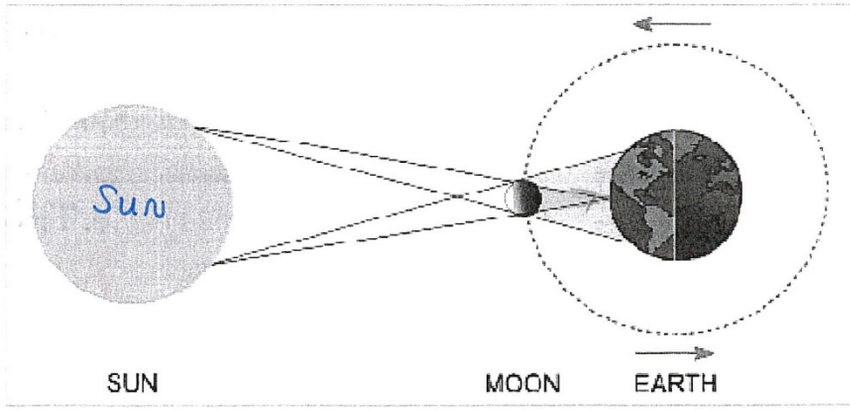
XIX. Eclipses

a. An Eclipse
IS WHEN A CELESTIAL OBJECT PARTLY OR COMPLETELY BLOCKS ANOTHER CELESTIAL OBJECT FROM VIEW

b. A SOLAR ECLIPSE Eclipse occurs when the moon's shadow falls on a small part of the Earth and blocks out the sun.

i. Total eclipses are RARE

1. Once every 200 years
2. It only affects a small part of the Earth since the Moon's shadow is so small.
3. A total eclipse only lasts for 7 1/2 minutes.



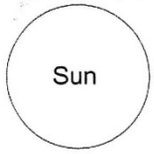
12

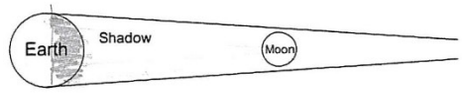
http://www.nightskyinfo.com

c. A LUNAR ECLIPSE IS WHEN THE E's SHADOW COVERS MOON

i. It is more common to observe

1. It happens 2 times a year.
2. A total lunar eclipse will last for over 100 minutes.
3. All the people on the dark- half of the Earth can see the ellipse.

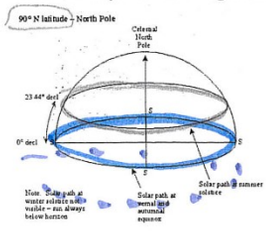


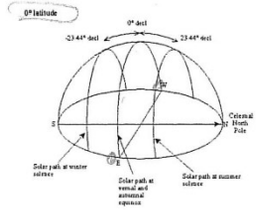


https://commons.wikimedia.org/wiki/File:Lunar_Eclipse_diagram.svg

XX. Seasons

a. The sun's path through the sky changes with the latitude and the season.

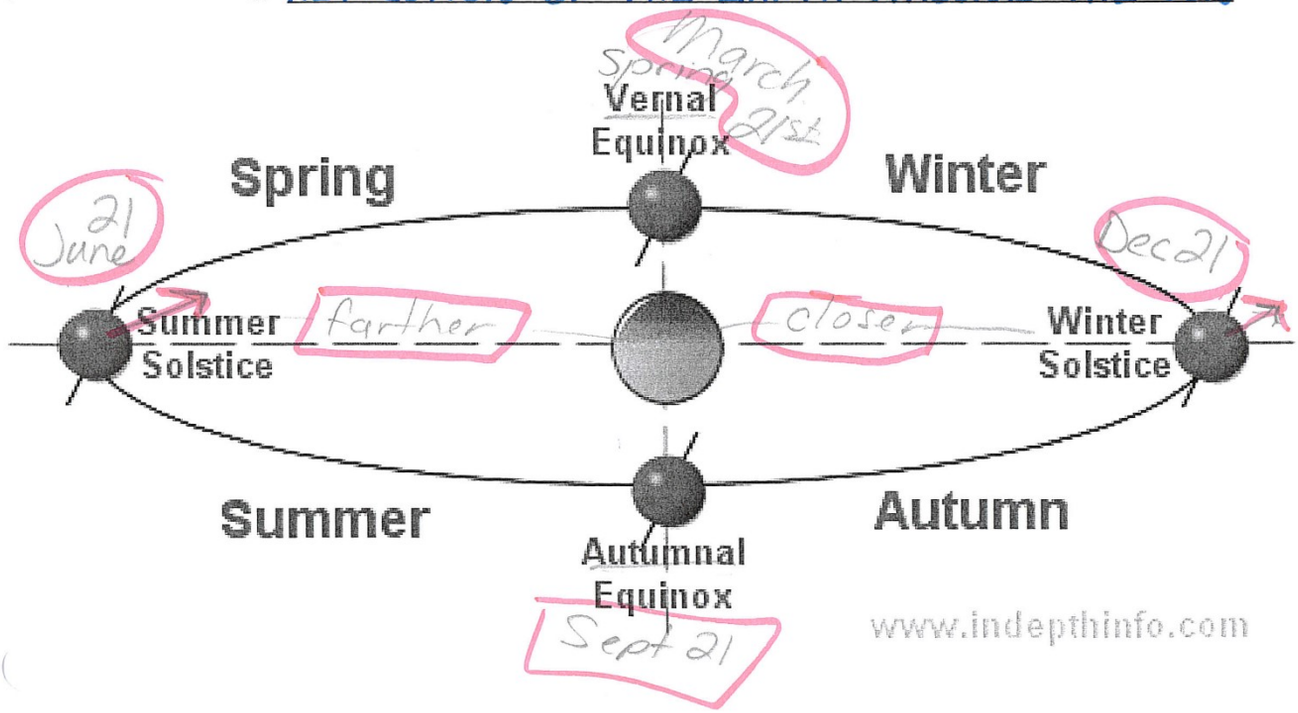




b. There are 2 reasons for the seasons

i. THE TILT OF THE E's [redacted] AXIS

ii. REVOLUTION OF THE EARTH AROUND THE SUN



13

Name _____ Shape and Structure of Earth Notes

Period ___ Date _____ Unit 7

I. Shape of the Earth

a. A model is a representation of an object or a natural event. It acts like the real thing but doesn't have to look like it.

b. The shape of the Earth is an oblate spheroid

i. That means the Earth is flattened at the poles and bulges slightly at the equator.

c. Even though the Earth is an oblate spheroid, it is very close to being a perfect sphere.

i. so close, the E looks like a perfect sphere to your eyes.

d. The Earth is oblate as a result of forces produced by the Earth's rotation.

e. rotation - spinning on an axis.

f. axis - immaginary line ground which the Earth spins

g. The Earth is very smooth compared to it's size.

II. Evidence of the Earth's Shape:

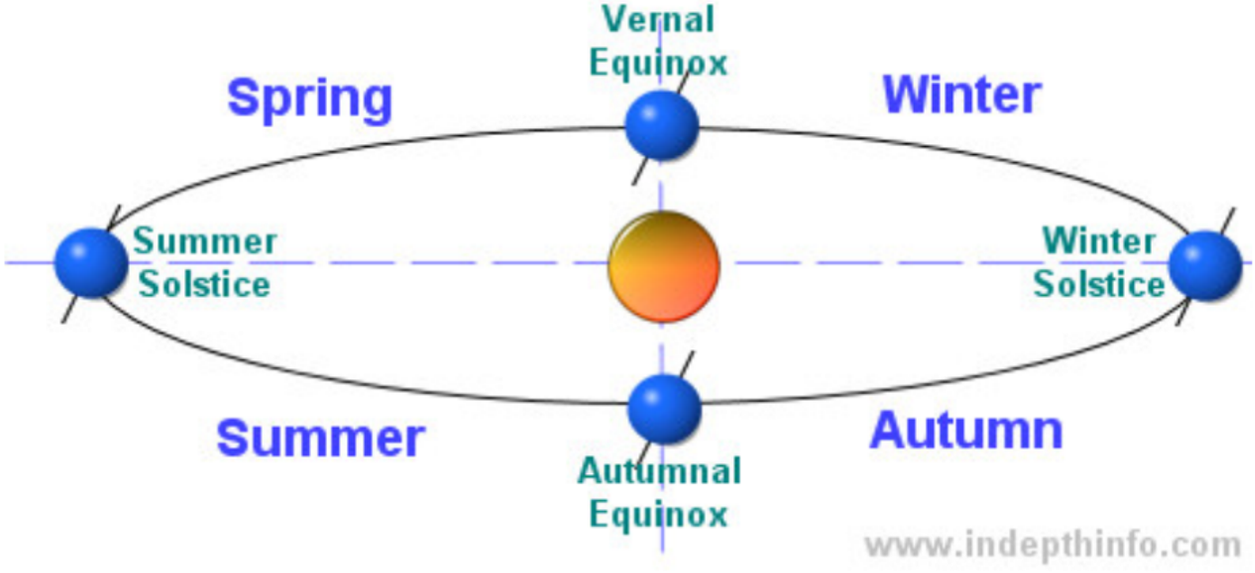
1

a. First Evidence:

i. Aristotle was one of the first people to believe that the Earth was round.

ii. He noticed that the Earth's shadow was round as it covered the moon during a lunar eclipse.

b. Another Early Evidence:



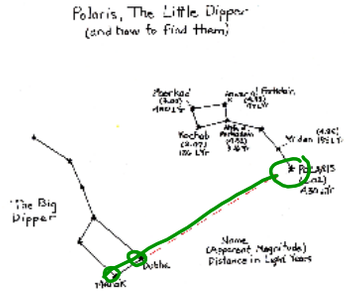
2

i. A sailboat's mast appears to sink as it goes out to sea.

3 4

c. Best Evidence:
   i. Photographs of the Earth from outer space are the best evidence.

d. The altitude of Polaris changes as we move from the Equator to the North Pole.
   i. The North Pole is aligned with Polaris.
   ii. Polaris - the North Star - can be seen at different altitudes in the sky in the Northern Hemisphere.
   iii. Altitude – distance above horizon in degrees
   iv. The latitude of the observer equals the altitude of Polaris.
   v. As a persons, latitude increases, the altitude of Polaris increases
   vi. Why is Polaris a good reference point? it is on the E's axis of rotation
   vii. How can you find Polaris in the sky?



e. Objects will weigh more at the poles than they do at the Equator.
   i. Gravity is a little bit greater at the poles because they are closer to the center of the Earth.

III. Structure of the Earth

a. Lithosphere - is the dense, solid shell of the Earth composed of rock and soil that surrounds the more fluid inner layers of the Earth.
   i. It is between 7 and 25 km thick.
   ii. Oxygen and Silicon are the two most abundant elements.
   iii. See page 11 of your reference tables.

b. Hydrosphere consists of the waters of the Earth.
   i. Oceans have an average depth of 3 to 4 km.
   ii. Hydrogen and Oxygen are the two most abundant elements.

c. Atmosphere is the shell of gases that surrounds the Earth.
   i. It extends out several hundred km into space, sorta fades away.

ii. It is stratified, layered, into zones based on temp.
iii. Nitrogen and Oxygen are the two most abundant elements.
iv. Troposphere:
    1. Lowest layer
    2. relatively thin
    3. It is the only layer to contain water.
    4. All the weather occurs in this layer.
v. Know how to read the chart on Page 14 of your reference tables.

Name_____ Unit 8 Rocks and Minerals
Period _____ Date _____ Earth Science

I. General Information

a. observation and classification have helped us understand the variety and complexity of Earth materials.

b. The use and distribution of natural resources and fossil fuels have important economic and environmental impacts.

c. Rocks and minerals are natural resources and must be used wisely.

d. List three things that humans can do to help save our natural resources.

REUSE, REDUCE, RECYCLE

II. Mineral Definition

a. 1 Naturally occurring

b. 2 inorganic (non-living)

c. 3 solid

d. 4 crystalline - atoms arranged in a fixed pattern.

i. crystal - when patterns of atoms can be seen with the human eye.

e. Composed of elements or compounds

i. elements - substances that cannot be broken down into simpler substances by ordinary chemical means.

ii. compounds - consist of molecule/atoms joined together in a definite proportion.

III. Mineral Information

a. Minerals are grouped according to:
- chemical composition
- observable properties

b. Minerals are the building blocks of rocks.

c. Minerals can be identified on the basis of well-defined physical and chemical properties.

d. Minerals are composed (made up) of elements.

e. Minerals are formed inorganically by the process of crystallization

i. crystallization - the process of becoming a crystal.

ii. Results from specific environmental conditions

1. cooling and solidification of magma
2. precipitation from water caused by evaporation, chemical reactions, temperature changes and the rearrangement of atoms

IV. Physical Properties of Minerals

a. A mineral's physical properties are determined by its chemical composition and internal arrangement of atoms.

b. We need to look at ALL the properties to identify a mineral.

1. Color - most minerals do not have a distinctive color.
   - **a.** Exception: Sulfur Sulfur
2. Streak - the color of a mineral's powder.
   - **a.** White, none, colored
3. Hardness the resistance to being scratched.
4. Luster - the way a mineral reflects light
   - **a.** Metallic looks like metal
   - **b.** Non metallic does not look like metal
5. Density - can calculate
6. Cleavage - tendency to split along smooth, flat planes
7. Fracture when minerals break in no particular way.
8. crystal shape

V. Chemical Properties of Minerals

a. Acid Test- (HCl) Hydrochloric Acid causes minerals with calcite to effervesce. (Calcium Carbonate) (bubble)

Calcite → limestone → marble

b. HcL causes minerals with Sulfur in them to smell.

VI. Rocks

a. Rocks are mixtures of minerals.

b. Are primarily classified by their origin (how they were formed.)

c. There are three types of rocks: Igneous, sedimentary and metamorphic.

d. Conditions under which rock formed can be inferred from the rock's mineral content and texture

e. Polymineralic - rocks composed of more than one mineral

f. monomineralic - rocks composed of only one mineral

g. ****Know how to read the Rock Cycle Chart on page 6 or your ESRT

VII. Igneous Rocks

a. Igneous rocks are formed by the solidification of molten magma.
- **i.** magma - melted rock below the Earth's surface
- **ii.** lava - melted rock at the Earth's surface

b. made from forming crystals

c. vesicules (gas holes) are present in some igneous rocks.

d. What is used to identify an igneous rock?
texture, color and density

e. We can tell the rate of cooling by observing the crystal size.
- **i.** Big crystals must have cooled quickly.
- **ii.** Small crystals must have cooled slowly.

f. There are two types of igneous rock:
- **i.** intrusive - cool slowly underground, from magma, large crystals form because there the magma cooled slowly
- **ii.** extrusive - cools quickly above ground from lava, small crystals form because there wasn't enough time to form

g. ****Know how to use the Igneous Rock Chart on page 6 of your ESRT.

VIII. Sedimentary Rocks

a. are often composed of rounded fragments cemented in layers.

b. Grains may be too small to be seen (microscopic)

c. In general, sedimentary rocks are classified by texture and composition.

d. Are formed by:
1. compaction/ compression - squeezing of really small pieces
2. cementation: gluing of larger pieces
3. crystals form from chemical precitpitation
4. bioclastic - piles of shells

e. Usually form under water.

f. May be made from a single sediment (monominerallic)

g. Are usually softer and deposited horizontally.

h. Sedimentary rocks are usually the _____ resistant to weathering.
i. Found near the _____ of the Earth.
j.

k. Fossils provide evidence of the environment in which they formed. Ex. Clam shells:

l. Evaporate sedimentary rocks precipitate (comes out of solution) from _____, shallow seas.
m. Show some ripple _____ and mud cracks.
n. Are classified as
  1. _____ -
  2. _____ -
  3. _____ -
o. **** Know how to use the Sedimentary Rock Chart on page 7 of your ESRT.

IX. Metamorphic Rocks

a. Are formed by the _____ of existing rocks.
b. Changes are caused by:
  1.

  2.

  3.
c. Metamorphic rocks are not formed from the _____ melting of other rocks.
d. Metamorphic rocks are very _____.
e. Can show _____ -

f. Can show _____-

g. Usually contains intergrown crystals.

h. Can undergo _____ changes or _____ changes.

i. _____ - the rock it used to be before it changed

j. It is possible to infer (guess at) the parent rock from the mineral _____ and the _____.

k. The same parent rock can form many different metamorphic rocks.

l. There are two types of metamorphism

1. _____ - very deep, over a large area from mountain building and plate tectonics.
2. _____ - occurs when molten rock comes into contact with cooler rock, small area (intrusion or extrusion)

m. ****Know how to use the Metamorphic Rock Chart on page 7 of the ESRT.

Name _____ Unit 9 NOTES – Earthquakes
Period _____ Date _____ Earth Science

I. Earthquakes

a. Earthquakes - Sudden movement of the ground

b. There are over 1 million earthquakes each year.

c. A major cause of earthquakes is because of faulting.

d. Faulting - sudden movement of rock along planes of weakness in the Earth's crust.

e. Fault - plane of weakness in the Earth's crust.

f. Rock is stressed to the breaking point and the two halves have an elastic rebound.

g. Focus - point where the rocks break

h. Epicenter - location on the surface above the focus

i. Analysis of seismic waves allows the determination of the epicenter location

II. Earthquake Waves

a. When faulting occurs, vibration called Seismic waves spread out in all directions from the focus.

b. Seismograph - a device that detects, measures and records the motions of the Earth associated with seismic waves.

c. Seismogram - the line that was recorded on paper by a seismograph.

d. Magnitude - the total energy released by an earthquake (strength)

e. The greater the density of the material it moves through, the faster the wave travels.

III. Measuring Earthquakes

a. Richter - based on the energy released – uses scientific instruments – measures the magnitude (strength) of the waves.

b. Mercalli - based on descriptions of earthquake damage on structures made by humans.

IV. Types of Earthquake Waves

a. P-Wave (Primary)
   i. Can travel through everything: solids, liquids and gases.
   ii. The fastest of the earthquake waves, usually the first to arrive.
   iii. Compressional wave – through the spring.

b. S-Wave (Secondary)
   i. Can only travel through solids.
   ii. Slower and usually the second type of wave to arrive.
   iii. Shear wave – makes the letter S.

V. Earthquake Prediction and Preparedness

a. Earthquakes can cause damage, injury and death.

b. Most injuries and fatalities are by buildings falling on people and related events.

c. Scientists
can make LONG TERM PREDICTIONS

d. Planning for earthquakes is important since earthquakes CAN NOT be accurately predicted.

e. During an earthquake
   i. "DROP, COVER + HOLD"
   ii. DROP DOWN UNDER A STRONG TABLE
   iii. COVER YOUR EYES
   iv. PROTECT YOUR HEAD

f. Before an earthquake
   i. HAVE E-QUAKE DRILLS
   ii. HAVE AN EMERGENCY KIT PACKED

VI. Tsunami

a. Tsunami - a large wavelength ocean wave produced by a disruption on the ocean bottom.

b. Disruptions: faulting, volcanic eruptions, Landslides

c. A tsunami can lead to huge waves hitting the shoreline causing building damage, injury and death.

VII. Volcanoes

a. Volcanoes mountains made from igneous rock.

b. A volcanic eruption is the giving off of gases, lava and/or lava rock onto the Earth's surface.

c. Volcanoes are considered to be natural disasters because its natural and can cause distraction.

i. tephra - falling rock from an eruption

ii. Lava can reach 1000 degrees Celsius.

iii. Ash lands on glaciers, melting the ice and causing mudslides.

iv. Gases emitted by volcanoes can cause immediate death.

v. Can cool the E's surface temperatures.

d. Because magma moves upward before an eruption, the eruption can be predicted by monitoring:

i. the temperature

ii. the angle of the mountain slope

iii. the width of the volcano

e. Volcanoes occur in areas of crustal boundaries where the land is pushing up/down (this causes friction and heat).

f. Planning for volcanic eruptions: EVACUATION routes

***Know how to use and read the P and S wave chart on page 11 of your ESRT.

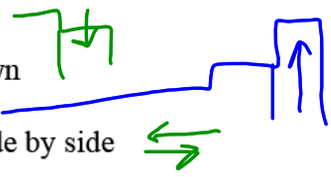
Name _____ Unit 10 Plate Tectonics
Period _____ Date_____ Earth Science

I. The Lithosphere is Moving

a. Lithosphere - the crust and upper mantel of the Earth.
b. The lithosphere moves because of convection currents within the Earth's interior. This causes difference in densities.

II. Evidence of Crustal Movement

a. Earthquakes occur along faults
  i. There are three types of faults
    1. Normal - land moves down
    2. Reverse - land moves up
    3. Transform - land moves side by side



b. volcanic eruptions
c. displaced structures – broken fences
d. Benchmark references are in different positions
  i. Benchmarks - are pieces of metal that humans put into the ground to record the latitude, longitude and elevation of the land in a certain spot.
e. folded or tilted rock

III. Isostacy

a. Isostacy - is the condition of balance/equilibrium within the segments of the Earth's crust.

IV. Plate Tectonics Theory

a. The Earth's surface is broken down into lithospheric plates that move.
b. DD make CC which make PT
c. Density differences make convection currents which make plate tectonics.
d. This theory has strengthened with time.
e. The theory explains earthquakes, volcanoes, mountains, and formation of rocks.
f. The lithospheric plate motions indicates that the Earth is a dynamic geologic system.
g. The lithosphere consists of separate plates that ride on the more fluid asthenosphere
  i. asthenosphere - the part of the Earth's interior below the lithosphere that acts as a plastic in response to stress
h. lithospheric plates move slowly in relationship with one another.

i. Surface features associated with plate tectonics include:
   i. mid-ocean ridges - hot, young rock in the middle of ocean. Older rock moves away from the middle.
   ii. rifts -land stretching apart to make oceans (happening in Africa)
   iii. trenches deep spots in the oceans made by subduction
   iv. subduction - areas where the lithosphere is pushing down
   v. island arcs - islands that were made because of subduction –
   vi. mountain ranges
   vii. Hot Spots places where the rock is coming up in the middle of a plate ????
   viii. magnetic patterns – can see patterns in ocean – proves sea floor spreading
   ix. age patterns – young in middle of ocean – proves sea floor spreading

V. Evidence of Plate Tectonics

a. Matching rock features
b. The apparent fitting together of the continents
c. Fossils of tropical plants are found in Antarctica
d. Earthquake and volcanic activity at plate boundaries
e. The mid-ocean ridges are moving apart. (sea floor spreading)

VI. Types of Plate Boundaries

a. Divergent - plate boundaries are moving away from each other
   i. new oceans and rift valleys are a result.
b. Convergent - plate boundaries are moving towards each other
   i. mountains are formed, earthquakes, subduction will result in trenches in the ocean.
c. Transform - plate boundaries are moving at angles to each other
   i. faults and earthquakes are a result

VII. Convection Currents

a. Are caused by the outward transfer of the heat energy from the Earth.
b. Move the lithospheric plates across the Earth's surface.
c. Cause the sea floor to spread mid-ocean ridges to form, and the hotter than normal temperatures at the mid-ocean ridges.

VIII. Model of the Earth's Interior

a. The outer core is liquid. We know this because S waves will not pass through.
b. Continental crust – thicker, felsic, less dense and float on oceanic crust (granitic)
c. Oceanic crust – less thick, mafic, more dense (basaltic)
d. ****Know how to use the diagram on page 10 of your ESRT

Name _____ Unit 11 Weathering and Erosion
Period ___ Date _____ Earth Science

I. Weathering

a. Weathering - the breakdown of rock.
b. Rocks are weathered when they are uplifted and exposed to the hydrosphere, atmosphere and biosphere
c. precipitation at or near the Earth's surface supplies the moister to the Earth's surface that contributes to the weathering of rocks.
d. There are two types of weathering
   i. Physical weathering is the weathering that changes the physical form without changing the chemical composition.
      1. Harder minerals and rocks breakdown slower than softer minerals and rocks.
      2. There are different types of physical weathering
         a. FROST ACTION important agent of weathering in areas with seasonal temperature changes
            i. Water seeps into cracks in rocks
            ii. Water expands when it freezes.
            iii. This makes the cracks LARGER
            iv. The alternating freezing and thawing will cause the rock to breakdown.
         b. ROOT ACTION roots grow in the cracks and push the rock apart.
         c. BURROWING ANIMALS expose new surfaces of rock to weathering.
         d. ABRASION - collisions that bump and break rocks apart.
   ii. CHEMICAL weathering that breaks sown rock by changing the rock's chemical composition.
      1. Happens when the rocks reach the Earth's surface. The rocks become unstable and the rock changes CHEMICAL composition.
      2. *Takes place more rapidly in WARM, MOIST climates.
      3. ACID PRECIPITATION can chemically breakdown very durable rocks (Marble)
      4. Some minerals are more resistant to chemical weathering (granite).

II. Factors affecting weathering

a. EXPOSURE - the more exposure that the rocks have to the environment, the FASTER the rocks will weather.
b. SIZE - the smaller the particles, the faster it will weather (because a pile of small particles has more surface area.
c. COMPOSITION - different minerals have different hardnesses. (calcite is soft, quartz is harder)

d. Climate - the type of climate greatly influences the rate and type of weathering.
   i. Warm, moist climates have more CHEMICAL weathering.
   ii. Cold climates have more PHYSICAL weathering.

III. Soil

a. SOIL - the mixture of weathered rock and organic remains that usually covers bedrock.
   i. BEDROCK is the rock under the soil in a particular area.
b. Both PHYSICAL and CHEMICAL weathering are involved over a long period of time.
c. Plants and animals add organic materials (HUMUS).
d. The decay of organic matter ACCELERATES the chemical weathering.
e. BURROWING animals help circulate air and water through the soil and mix minerals.
f. The type of soil depends on the type of bedrock.
g. RESIDUAL soil is soil that matches the bedrock below. It hasn't been moved.
h. TRANSPORTED soil is soil that does not match the bedrock below. It must have been transported from somewhere else.

IV. Erosion

a. EROSION - THE TRANSPORTING OF SEDIMENTS

b. SEDIMENT - are rocks that have been broken into fragments.

c. AGENTS of erosion are natural occurrences that actually move sediments.

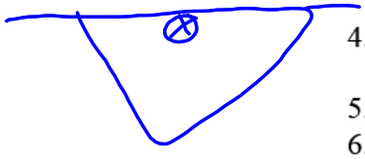
V. Agents of Erosion

a. GRAVITY is the *DRIVING* force behind erosion.
   i. Makes mass movements: landslides and mudslides.

b. RUNNING WATER is the *most common* agent of erosion in moist areas.
   i. Small particles travel at the SAME velocity as the water while large particles travel SLOWER than the water velocity.
   ii. The greater the velocity of the water, the ↑ the diameter of particles it can carry.
   iii. Running water breaks down mountains and carries the sediments to where they are deposited somewhere else.
   iv. The velocity of a stream is controlled by
      1. SHAPE - water flows faster in straight streams

2. SLOPE - water flows faster on steep slopes
3. DISCHARGE - the more water there is in a stream, the faster the water will flow.
   a. DISCHARGE - is the amount of water in a stream

v. WATERSHED - is the area drained by a stream and its tributaries.
1. TRIBUTARY is a small stream or creek that flows into a larger one.
2. Most erosion caused by running water takes place during a FLOOD
3. GRAVITY pulls water downhill while FRICTION slows the water down.



4. The fastest flow of water is commonly found at mid-stream just BELOW the surface.
5. MEANDERS are s-shaped curves found in some streams.
6. Erosion takes place on the outside of a curve in a stream while deposition takes place in the inside of a curve.
7. Valleys formed by running water are V shaped.

c. WIND - horizontal movements of air
   i. Wind can pick up loose ~~~ materials like sand, silt and clay.
   ii. Wind erosion occurs mainly in DRY areas like deserts and WINDY areas like shorelines.
   iii. ABRASION happens due to the bouncing around of rock as the pieces are carried in the wind.
   iv. Wind generated features include sand dunes and sand blasted rock.
   v. VENTRIFACTS are rocks that are "pitted" and triangular shaped.

d. GLACIERS - masses of moving ice and snow
   i. If more snow ACCUMULATES in the winter than melts in the summer, the bottom turns to ice.
   ii. As a glacier moves it carries, pushes and drags loose rock material with it.
   iii. Glacial features include parallel scratches and grooves in bedrock (called STRIATIONS).
   iv. When ice melts - UN SORTED rocks and boulders are left scattered around on hilltops and sides of valleys.
   v. Valleys formed by glaciers are U shaped.

e. WAVE ACTION
   i. Erosion and deposition cause changes in shoreline features like:
   ii. Wave actions ROUND sediments as a result of abrasion.
   iii. Waves approaching a shoreline move sand parallel to the shore.

VI. Effects of Agents of Erosion

a. Each agent of erosion causes characteristic changes in the particles that it carries.

Name _____ Unit 12 Deposition
Period _____ Date _____ Earth Science

I. Deposition when an agent of erosion deposits (drops) the sediment
a. results from a loss of energy.
b. Most deposition takes place in water.
c. The sediments that are deposited may under go processes to make them turn into Sedimentary rock.

II. **Factors that Affect Deposition**
a. Particle Size - the greater the size, the greater the settling rate.
b. Particle shape - the more spherical the shape, the greater the settling rate.
   i. Flat, angular and irregularly shaped particles settle slower
   ii. Smooth and round particles settle quicker.
c. Particle density - the greater the density, the greater the settling rate (if all the other factors are the same like size and shape).
d. Velocity (speed)
   i. The faster the medium, the lower the settling rate.
   ii. The slower the medium, the higher the settling rate.
   iii. Rate and time
      1. The greater the settling rate, the less time it takes.
      2. The lower the settling rate, the more time it takes.
e. Saturation of dissolved minerals
   i. Evaporation, temperature changes or an increased amount of dissolved minerals in a body of water would make the water unable to hold any more dissolved minerals.
   ii. Any more minerals will NOT dissolve and settle to the bottom.
   iii. Some minerals may PRECIPITATE to form crystals of minerals or rocks.

III. **Sorting of Sediments**
a. During deposition sediments of similar size, shape or density get separated (sorted) by types.
b. Deposition happens when the velocity decreases
c. Horizontal sorting happens when a stream enters a large body of water and the larger, denser, rounder particles settle out first. The smaller, less dense particles are carried farther from shore.
d. Vertical Sorting - happens when a landslide dumps sediments into the ocean.
e. Graded bedding - happens after a series of vertical sorting events.

IV. Deposition by Gravity

a. No Sorting occurs, pieces of different sized are mixed together – very angular

V. Deposition by Running Water

a. Deposition occurs where the water is decreasing its velocity.
b. Deltas can form at a river's mouth.
c. Alluvial Fans can form at the base of mountains on land.

VI. Deposition by Waves

a. When ocean waves slow down as they drag on the bottom of the beach, the waves tend to move sediment towards shore and sometimes parallel to the shoreline.

VII. Deposition by Wind

a. Wind drops the sediment that it carries when the wind velocity decreases.
b. Sand dunes can result.

VIII. Deposition by Glaciers

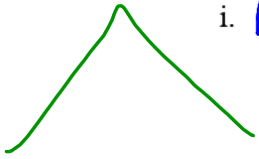
a. Deposition occurs when glaciers melt and sediments are dropped.
b. Glacial erratics are large rocks that have been transported by glacial ice without being broken into small pieces.
c. Glacial drift consists of deposits of material left by a glacier
d. immature soil are soils that haven't developed all the way (3 well-defined layers is a well developed soil).
e. eskers are curving ridges of sand and gravel
f. drumlins are elongated hills of sediment.
g. Kames are small, rounded hills.
h. Kettle Hole Lakes are where chunks of ice have melted.

The steepest side of a drumlin faces North.

IX. Landscapes - are regions on the Earth's surface in which physical features are related by origin (hills, valleys, streams…)

a. The shape and composition of the landscape are determined by the climate, local bedrock, geologic structure and human activities.

b. Landscape regions:



i. Mountains - have the greatest relief.
   1. relief is the change in elevation between the highest and lowest places.
   2. Can find each of the three types of rocks in mountains.
   3. Result from plate tectonic forces with the Earth that push up mountains, some mountains are volcanic.

ii. Plateaus - often relatively flat or rolling uplands in which streams have cut deep valleys.
   1. Famous Example: Grand Canyon

iii. Plains - flat and low in elevation
   1. Contain small hills and generally have flat sedimentary rock.

c. The climate influences the landscape.
   i. Humid climates have a lot of water.
      1. Rounded landscapes that have lots of vegetation (plants hold the water in the soil.)
      2. Chemical weathering may occur more here it it's warm.
   ii. Arid climates have very little water.
      1. Angular landscapes that have little vegetation
      2. Physical weathering is more abundant

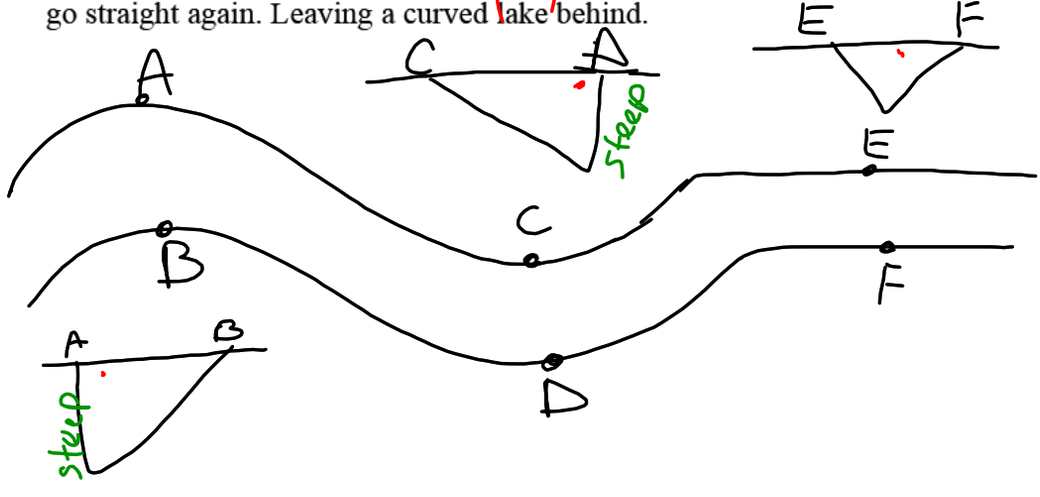
X. **Stream Development**

a. Precipitation falls on the ground and flows downhill along the easiest path.

b. Young streams have V shaped channels and are relatively straight.

c. Middle-aged streams have modified V shaped channels are have many meanders.
   i. meanders are curves in a stream.

d. Old-aged streams have sort of ___ shaped channels hand have many meanders.
   i. Once a meander gets too loopy, the streams can cut itself off to go straight again. Leaving a curved lake behind.



Name _____ Unit 13 Notes Earth's History
Period _____ Date _____ Earth Science

I. Sequence of events

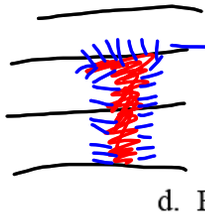
a. As we look at the Earth, we find clues to its origin, how it's changed and to evolution of life on Earth.
b. Our planet has existed for about 4.6 billion years.
c. Rocks preserve clues to the Earth's History.
d. Relative Age a comparative age – age expressed as "younger" or "older" without specifying units of measure. Example: this rock is older.

II. Uniformitarianism

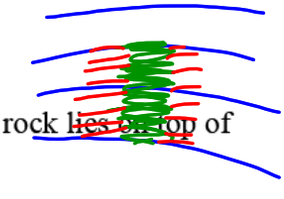
a. Uniformitarianism - a principle that assumed that forces that acted upon the Earth's crust in the past are the same as those that are active today.
   i. "The present is the KEY to the past."
   ii. Mountains wear down the same way today as they have done in the past.

III. Law Superposition

a. The rock layers on the bottom of an undisturbed rock exposure are usually the oldest.
b. The rock is always older than the process that changed it.
c. Intrusions and Extrusions are both younger then the rock they move through.
   i. Intrusions are igneous rocks that formed from magma beneath the surface of the crust. Never reached the surface. Has contact metamorphism on the rock above it.
   ii. extrusions are igneous rocks that formed from lava at the surface of the crust. Reached the surface. NO contact metamorphism on the rock layer above.



d. Folds and Faults are both younger then the rock they affected.
   i. folds are bends in rock strata (layers).
   ii. Sometimes folding can overturn rock strata so that older rock lies on top of younger rock.



IV. Fossils

a. FOSSILS - are naturally preserved remains or impressions of once living things.
b. The pattern of EVOLUTION on Earth is at least partially preserved in the rock record.
c. Fossils are generally found in SEDIMENTARY rock.
d. Fossil evidence indicates that
   i. A wide variety of life forms have existed in the past.
   ii. Many of the life forms have become extinct (species died out.)
   iii. That human existence has been very short compared to geologic time.

e. Geologists have divided the Earth's history into time units based upon the fossil record.

V. Correlation

a. Correlation - matching similar rock strata in different location to see if they formed at the same time or under similar conditions.

Walking the outcrop at an exposed outcrop (cliff of rocks).

1. It is often possible to follow a rock layer by walking from one end to another.

ii. index fossils are organisms that existed for a very brief period of time, found over a large area and are easily recognizable.

iii. volcanic ash

1. Some volcanoes erupt explosively and leave a layer of volcanic ash over a large area.
2. A single layer of ash that can be found over a large area allows geologists to make remarkable correct time correlations from one location to another.

VI. Geologic Time

a. Geologic time is based on fossil life forms and rock layers to correlate (match) the bedrock.

b. impact events - (meteors hitting the ground) have been correlated to mass extinction and global climate change.

c. The Earth's early atmosphere formed as a result of out gassing (gas was produced from chemical processes).

d. The Earth's ocean formed as a result of precipitation of millions of years.

e. The evolution of life caused dramatic changes in the composition of the Earth's atmosphere.

f. OROGENY is the process of mountain building.

VII. Evolution of Life

a. Scientists are not yet sure of how life began.

b. The first organisms lacked Hard parts are were not preserved.

c. In time, more complex life forms developed (many had skeletons and shells that were preserved).

d. Because most individual organisms decompose or are eaten by other organisms – few leave fossil remains. As a result – many life forms will never be known.

e. Heterotroph Hypothesis – theory of how life began

i. First organisms were globs of chemicals that combined together. Did not make their own food.

ii. Then chemical combined to use sunlight – autotrophs

iii. Made a lot of oxygen

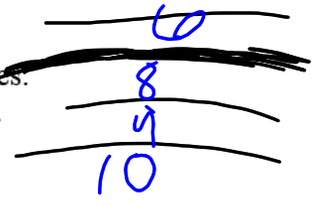
iv. Allowed for Sexual reproduction

v. Allowed for variation (mutations and variations)

f. Charles Darwin studied evolution and developed the Theory of Organic Evolution
   i. Natural Selection - individuals that have traits that better suit them to their environment would survive longer and produce more offspring.
g. fossils show evidence of evolution.
h. humans are one of the most complex life forms to have evolved – over 4 million years ago.
i. Humans evolved from a common ancestor of apes.
j. From fossil evidence, humans have been around for just 1% of geologic time.

VIII. Unconformities

a. unconformities - are buried erosional surfaces.
b. They are gaps in the rock record due to missing rock layers.



IX. Radioactive Dating

a. actual/absolute age - is the age of a rock unit, fossil or an event expressed in units of time (the exact age)
b. The regular rate of nuclear decay (half-life) of a radioactive isotopes allows us to find the absolute age of rocks and fossils.
c. Radioactive dating is a way to determine the absolute age by comparing the amounts of isotope to the amounts of decay product.
d.

# of ½ lives

	0	1	2	3	4
Isotopes unstable	100%	50%	25%	12½%	6.25%
Decay Products stable	0%	50%	75%	87½%	93.75%