EARTH SCIENCE

REVIEW

Name: _____

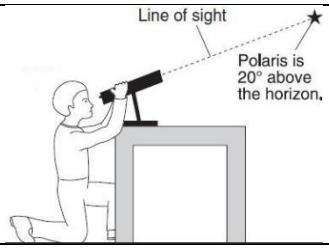
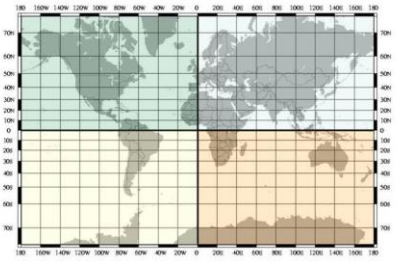
Topic 1: Earth's Dimensions: Layers of the Earth, Latitude/Longitude, Contour Maps

(ESRT p 14, 15)

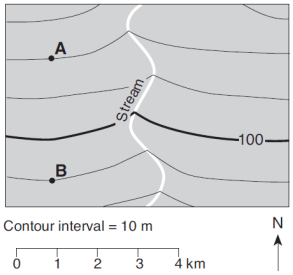
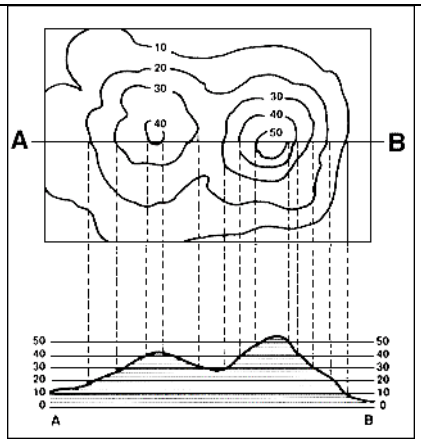
Layers of Earth

Lithosphere	• **Solid** (made of crust and rigid mantle) • **Oxygen & Silicon:** Most abundant in crust; form pyramid shape (Si-O tetrahedron).	
Hydrosphere	• **Liquid** (oceans)	
Atmosphere	• **Gas**, broken down into 4 layers: • **Troposphere** is closet to sea level and contains water vapor • **Stratosphere** contains the ozone layer	

Earth Dimensions

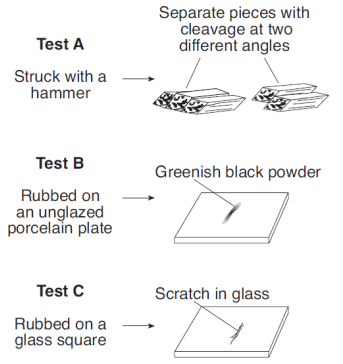
Shape of the earth	• **Oblate spheroid**	
Altitude of Polaris equals your:	• **Northern latitude** (be able to use NYS map to find altitude of Polaris)	
Latitude lines run horizontal across like the equator	• **0° - 90° North or South of Equator**	
Longitude lines run up and down	• **0° - 180° East and West of the Prime Meridian** • **Same line of longitude = same time** • Time zones are separated by 15° of longitude based on Earth's Rotation • Going to the west (California) time gets earlier, going east it gets later (London)	

Topographic Maps

Isoline	• Line connecting points of equal value • Isobars- pressure • Isotherm- temp • Contour- elevation	
Tick Marks	• Depressions, the first tick marked line is the same elevation as adjacent contour line	
Contour Interval	• Amount between contour lines, Ocean is sea level 0'	
Lines close together=	• Steep gradient	
Direction of streams	• Water goes downhill • Opposite bends in contour lines	
Gradient	• = <u>Change in Field Value</u> Distance • **Units:** Feet (ft)/miles (mi) OR meters (m)/kilometers	
Know how to make gradient profile		

Topic 2: Rocks and Minerals (ESRT pages are huge here, Rock pages on 6, 7, 16 and top of 11)

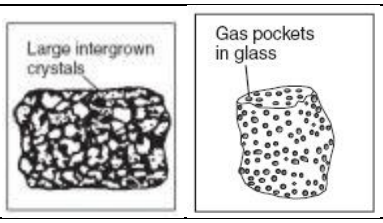
Minerals

Definition	• Solid, naturally occurring, inorganic (not living) substances	
Mineral Properties are due to:	• Internal atomic arrangement	
Calcite bubbles with	• **Acid** • Rocks made of calcite (marble, limestone, dolostone) also bubble.	
Mineral Tests		
Luster	• How light is reflected: metallic (looks like a metal)	
Hardness	• Resistance to scratching (1-10) • Soft- can't scratch glass (less than 5.5) • Hard- can scratch glass	
Cleavage	• Flat sides on a mineral, mineral breaks along planes of weak bonding	
Streak	• Powered form of a mineral, as found by using a streak plate	

Rock Type determined by	Origin	

Igneous Rocks

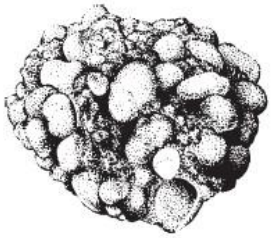
Process:	Solidification or crystallization of magma or lava	

Classified by:	• Texture (grain/crystal size): ○ Coarse, fine, vesicular (gas pockets), glassy	
Texture is determined based on:	Rate of cooling & location	

Type:	**Intrusive (In)**	**Extrusive (Out)**
Molten Material:	**Magma**	**Lava**
Cooling Rate:	**Slow**	**Fast**
Texture:	**Coarse, Very Coarse**	**Fine, Vesicular, Glassy**

Sedimentary Rocks

Process:	Compaction & Cementation (Clastic), Organically, Chemically	

Classified by:	• Grain Size:
	  ○ Pebbles, sand
	  ○ Contains Fossils
		

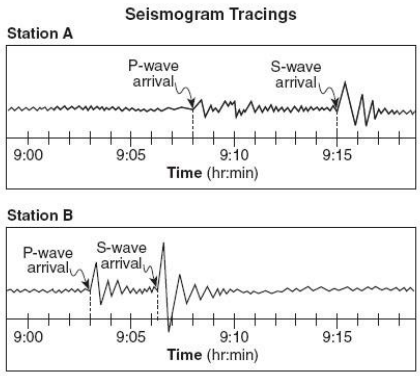
Metamorphic Rocks

Process:	Heat & Pressure	
Key words:	• Foliation • Re-crystallize • Distorted • High density	
Contact metamorphic rocks found between:	Igneous intrusions and sedimentary rocks	
Parent rocks:	• shale turns into slate • sandstone into quartzite • limestone into marble	

Topic 3: Plate Tectonics and Earthquakes (ESRT pages 5, 10, 11)

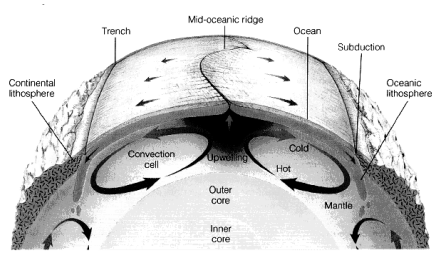
Earthquakes

Evidence of plate tectonic theory (continental drift):	• Continents fit together • Rock and fossils match • Evidence of ancient glaciers & tropical forests	
Earthquakes and Volcanoes occur along:	Crustal plate boundaries	
Definition of Earthquake:	Sudden movement along a fault, usually happens at plate boundaries	

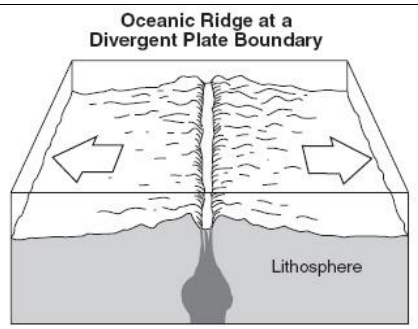
Types of Waves:	**P-waves**	**S-waves**
Speed:	Fast	Slow
Go through:	Solid, Liquid, Gas	Only solid (not outer core)
Motion:	Compression	Up & Down
Time difference between P and S waves gives us	**Distance to epicenter**	
1 Seismic Station determines:	**Distance** to the epicenter (Not Direction)	
3 Seismic Stations determine:	Epicenter- where earthquake occurred (Big circles → far distance)	

Type of Crust:	**Continental**	**Oceanic**
Rock	Granite	Basalt
Density	Low (2.7)	High (3.0)
Thickness	Thick	Thin
Age	Older	Younger

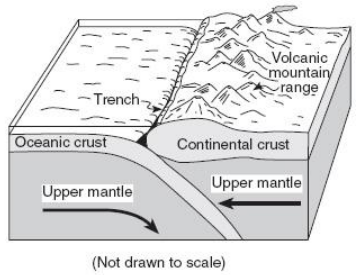
Plate Tectonics

Convection currents cause:	Plates to move	
Convection currents are located in:	Asthenosphere	
Convection currents move due to:	Differences in density	
Hot Spot:	Mantle plume through the middle of a plate, like Hawaii or Iceland	

Divergent Boundary

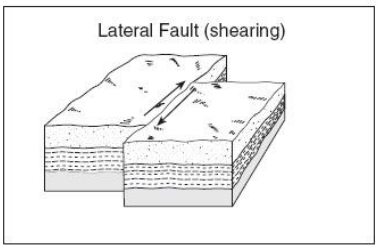
Plate movement:	Moving away (Spreading Center)	
What is being formed:	• Ridges • Where magma comes up through the sea floor • New ocean floor is created at mid ocean ridges	
Evidence:	• Age of rock increases as distance from ridge increases (youngest at ridge) • Reversal of magnetic polarity	

Convergent Boundary

Plate movement:	Moving towards	
What is being formed:	• Trenches • Mountains (Two continents collide → Mt. Everest (Himalayas)	
Which plate subducts (sinks):	• More dense plate (oceanic)	

Transform Boundary

Plate movement:	Plates slide past each other	

What is being formed:	• Fault	

Preparation

Earthquake	• Create an action plan • Learn first aid • Make buildings stronger • Hide under table	
Volcano		
Tsunami	• Get to higher elevation • Get away from shoreline	

Topic 4: Weathering, Erosion, Deposition, and Landscapes

(ESRT p.6, p. 2 Landscapes)

Weathering

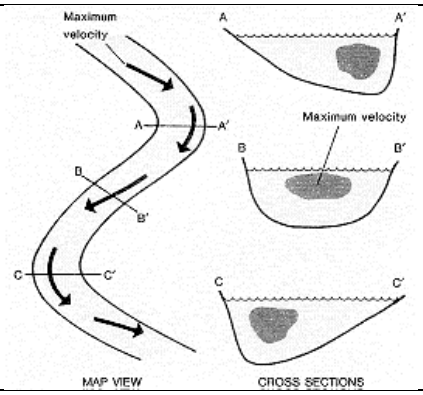
Weathering is	Breakdown of rocks into smaller pieces	
Physical weathering	• Rocks become smaller and rounder in a stream due to abrasion • Frost action → water seeps in crack, freezes and expands • **Climate:** Cold and Wet (humid)	
Chemical Weathering	• **Changes the chemical composition** of the rock • **Examples:** rust, cave formation due to acid rain. • **Climate:** Warm and Wet	

Soil

Definition:	Mixture of weathered rock and organic remains (bugs) that covers bedrock	
Transported Soils	Soil different from bedrock below	
Residual Soils	Matches to rock layers	

Streams

Discharge	Amount of water in a stream (Stream Volume)	
Velocity of river determined by:	• Slope and Discharge. • As either increases, velocity increases	
Delta forms when:	• River enters a body of water. • Velocity slows down, so more deposition.	
Watershed/ Drainage Basin	Land area that drains into a river.	

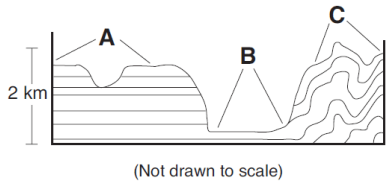
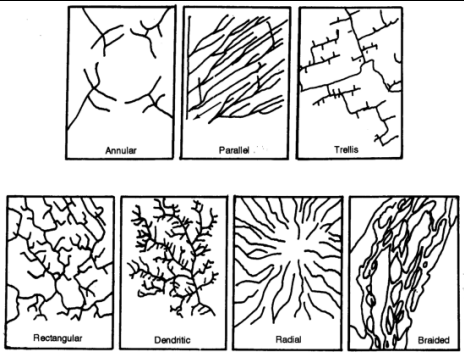
How sediments are carried:	• Smallest particles are carried by suspension • Salt by solution • Largest sizes bounce & roll on river bed	
Erosion	Transportation of sediments (water*, wind, glaciers)	
Driving force of erosion :	Gravity	
Wind erosion causes:	• sand dunes • Windward side of a sand dune has a gentle slope	
Deposition	When an agent of erosion slows down and **drops sediments** • As **roundness increases**, rate of Deposition increases • As **density increases**, rate of Deposition increases • As **size increases**, rate of deposition increases.	
In a stream where does, erosion occur:	• Outside of curve • High water velocity • Deeper	
In a stream where does, deposition occur:	• Inside of curve • Slower water velocity • Shallower	

Glaciers

Evidence:	• U-shaped valley's • Unsorted and Unlayered sediments • Scratched bedrock (striations) • Erratics (large boulders).	
Steep side of a drumlin indicates:	Direction the glacier advanced from (usually north).	
Kettle Lake forms when	Ice is wedged into ground	

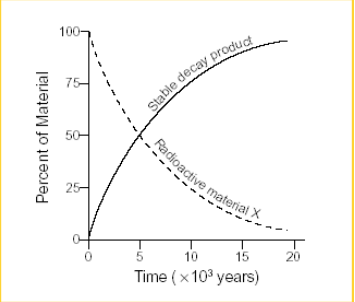
	creating a hole, fills with water.	

Landscape Regions

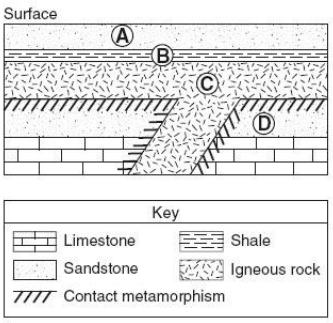
Determined by:	Climate, bedrock, and geologic structures	
Region	**Elevation**	**Bedrock**
Mountains	High	Distorted (MET rock)
Plateaus	Medium	Horizontal (SED rock)
Plains	Low	Horizontal (SED rock)
Drainage Pattern	Where stream flows • Match to landscape	 Figure 2-27. Stream drainage patterns

5. History of the Earth (ESRT p. 8-9, p. 1 (radioactive decay))

Half-Life

Definition	• Determines age of rocks • The time it takes for 1/2 the unstable atoms to decay into stable atoms	
Uranium 235	Dates old rocks	
Carbon 14	Dates recent living objects	
If you crush a rock, can it change the half-life?	No.	

Rock Layers

Undisturbed layers	Bottom layer is the oldest	
Unconformity	Erosion (time gap in layers).	
Intrusions and faults are younger than:	The rock they are in.	
Marine fossils on a mountaintop indicate:	Uplifted land.	
Observe contact metamorphism to determine relative age of layers.	If a rock layer has tick marks on it, it is older than the intrusion.	
Be able to tell the difference between folding, faulting, and tilting of rock layers		
Volcanic Ash	Good time marker because it spreads out quickly over a large area	
Index fossils	Good time markers: 1. Easily recognizable 2. Short lived 3. Widespread geographically	

Geologic History

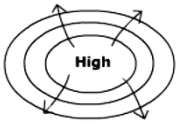
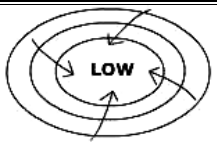
• The atmosphere formed from outgassing of volcanoes (CO_2, N_2, H_2O). Algae (plant-like) organisms turned the CO_2 rich atmosphere into one containing O_2.		
Precambrian Time Period is 4 billion years long (only simplest life forms existed)		
[Cen-Mez-Pal--| ---------- Precambrian part of Geologic Time Scale----------]		
Life evolved from simple to complex organisms, evolved b/c changes in environment		
Asteroid Impacts are thought to cause mass extinctions (dinosaurs died 65 million years ago). Asteroids leave behind large craters in the Earth's crust.		

6. Weather (ESRT p. 12 &13)

Weather Instruments

Weather Variable	Weather Instrument	
Air Pressure	Barometer	
Temperature	Thermometer	
Dew Point/ Relative Humidity	Sling Psychrometer	
Wind Direction	Wind Vane	
Wind Speed	Aneometer	

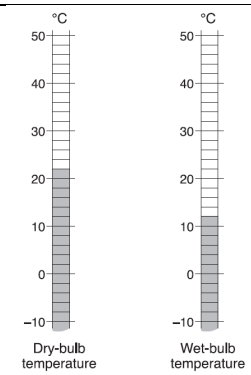
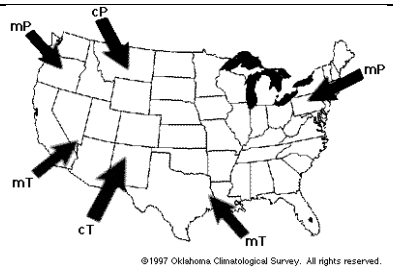
Air Pressure or Barometric Pressure:

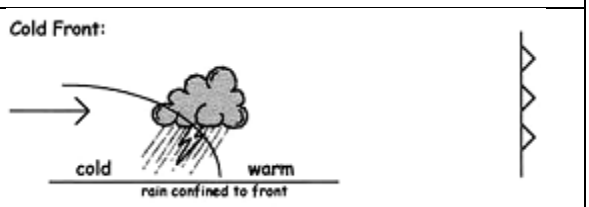
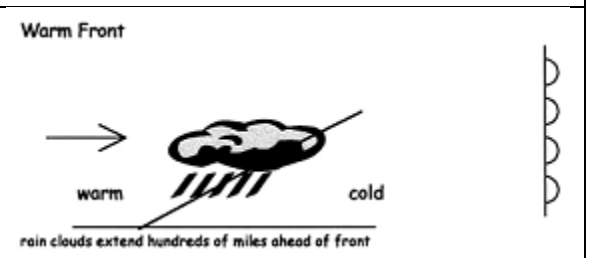
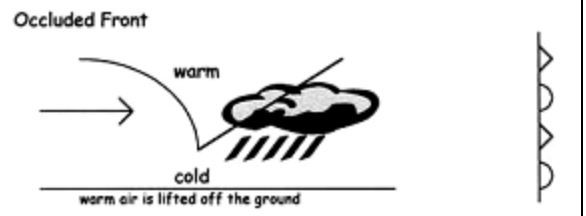
Pressure:	High →	Low
Temp.	Cold (air sinks- more dense)	Warm (are rises- less dense)
Clouds	No	Yes
Precipitation	No	Yes
Air movement	 Hoc	 Licc

Winds

Caused by:	• Uneven heating of earth • Differences in Air Pressure	
Winds blow from:	High to Low Pressure	
Isobars close together=	Fast Wind Speed	
Sea Breeze:	• Daytime • Ocean is cold (High Pres.) → land is hot (Low Pres.)	
Land Breeze:	• Night • Land is cold (High Pres.)→ ocean is warm (Low Pres.)	

Weather Variables

Dew Point Temperature:	• The temperature at which the air is saturated (filled) with water	
When the air temperature= dew point temperature→	100% Precipitation 100% Relative Humidity	
Relative Humidity:	% of water in the air	
Condensation forms:	Clouds	
Steps of Condensation:	• Warm moist air rises (less dense) cools and expands (adiabatic cooling) • Cools to the dew point temperature condensation occurs if condensation nuclei are present (attach to dust)	
Coriolis Effect	Winds & Ocean Currents deflected due to Earth's Rotation	
In Northern Hemisphere, winds deflect to the	Right	
Air mass refers to	Humidity and Temperature over surface region formed	
mT	• warm and wet • Gulf of Mexico	
cP	• cold and dry • Canada	
Front	Boundary line between two air masses (mainly between	

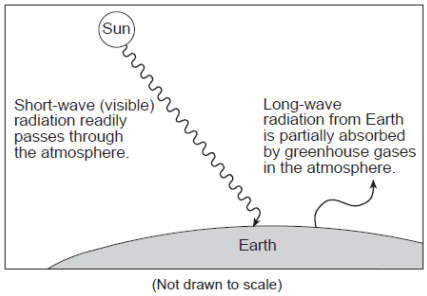
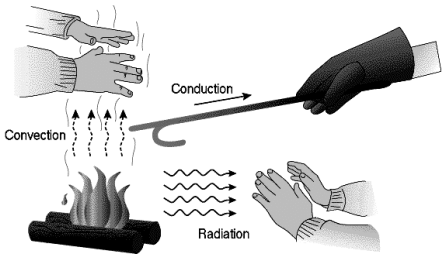
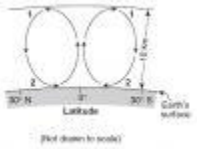
	cP and mT air masses)	
Cold Front	Cold air moving into an area of warm air	
Warm Front		
Occluded Front		
All weather in the U.S. moves from west to east or toward the	Northeast	
Station Models- Convert Pressures		
mb→ Station Models • **Ex. 1000.9 mb=**	 009	
Station Model→mb • **Ex. 600** • **Ex. 100**	 960.0mb 1010.0mb	

<u>Weather Events</u>

Hurricanes	Very large, strong, low-pressure systems that can last for days.	
Preparation for Hurricane:	Prepare an escape route, learn first aid, tape or board up windows, store up food, water and candles.	
Tornadoes	Short-lived (a minute or less) small in size	
Preparation for Tornadoes:	Going to the basement	

7. Energy, Water Cycle and Climate (ESRT p.14)

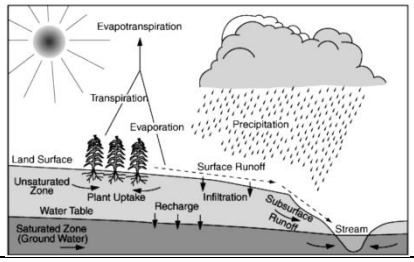
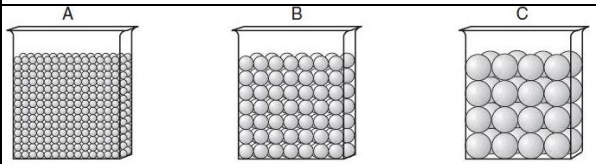
Energy

Sun (stars) give off	electromagnetic radiation (based on wavelength)	
Sun radiates Solar Energy:	Ultraviolet radiation	
Earth radiates Heat Energy:	Infrared radiation	
Good absorbers of light:	• Dark and rough objects • Dirt/forest	
Good reflectors of light:	• Light and smooth objects • Ice and snow	
Good absorbers of light are good:	Radiators (black heats up and cools down quickly)	
Specific Heat	Resistance to heating	
High Specific Heat	• Longer and more energy required to heat the object up.	
Which takes longer to heat up, water or granite?	• Water- high specific heat	
Conduction	• Transfer of energy in **solids**	
Convection	• Transfer of energy in **liquids and gases** due to differences in density	
Radiation	• Transfer of energy in waves • Ex. Solar Radiation	

Types of Greenhouse Gases:	CO_2 , H_20, and CH_4 (Carbon dioxide, Water Vapor, and Methane)	
Greenhouse gases act as	Glass to trap infrared (they	

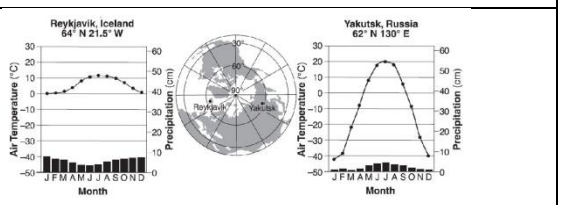
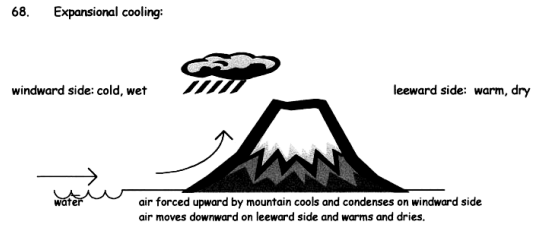
	absorb it and then re-radiate it back to Earth).	

Water Cycle

Water Cycle		
Infiltration	Sink in	
Infiltration occurs when land is:	permeable, unsaturated, low slope, not frozen.	
Run off	Move over the surface of Earth	
Runoff occurs when land is:	impermeable, saturated, steep slope, frozen ground.	
What increases stream discharge?	Infiltration, Runoff, Precipitation, Snow melt	
Porosity	percent of empty space in soil.	
Permeability	How fast water flows through soil.	
As grain size increases, permeability:	Increases	
Capillarity	Upward movement of water into small spaces or the water retained by soil as water passes through a sample.	
As grain size increases, capillarity	Decreases	

Climate

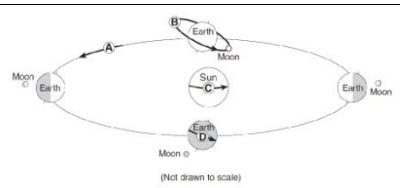
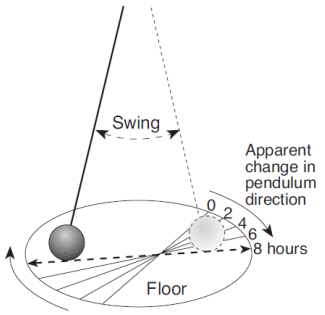
Climate:	Long term weather for a location (based on temperature and rainfall)	
As latitude increases, temperature:	Decreases	

As elevation increases, temperature:	Decreases	
Compare temperature of inland cities vs. coastal cities:	Coastal areas have moderate climates (cool summer, warm winter) b/c the proximity to water which has a high specific heat	
Windward vs. Leeward side of a Mountain		

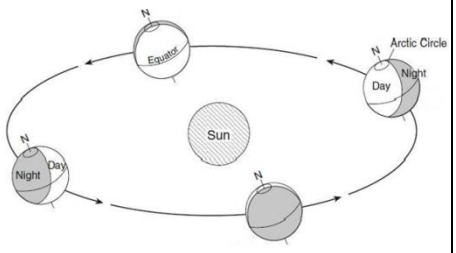
8. Astronomy (ESRT p.15)

As angle of insolation increases, the temperature:	Increases	
Solar noon occurs when the sun is:	Highest in the sky	
Celestial Objects (sun, moon, stars) rise in the _____ and set in the _____	• Rise in the EAST • Set in the WEST	
Zenith is	90° overhead	
Constellations are	Groups of stars near each other in the sky	

<u>Rotation</u>

Definition:	Spinning on the axis (counterclockwise)	
Cause:	Day & Night	
Rate:	• 360°/24 hours • 15°/hour	
Evidence:	• Foucault Pendulum • Coriolis Effect	

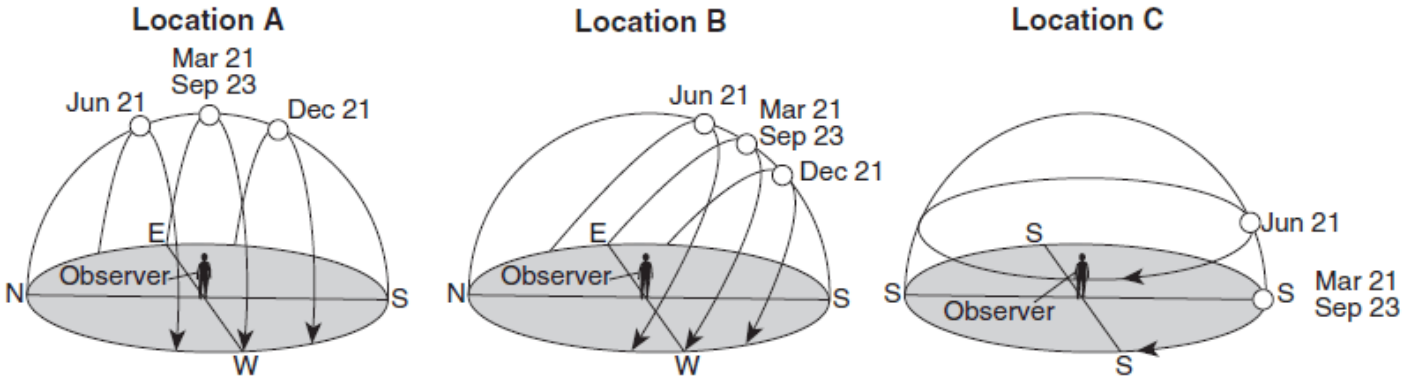
<u>Revolution</u>

Definition:	One body orbits around another body	
Rate:	• 360/365 days (1 year)	

	• ~ 1°/day	
Evidence:	• Seasons • Different constellations seen during the year	

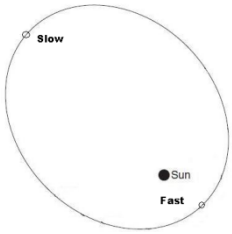
Know this chart for NY at 42ºN latitude.

Approximate Date	Latitude of Sun's Direct Rays	Direction of Sunset and Sunrise	Altitude of Noon Sun	Duration of Insolation	Temperature
September 23 (Autumnal Equinox)	Equator (0º)	Rises due East Sets due West	48º	12 hours	
December 21 (Winter Solstice)	Tropic of Capricorn (23.5ºS)	Rises in SE Sets in SW	24.5º (lowest) Long shadow	8 hours (shortest day)	Cold
March 21 (Vernal Equinox)	Equator (0º)	Rises due East Sets due West	48º	12 hours	
June 21 (Summer Solstice)	Tropic of Cancer (23.5ºN)	Rises in NE Sets in NW	71.5º (highest) Short Shadow	16 hours (longest day)	Warm

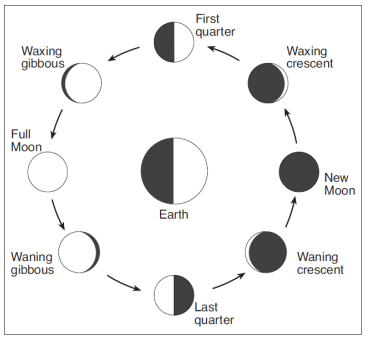
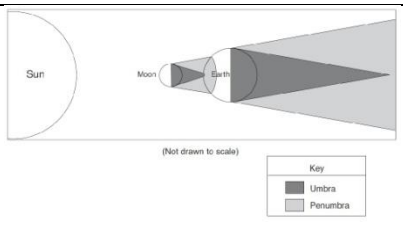


Is the sun ever 90 directly over NYS?	• NO. Only between the Tropics.	
If Earth was not titled, would there be seasons?	• No	

Geocentric Model	• Earth Centered • Wrong model • p\Planets and sun revolve around earth	

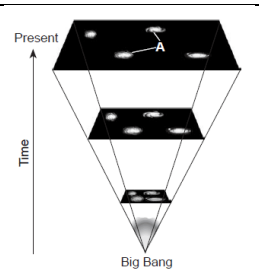
Heliocentric Model	▪ Sun Centered ▪ Planet revolve in elliptical orbits ▪ Sun at one focus	
If a satellite is close to a star, orbital velocity is:	▪ Greatest ▪ High gravitational attraction	
Eccentricity	▪ measure of how flattened the orbit is (highest =1, line) (lowest=0, circle)	
Equation:	▪ Eccentricity= distance between foci / length of major axis	
Earth's orbit is:	▪ Slightly Elliptical	

Moon

Moon Phases are caused by the:	Revolution of the moon around the earth	
One Moon Revolution=	27.3 days	
One complete Moon Cycle=	29.5 days	
Moon Cycle	View from Earth→	 (Not drawn to scale)
Solar Eclipses	• During New Moon	
Lunar Eclipses	• During Full Moon Phase • Moon in Earth's shadow	
Tides are caused by:	• Moons gravitational pull on the earth (also sun's but not as much, too	

	far)	
Spring Tide	• When Earth, Moon, & Sun are in line (New/Full Moon) • Very high tide, Very low tide	
Neap Tide	• When the Moon and Sun are working against each other we get small tides (First/Third Quarter)	
How many high and low tides per day?	• 2 high tides • 2 low tides	

<u>Solar System/Universe</u>

Terrestial	• 1st 4 planets closest to sun • Small and rock	
Jovian	Gas Giants	
Asteriod	• Big rock in space • Asteriod belt: between Mars & Jupiter	
Meteor	• Shooting star • Rock burns up in our atmosphere • If no atmosphere, no burning up (moon)	
Comet	• Dirty Snowball • Highly elliptical orbit	
Sun	• Star • Burns by converting Hydrogen into Helium **(Nuclear Fusion)**	
Age of Our Solar System	• 4.6 Billion years old	
Galaxy	• Collection of billions of stars (solar systems)	
Our Galaxy	• Milky Way (our solar system is located on one of the spiral arms) • ~10 billion years old	
Levels of Organization within Universe: (from smallest/youngest to largest/oldest)	• Planet→ star→ solar system→ galaxy→ universe	

Big Bang Theory	• Universe formed 13 billion years ago from an explosion	
Proof of Big Bang	1. Galaxies are moving away from us (RED SHIFT), the further the galaxy is from us the faster it is moving away 2. Cosmic background radiation	
Age of Universe	• 10-15 Billion years old	
Light Year	• Distance light travels in one year	

EARTH SCIENCE

REVIEW

QUESTIONS

Regents Exam:
Friday June 14th at 8 am

Name: _____

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