Mrs. Cohn's 289 Concepts To Understand In Earth Science.

INTRODUCTORY CONCEPTS

1. Use your ESRT. 25% of questions involve using information from your ESRT.
2. Know how to round numbers to the *tenth* 0.5, to the *hundredth* 0.53 and *thousandth* 0.531
3. Know Scientific Notation - 345,876 = 3.45 x 10^5 or 1,300,000,000 = 1.3 x 10^9
4. Know how to use the Rate of Change and Density on front of ESRT's with *correct units!*
5. Cyclic Relationships - **repeat and are predictable** (ex Moon Phases, Tides, and Seasons)
6. Density is how close or compact the molecules are.
7. As Temperature Increases, the Density Decreases because the molecules spread out and volume increases.
8. As Pressure Increases, the Density Increases because the molecules move closer together.
9. The same objects/material have the same density **NO MATTER WHAT SIZE IT IS!!!**
10. Water is most dense at 3.98°C in the liquid form (density is 1 g/cm^3) located on page 1 of ESRT.
11. Everything else is most dense in the solid form.
12. For objects with densities less than 1, the lower the density the higher the object will float in water.
13. As population increases, pollution increases, water quality decreases.

Planet Earth
Contour Maps, Layers of the Earth, Latitude/Longitude
(ESRT page 1, 3, 10 and 14)

14. The true shape of the earth is an **oblate spheroid** (Bulging Equator & Flattened At The Poles)
15. The Earth looks like a perfect sphere from space, only SLIGHTY oblate.
16. **THE ALTITUDE OF POLARIS EQUALS YOUR LATITUDE** (Use ESRT pg 3 for cities in NYS)
17. Always look **north** to see Polaris, hence why it is called the North Star!
18. Polaris is only special because it is in line with the earth axis of rotation (doesn't appear to move), hence why all other stars appear to rotate around Polaris.
19. Lithosphere is the solid land part of the earth (made of crust and rigid mantle) and pg 10 of ESRT.
20. Hydrosphere is the liquid layer of the Earth (oceans) and know average chemical compositions from pg 1.
21. Atmosphere is the gas portion, broken down into 4 layers, and know page 14 of ESRT.
22. Latitude lines run **horizontal** across like the equator, read North or South of Equator (Cross the t's)
23. Longitude lines run **vertically** (up and down), read east and west of the Prime Meridian (Say Longitude)
24. Astrolab is the instrument to measure the altitude of a star above the horizon
25. The pointer stars in the Big Dipper points to Polaris or North Star.
26. Time zones are separated by **15 degrees of longitude,** based on **Earth's Rate of Rotation=15 degree/hour**.
27. Going to the west (California) time gets LESS; going east it gets INCREASE (London)
28. Isoline - a general line connecting points of equal values.
29. Special isolines include: **Isobars** - pressure, **Isotherm** - temp, and **Contour** - elevation
30. A set of circles inside circles indicates a hill; the smallest circle in the middle is the hilltop
31. Tick marks-depressions, the first tick marked line is the same elevation as adjacent contour line
32. Contour Interval - elevation between adjacent contour lines, Ocean is sea level 0'
33. Lines close together --> steep gradient
34. Streams flow in the opposite way that the contour lines bend or down in elevation!!!
35. Use Gradient Formula in ESRT, use contour interval to determine highest elevation of hills
36. Count on getting a Profile, which is a side view of a topographic cross section and constructing a profile.
37. When drawing a profile remember to **round the top of hills and bottom of valleys**.
38. Be able to draw Isolines, the boxes with numbers inside where you have to connect the dots

Astronomy
(ESRT Page 15)

39. As the latitude increases, the angle of insolation increases, and the temperature increases.
40. Solar noon occurs when the sun is highest in the sky, while the warmest time of day is 2pm coldest 6am.
41. Celestial Objects (sun, moon, stars) **rise in the east and set in the west** due to earth's rotation (EW!)
42. Stars around Polaris make circles, (circumpolar) Polaris stays still (North Star) (Pole Star)
43. **Altitude of Polaris equals your latitude** (Use ESRT pg 3 for cities in NYS) SECOND TIME ON LIST!
44. Use the pointer stars in the big dipper (Ursa Major) to find Polaris in the little dipper (Ursa Minor)
45. Constellations are groups of stars near each other in the sky
46. **Rotation** - Spinning on the axis, causes day and night, 365 x per year, at a **rate of 15 degree/hour**
47. **Proof of Rotation** - Foucault Pendulum, Coriolis Effect, Day and Night, and Rising and Setting of the Sun, Moon and Stars (Excepet Polaris-circumpolar star) Increase Rate of Rotation increase the Coriolis Effect
48. Be able to tell time of day on Earth from diagrams, Earth **rotates counterclockwise 15 degree/hr**
49. **Revolution** - one body orbits around another body, Earth Revolves ~ 1°/day (gives us the year)
50. **Seasons are caused by revolution** and **tilt** of the Earth on its axis that doesn't change.
51. The tilt of the earth 23.5° causes the uneven length of daylight during the year.
52. Zenith is 90° overhead; the sun is **NEVER** overhead in NYS (sun only overhead between the tropics)
53. Equinox means equal day and night 12 hours of each, sun overhead (zenith) at the equator
54. **Know the position of the direct ray (sun at zenith). 6/21-23.5°N, 12/21-23.5°S, 3/21 & 9/21-0°**
55. The sun is always south at noon in the United States (solar collectors point south)
56. Altitude of noon sun greatest on June 21 then decreases to minimum on Dec 21 then rises again
57. When the sun is highest in the sky it has maximum intensity & your shadow is shortest
58. **Summer in NYS sunrise NE and sunset NW. Winter in NYS sunrise in SE and sunset in SW**
59. Duration of Insolation is the length of day; high in summer, low in winter
60. **Summer; North Pole faces sun** (24hr/day); **Winter; North Pole away from sun** (24/hour night) using diagrams if the North Pole is all dark it is winter, all light it is summer, ½ and ½ equinox
61. If the earth was not tilted there would be no seasons (more tilt, more extreme seasons)
62. Shadows are longest when the sun is low, shortest when the sun is highest
63. Revolution causes different constellation to be visible at different times of the year
64. **Heliocentric Model** - Sun Centered, planet revolve in elliptical orbits, sun at one focus. Correct Model!
65. **Geocentric Model** - Earth Centered, wrong model, planets and sun revolve around earth. Incorrect Model!
66. If a satellite is close to a star, orbital velocity is greatest; far away, moves slow
67. Satellite/Planet is closest, high gravitation force, high Kinetic Energy, high apparent diameter
68. Planets sweep out equal area's in equal amounts of time
69. As distance from a star increases, rate of revolution decreases by inverse square
70. As the mass of an object increases, gravity increases proportionally (2x mass, 2x gravity)
71. **Eccentricity is a measure of how flattened the orbit is (highest =1, line) (lowest=0, circle)**
72. Satellites are kept in elliptical orbits by inertia and gravity
73. The earth's orbit is extremely round, almost perfect, but it is slightly elliptical
74. **Moon Phases are caused by the Revolution of the moon around the earth** and **the reason why we only see one side of the moon is because the Moon rotates and revolves at the same rate!**
75. One Revolution of the moon takes 27 days, HOWEVER, it takes 29.5 days from Full moon to Full moon.
76. When the moon is between the earth and sun this is a New Moon (all dark from Earth) easiest to start!
77. Solar Eclipses can occur during a new moon, it gets dark during the middle of the day = closest to sun.
78. Lunar Eclipses can occur during the full moon phase (earth's shadow on the moon) or farthest from sun.
79. Eclipses don't happen every month because the moon's orbit is inclined by 5 degrees
80. When an object is close it looks bigger (has a large angular diameter) {far→small} just like Moon!

81. Tides are caused by the moons gravitational pull on the earth water due to the moon being close to us, HOWEVER, the sun has some affect, but the sun is farther but bigger then moon
82. When the Earth, Moon, and Sun are in a line → **Spring Tides** (higher than normal high tide and lower than normal lower low tide or a high tidal range)
83. When the Earth, Moon and Sun are at 90 degrees from each other we get small tidal rages → **Neap Tides**
84. Two high tides and two low tides per day on Earth that are across from each other(cyclic change)
85. **Inner four planets are rocky (terrestrial), outer 4 planets are gas giants (Jovian) page 15 bottom chart**
86. Venus is the hottest planet due to runaway greenhouse effect
87. Earth is the only one with liquid water on the surface
88. Asteroid- big rock in space, most are between Mars and Jupiter
89. Meteor –shooting star, rock burns up in our atmosphere, no atmosphere no burning up (moon)
90. Comet - Dirty Snowball, highly elliptical orbit; tail streams away from sun
91. Sun is a regular star, burns by converting Hydrogen into Helium (Nuclear **Fusion**) page 15 Top Chart!
92. **Increasing Size -- planet, star, solar system, galaxy, universe**
93. Galaxy - collection of billions of stars (solar systems)
94. **Big bang** – universe formed about 10-15 billion years ago from an explosion
95. **Proof of Big Bang** - Galaxies are moving away from us, the further the galaxy is from us the faster it is moving away
96. 2nd proof of big bang is the cosmic background radiation (noise from the big bang)
97. Evidence the galaxies are moving away are seen in Spectroscope as a **RED SHIFT, RUNNING AWAY**, which is longer wavelength. **(Not Blue Shift, Coming Towards)**
98. Our position in our Milky Way Galaxy is about 2/3 of the way from the center to the edge of a spiral arm
99. Age of universe is approximately 10-15 billion years old; solar system is only 4.6 billion
100. Light year- distance light travels in one year

Energy and Water Cycle
(ESRT Page 1 and 14)

101. Sun (stars) give off electromagnetic radiation. Radiation such as Radio Waves, UV, visible light, microwaves, X-Rays and Infrared are classified based on their wavelength page 14.
102. Incoming solar radiation (**INSOLATION**) can be absorbed, reflected, refracted, or scattered
103. The atmosphere (ozone) filters or blocks harmful rays such as Ultra Violet and Gamma page 14 top chart!
104. The most intense form or radiation received by earth is short wave VISIBLE LIGHT
105. Earth Radiates (Terrestrial Radiation) long wave **Infrared** = Heat Energy
106. A greenhouse works because short wave visible light can pass through glass, but longer wave infrared is radiated and does not have enough energy to pass through glass.
107. The greenhouse effect on Earth is similar except the greenhouse gases CO_2 (Carbon Dioxide), H_20 (Water Vapor, and CH_4 (Methane) act as the glass to trap infrared (they absorb it and then re-radiate it back to Earth). Therefore cloudy nights are warmer than clear nights.
108. Humans add CO_2 to the air by burning fossil fuels from cars, factories, and pollution
109. As CO_2 levels increase, the amount of infrared-trapped increases, temperature increases
110. If the Earth heats up, the ice caps will melt and sea level will rise
111**. Dark and rough objects absorb light like dark dirt or a forest**
112. **Light and smooth objects reflect light like ice and snow**
113. **Good absorbers of light are good radiators (black heats up and cools down quickly)**
114. **Specific heat** is the resistance to heating, the higher the specific heat the longer and more energy required to heat the object up. Water has a high specific heat and heats up and cools down slowly. Lead with a low specific heat changes temperature very easily from page 1 of ESRT!
115. Evaporation (L→G) adds energy to atmosphere (atmosphere gains 334 Joules/gram) from page 1 of ESRT
116. Use ESRT to see which process release and absorb energy from page 1 of ESRT
117. Water Cycle – process by which water circulates on Earth. Water enters the atmosphere by **TRANSPIRATION** (water given off by trees) and **EVAPORATION**. Falls back to the ground as rain

118. Water that lands on soil can **infiltrate** (sink in) or **runoff** (move over the surface of Earth)
119. **Infiltration** occurs when the land is **permeable**, **unsaturated**, **low slope**, ***not*** **frozen**
120. **Runoff** occurs when the land is **impermeable**, **saturated**, **steep slope**, **frozen ground**
121. **Porosity** is the percent of empty space in soil. **Grain size does not affect porosity** because in a sample with small particles the holes are small but there are many of them, with large particles the spaces are large and there are few of them. Unsorted samples have lower porosity
122. **Permeability** – how fast water flows through soil. As grain size increases, permeability increases
123. **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
124. **Zone of Aeration** – air between soil; Zone of Saturation – water between soil; water table is the boundary line that separates the two zones
125. **Conduction** - transfer of energy in solids through molecules vibrating and touching
126. **Convection** - transfer of energy in liquids and gases due to differences in density
127. **Radiation** - transfer of energy in waves; needs no medium (space) sun→earth or light bulb

Weather
(ESRT Page 12, 13, and 14)

128. Meteorologist - Weatherman –Weather, short term atmospheric conditions
129. 99% of earth's energy comes from the sun (1% from radioactive decay in the core)
130. **Air Pressure** or **Barometric Pressure** is caused by weight of the air (measured with **barometer**)
131. **Cold air is high pressure b/c the molecules are close together, and weight more than hot air**
132. **Hot air is low pressure b/c the molecules are far apart, and there is more room for water**
133. High pressure is cold and dry – Low pressure is warm and wet
134. **Dew Point Temperature** – the temperature at which the air is saturated (filled) with water and condensation occurs!
135. When the Air temperature is at or very close to the dew point temperature, then the air is full of water and rain is probable. When the air temp and dew point are far apart it is dry out.
136. Relative humidity is the % of water in the air; temp & dew point close = high relative humidity
137. Sling Psychrometer - has wet and dry bulb to measure dew point and relative humidity
138**. Finding dew point or Relative Humidity in ESRT, remember to use the difference between the wet and dry bulb**
139. The wet bulb is always colder than the dry bulb b/c evaporation is a cooling process
140. **Cloud Formation - warm moist air rises (less dense) cools and expands (adiabatic cooling) when it cools to the dew point temperature condensation occurs if condensation nuclei are present; then a cloud drop forms, cloud drop size increases and will fall as a rain drop (The Rain Dance)**
141. Isobars connect points of equal Barometric Pressure or Air Pressure
142. Isobars close together indicate a fast wind speed - far apart, calm winds
143. If the difference in pressure between two weather stations is high wind speed high
144. Winds are caused by the uneven heating of the earth, and Differences in Air Pressure. Instrument to measure wind speed is an **ANEMOMETER.**
145. **Winds blow from high pressure to low pressure**
146. Sea Breeze; daytime, land is hot (Low Pressure), ocean is cold (High Pressure) winds go H→L
147. Land breeze occurs at night and is the exact opposite of the conditions above
148. **Coriolis Effect – winds and ocean currents deflected due to Earth's Rotation**
149. Winds are deflected to the RIGHT in NORTHERN hemisphere and to the LEFT in SOUTHERN hemisphere.
150. **HOC (High, Outwards, Clockwise) and LICC, (Low, INWARDS, CounterClockwise)**
151. Air rises and makes clouds and rain, **low pressure**; Air sinks, cold air, dry, **high pressure**.
152. Precipitation = rain, sleet, hail, snow
153. Evaporation is greatest when it is HOT, DRY, and Windy -- also increase surface area
154. Condensation - water vapor turns into liquid water; releases 334 Joules/gram of heat energy

155. Master the station model, use your ESRT pg 13 and follow the guidelines exactly
156. Convert pressures 1001.0mb → 010 985.1mb → 851 112 → 1011.2 mb 985 → 998.5mb
157. Air mass - move slowly over an area take the characteristics of that area (Gulf of Mexico=mT)
158. **mT** – warm and wet forms over Gulf of Mexico, **cP** – cold and dry forms over central Canada
159. **mP** – cold and wet, cT – warm and dry, **cA** very cold and very dry
160. A front is the boundary line between two air masses (mainly between cP and mT air masses)
161. Behind a cold front is cold dry air; in front of a cold front is warm and wet air
162. In the middle of a cold and warm front is the mT air mass
163. **At the cold front air is very unstable, thunderstorm occur (short heavy rain)**
164. **In front of a warm front is long period and large area of drizzle**
165. **All weather in the U.S. moves from west to east or toward the northeast due to Southwesterlies from page 14 of ESRT.**
166. **Hurricanes** are very large, strong, low-pressure systems that can last for days. They get their energy from warm ocean water and lose power when they move over land
167. **To prepare for a hurricane** - prepare an escape route, learn first aid, tape or board up windows, store up food, water and candles
168. **The typical hurricane track** – they move northwest from the southern Atlantic Ocean toward Florida, and then they move northeast when they enter our prevailing south westerly wind belt from page 14 of ESRT.
169. **Tornadoes** - short lived (a minute or less) small in size – prepare by going to the basement

Climate
(ESRT page 14)

170. **Watershed** - geographic area where all the rainwater flows into a river then a body of water
171. Climate – long term weather for a location (based on temperature and rainfall)
172. **As latitude increases, temperature decreases; as elevation increases, temperature decreases**
173. **Coastal areas have moderate climates (cool summer, warm winter) b/c the proximity to water which has a high specific heat (doesn't change temperature much)**
174. **Windward side of mountains - Air rises, expands, cools to dew point, and then rains. Leeward side the air compresses and sinks, becomes dry and warm**
175. **Winds cause ocean currents** - Planetary Wind Belt and Ocean Currents in ESRT
176. Monsoons caused by differences in land and water temps (Seasonal Winds see # 113)

Weathering, Erosion, Deposition, and Landscapes
(ESRT page 6 top right also page 2 Landscapes)

177. Weathering is the breaking down of rocks into smaller pieces
178. **Physical Weathering** - breaking down of a rock into smaller pieces, best example is frost action
179. **Frost action** → water seeps in crack, freezes and expands; the climate needed is a wet one where the temperature alternates from above and below freezing
180. Rocks become smaller and rounder in a stream due to abrasion (rock chipping in river bed)
181. **RIVERS CARVE V-SHAPED VALLEYS**
182. **Chemical Weathering** - changes the chemical composition of the rock, best example is rust, also cave formation and acid rain
183. Best climate for chemical weathering is Warm and Wet (Humid)
184. **Soil** - mixture of weathered rock and organic remains (bugs) that covers bedrock
185. As organic material increases (bugs) soil thickness increases, Organics are on top layer of soil
186. Discharge is the amount of water in a stream (Stream Volume)
187. Velocity of a river determined by Slope and Discharge, as either increases, velocity increases
188. **In a river flowing in a straight line, water flows fastest in the center just below the surface**
189. **When a river flows around a curve, it is fastest on the outside edges**
190. **Outside curves in rivers are fast, erosion is dominant and the water is deep**

191. **On inside curves the water flows slowly, deposition is dominant and the water is shallow**
192. Smallest particles are carried by suspension, salt by solution, largest sizes bounce & roll
193. Glaciers form when yearly snowfall exceeds melting, continental form when the climate is cold
194. **GLACIERS CARVE U-SHAPVED VALLEYS**, deposit **Unsorted** and **Unlayered** sediments (**Glacial Till**), and scratch bedrock (S**triations**)
195. Other Glacier Landscape characteristics are numerous **kettle lakes**, and **Erratics** (large boulders)
196. Outwash plains (sorted & layered) form as a glacier melts and rivers carry small sediments away from the glacier
197. Glaciers advance from the north, they formed Long Island, left sand and gravel and flows like a river, fastest in the middle
198. The steep side of a drumlin indicates the direction the glacier advanced from (usually north)
199. Gravity is the force responsible for all the agents of erosion.
200. Evidence of gravity erosion is unsorted and angular rocks at base of cliff
201. Deposition –occurs when an agent of erosion slows down and drops sediments
202. As roundness increases, rate of Deposition increases; as density increases, rate of Deposition increases; as size increases, rate of deposition increases
203. Large particles have a high settling rate but a low settling time (careful with graphs on this)
204. Longshore drift moves sand along the beach in the direction of the ocean current
205. Landscapes are determined by the climate, bedrock, and geologic structures
206. Mountains have high relief, igneous or distorted metamorphic rock, built along plate boundaries
207. Plateau's are medium elevation, horizontal sedimentary rock, with river carved V-Shaped valleys
208. Plains are flat, low relief, sedimentary rock, and have meandering streams
209. Arid Climates-dry, steep slopes, -- Humid climates rounded hills, wet
210. Sand dunes have gentle slope on windward side, steeper on leeward side
211. Mountains create a radial drainage pattern, all water runs downhill away from the Mt. Pea
212. A random pattern occurs on plains similar to the Mississippi river (lots of meanders)
213. If uplift > erosion – elevation increases (uplift), if Erosion > uplift → elevation decreases

Rocks and Minerals
(ESRT pages are huge here, Rock pages on 6, 7, 16 and top of 1)

214. Minerals are **solid, naturally occurring, inorganic (not living) substances**
215. There are over 3000 known minerals but only 12 are commonly found
216. Most rocks are made from a few of those 12 minerals from 215.
217. Oxygen and Silicon ~ two most abundant elements in crust form a pyramid shape (**Si-O tetrahedron**)
218. Almost all rocks contain minerals (coal & limestone are exceptions, but they never ask about it)
219. **Mineral properties hardness, cleavage, shape - based on the internal arrangement of atoms**
220. **Color** is not a good way to ID a mineral b/c some minerals come in lots of colors like quartz
221. **Streak** is the powered form of a mineral, as found by using a streak plate
222. **Cleavage** is flat sides on a mineral, mineral break along planes of weak bonding vs. **Fracture** when a mineral doesn't break on clean flat surfaces.
223. Use the Rock Cycle Chart from page 6 of ESRT to see how each of the 3 rock types forms.
224. Calcite is the mineral that is shaped like a rhombus, bubbles in acid, and double refraction from page 16.
225. The **origin of the rock** determines if it is a **SED rock, IGN rock or MET rock**
226. Igneous rocks form from the solidification or crystallization of magma or lava
227. **Texture** or crystal size in igneous rocks is determined based on **rate of cooling due to environment**.
228. **Fast cooling → glassy or fine texture (small)**; **slow cooling→ coarse crystals (big)**
229. Clastic Sedimentary rocks are classified based on grain size (shale vs. sandstone)
230. Be able to determine sediments based on grain size 0.0007 are silt and 0.008 are sand
231. Sedimentary Rocks form 3 ways, Compaction & Cement, Organically, Chemically
232. Chemically formed Sedimentary rocks form from evaporating seawater, leaves behind evaporates
233. **SEDIMENTARY ROCKS ARE THE ONLY ROCKS WITH FOSSILS IN THEM! ! !**

234. Sedimentary Rocks are found as a thin layer covering the continents; beneath this thin layer are metamorphic rocks and igneous rocks which make up most of the crust.
235. **Metamorphic rocks** form from **heat and/or pressure**. Fossils are seldom found b/c they are distorted.
236. Key words for **metamorphic** rocks are; foliation, re-crystallize, distorted structure, increased density
237. Contact metamorphic rocks are found between igneous intrusions and sedimentary rocks
238. According to ESRT p7 shale turns into slate, sandstone into quartzite, limestone into marble
239. Nonrenewable resources include fossil fuels (coal, petroleum, natural gas) and metals

Plate Tectonics and Earthquakes
(ESRT pages 5, 10, 11, sometimes the centerfold)

240. Earthquake is the sudden movement along a fault, usually happens at plate boundaries
241. **P waves** are **fastest** waves, can go through **anything**, they go faster through more dense layers
242. **S waves** are **slowest**, move in S motion, **can not go through liquids** (outer core)
243. P Waves are compression waves ( ) S Waves are transverse waves ( ) pg 11.
244. Seismic data allows scientists to determine the thickness of earth's layers and liquid outer core
245. 1 seismic station is used to determine the distance to the epicenter (Not Direction)
246. Use time lag between the arrival of P and S waves to get distance to Epicenter!
247. A minimum of 3 are needed to determine the epicenter location (Big circles → far distance)
248. Ocean Crust - High Density (in ESRT pg 10), Young Age, Thin, made of Basalt
249. Continental Crust - Low Density, Old Age, and Thick (think Mt. Everest) made of Granite
250. The core of the earth is thought to be Iron and Nickel based on Meteorite data (not provened?)
251. Most Earthquakes and Volcanoes are found together along Plate Tectonic Boundaries
252. Tsunamis (tidal wave) caused by underwater earthquake
253. **Proof of Continental Drift** - Continents fit together, fossils/rocks/mountains. All match up along coasts
254. **Divergent Boundary** (Ridge, Spreading Center) where magma comes up through the sea floor
255. New ocean floor is created at mid ocean ridges. Crust is hottest at ridges (rising magma) page 5.
256. **Age of rock increases as distance from ridge increases** (youngest at ridge)
257. **Convergent Boundary** (Continent-Ocean), the more dense plate (ocean) subducts beneath the continent plate. Proof of this is how the depth of earthquake foci increases as you move inland
258. Two continents converge → Mountains form - Mt. Everest (Himalayas)
259. Transform Boundary - Plates slide past each other → San Andreas Fault
260. **Hot spot** - mantle plume through the middle of a plate, like Hawaii or Iceland
261. Plates move due to **Convection Currents** in the upper Mantle (Asthenosphere)
262. Magma rising causes divergent boundaries, sinking magma causes convergent boundaries

History of the Earth
(Centerfold in ESRT (pg. 8-9) and radioactive decay box on pg 1)

263. Oldest rocks are on the bottom unless the rocks have been overturned (**Law of Superposition**)
264. Any event that crosses another layer is younger than it (faults, folds, intrusions)
265. Need to observe contact metamorphism to determine the relative age of layers (burns it-younger). If a rock layer has tick marks on it, it is older than the intrusion
266. Be able to tell the difference between folding, faulting, and tilting of rock layers
267. Fossils in mountains prove crustal uplift occurred (an uplifted sea floor)
268. Marine fossils indicate the area was once covered by water
269**. Index fossils** are found all over (**widespread**) and only lived **for a short geologic time period**
270. **Earth is 4.6 billion years old** (that is when the sun and solar system formed)
271. Precambrian Time Period is 4 billion years long (only simplest life forms existed)

[Cen-Mez-Pal---------- Precambrian part of Geologic Time Scale----------]

272. Eras and Time periods marked by extinctions and changes in life forms
273. Sedimentary Rocks are ALWAYS deposited in horizontal layers and underwater.

274. Sedimentary rocks found at high elevations are proof of crustal uplift
275. Unconformity -ancient erosional surface - represents missing rock layers - time gap. Also seen as the line that separates crazy layers from straight layers.
276. Volcanic ash - good time marker because it spreads out quickly over a large area (like #130)
277. **Radioactive dating** - compare percentage of unstable atoms to stable atoms to get age of rock
278. **Half Life** - the time it takes for 1/2 the unstable atoms to decay into stable atoms
279. **HALF LIFE NEVER CHANGES NO MATTER WHAT!** Radioactive elements decay forever!
280. If a rock contains 50% unstable and 50% stable - 1 half life has past (25%-75% - 2 Half Lives)
281**. Carbon dating is used for things that were once living and less than 50,000 year old**
282. Asteroid Impacts are thought to cause mass extinctions (dinosaurs died 65 million years ago)

13 Must-Know Earth Science Facts

1. If you cut an object into pieces, you don't change its density.

2. The altitude of Polaris equals your latitude.

3. The Coriolis Effect deflects winds and currents to the right in the N. Hemisphere.

4. Condensation: water vapor changing into liquid water.

5. Boiling/evaporation: liquid water changing into water vapor.

6. Planets take longer to revolve around the sun the further they are from the sun.

7. Low Pressure: wet weather (warm).

8. High Pressure: dry weather (cool).

9. Weather moves west to east.

10. Porosity does not depend on particle size.

11. The Earth is closest to the sun in Winter.

12. Minerals have different properties because of the internal arrangement of atoms.

13. Marine (sea) fossils on mountain tops indicate that the land has been uplifted.