Earth Science Regents Review

The following is a list of the important concepts that you will need to know for the upcoming Regents exam in Earth Science. Use this list as a review guide. Vocabulary is underlined and bold. *If you don't know what a word means LOOK IT UP!*

Unit One: Observation, Measurement, and Graphing and Change

* **Observations** use the senses. **Inferences** are interpretations based on observations. Anything in the future or the distant past is an inference.

- * A uniform substance always has the same density
- * As pressure increases, density increases.
- * Most substances are most dense in the solid state, least dense in the gaseous state.
- * Water is most dense (smallest volume) at 3.98° C, when it is a liquid.
- * Water expands when it freezes.
- * As temperature increases, density decreases.
- * Direct Relationship = both variables increase or decrease.
- * Inverse Relationship = one variable increases while the other decreases.
- * <u>Scalar</u> values: magnitude (size) only.
- * <u>Vecto</u>r values: magnitude & direction (wind & magnetic fields)
- * Most environmental changes are cyclic.
- * Change occurs at *interfaces* and always involve energy transfers.
- * **Dynamic Equilibrium** = changes are occurring, but are balanced, so overall conditions stay the same.

Unit Two: Astronomy

- * <u>Universe</u>: everything. Began with <u>big bang</u> approximately 12 billion years ago
- * Evidence for big bang: Expansion (red shift) & cosmic background radiation.
- * Galaxies: collections of billions of stars. Our galaxy the Milky Way
- * **Stars**: powered by **hydrogen fusion**. <u>Hydrogen is the fuel</u>. <u>Helium is the product</u>.
- * <u>Star color depends on temp</u>. Hot = blue. Red = cool. Sun = yellow (medium)
- * **<u>Planets</u>**: non-luminous. Orbit stars. The closer to the star, the <u>faster the orbital velocity</u> and the <u>shorter the period of revolution</u>.
- * <u>Moons</u>: orbit planets.
- * Luminosity: Brightness independent of distance.
- * <u>Meteor</u>, <u>asteroid</u>: Space rocks.
- * Comet: Ice, dust, & rock in orbit around sun
- * <u>Nebula</u>: cloud of gas & dust
- * Supernova: exploding star.
- * Orbits are <u>ellipses</u>. Know formula.
- * Keppler's law of 'equal swept area in equal time'

Unit Three: Measuring the Earth

* The true shape of the Earth is an **<u>oblate spheroid</u>**.

- * The best model of the Earth's shape is a sphere.
- * To determine the earth's circumference, we need the altitude of the sun at two locations and the distance between those locations.(Eratosthenes)
- * The <u>altitude</u> of <u>Polaris</u> equals your latitude.(Northern Hemisphere)
- * <u>Latitude</u> lines go east west. (Equator = 0° Lat., Poles = 90° Lat.)
- * Maximum Latitude is 90°.
- * Longitude is based on observations of the sun (solar noon).
- * Longitude lines go north south. (**<u>Prime Meridian</u>** = 0° Long. through Greenwich, England)
- * Maximum Longitude is 180°.
- * <u>Atmosphere</u> = gasses, <u>Hydrosphere</u> = water, <u>Lithosphere</u> = rock (crust)
- * Isolines connect points of equal value.(Isotherms, Isobars, Contour Lines)
- * Closer isolines mean a steeper gradient.

Unit Four: Earth Motions

- * The Earth **<u>rotates</u>** west to east at a rate of **<u>15° per hour</u>** (one rotation in 24 hours).
- * The Earth <u>revolves</u> counterclockwise around the sun (one revolution in 365 1/4 days or about 1° per day).
- * All celestial objects appear to move to the west.
- * <u>Geocentric</u> = Earth centered / <u>Heliocentric</u> = sun centered.
- * Evidence that the Earth rotates: Foucault Pendulum appears to change direction.
- * Coriolis Effect deflects to the right in the northern hemisphere.
- * The sun is never, ever, ever directly overhead in New York State !
- * Summer <u>Solstice</u> June 21 16 hours of daylight sun rises north of due east sun is directly overhead at the <u>Tropic of Cancer</u>, 23 1/2 degrees north latitude.
- * Winter Solstice December 21 8 hours of daylight sun rises south of due east, sun is directly overhead at the Tropic of Capricorn, 23 1/2 degrees south latitude.
- * <u>Equinoxes</u> March 21 (vernal) and September 23 (autumnal) 12 hours of daylight sun rises due east sun is directly overhead at the equator.
- * Earth is closer to the sun in winter December. (perihelion)
- * The equator always has 12 hours of daylight.
- * The closer a planet is to the sun, the faster it orbits.
- * Planets appear to go backwards (retrograde motion) as the Earth passes them in space.
- * Cycle of moon phases = 29.5 days. One lunar revolution around Earth = 27 1/3 days

Units Five and Six: Energy and Insolation

- * <u>Kinetic Energy</u> = energy of motion, increases with velocity.
- * **Potential Energy** = stored energy, increases with height (energy of position).
- * Good <u>absorbers</u> of energy are also good <u>radiators</u> of energy.
- * Dark, rough surfaces absorb more energy than light, smooth surfaces.
- * <u>Conduction</u> = energy transferred from molecule to molecule (solid, liquid, and gas) by collisions.
- * <u>Convection</u> = energy is transferred by moving molecules (liquid and gas) due to density differences.
- * <u>Radiation</u> = energy is transferred by waves, needs no medium (vacuum, space).
- * Energy moves from Source to Sink.
- * <u>Specific Heat</u> = energy needed to raise 1 gram of a substance 1° Celsius.
- * Water has the highest specific heat.
- * <u>calorie</u> = specific heat of water.
- * Temperature does not change during a phase change. (Latent Heat)
- * Know the water phase change graph.

Unit Seven: Weather

- * Bodies of water moderate temperatures.
- * Atmosphere is heated by *infrared* energy *re-radiated* from the Earth.
- * Atmosphere gets moisture from evapotranspiration.
- * The more moisture in the air the slower the **evaporation** rate.
- * Warm air is less dense, Moist air is less dense.
- * <u>**Convection**</u> = air movement due to differences in density (and pressure).
- * Wind blows from high pressure to low pressure. (Note: Coriolis effect)
- * Winds are named for the direction they come from.
- * As altitude increases: pressure decreases, temperature decreases.
- * <u>Adiabatic</u> Temperature Change = results from a change in pressure direct relationship
- * Expanding gasses cool, compressing gasses warm.
- * Warm air can hold more water than cold air.
- * <u>Condensation</u> = water vapor turning into liquid water.
- * <u>**Relative Humidity</u>** = % of moisture in the air compared to the air's capacity.</u>
- Warm air = greater capacity, cool air = smaller capacity.
- * <u>**Dew Point</u>** = temperature at which air becomes saturated (R.H. = 100%).</u>
- * The smaller the difference between air temp. and Dew Point = the greater the chance of precipitation.
- * Know how to find Dew Point and Relative Humidity.
- * Condensation Nuclei = surfaces on which condensation can occur (dust, pollen).
- * <u>Cloud</u> = collection of water droplets too small to fall.
- * **<u>Precipitation</u>** = any form of water that falls from the atmosphere.
- * <u>Snow</u> only precipitation that does not begin as a liquid.
- * <u>Sublimation</u>: solid to vapor or vapor to solid without going through the liquid phase.

* <u>Air masses</u> are classified based on their source region.

- * High pressure systems = cool and dry, Low pressure systems = warm and moist.
- * Weather in the US moves from SW to NE or W to E (storm track)
- * Cold fronts are faster than warm fronts.
- * Wind direction around Lows (counterclockwise, towards the center) and Highs (clockwise away from the center) in Northern Hemisphere.
- * Know how to read <u>Station Models</u>, <u>isotherms</u> and <u>isobars</u> on a weather map.

Unit Eight: Groundwater

- * Infiltration depends on permeability, permeability depends on porosity.
- * **Porosity** is independent of particle size. (unless particles are mixed!!!)
- * As particle size increases, permeability increases, <u>capillarity</u> decreases.
- * Ep (potential evapotranspiration) depends on temperature.
- * <u>Climates</u> are determined by P/Ep ratio.
- * Aquifer: layer of porous rock or soil
- * Watertable: Interface between zones of aeration & saturation.
- * Evapotranspiration: Combination of evaporation & transpiration

Units Nine and Ten: Weathering, Erosion and Deposition

- * <u>Weathering</u> = breakdown of rock
- * Rate of weathering depends on climate, particles size, and mineral composition.
- * Smaller particles have more *surface area*.(weather faster)
- * Mature soils have several identifiable layers (horizons).
- * Most **sediments** are "transported" sediments.
- * Some soils are **residual**: formed in place from the bedrock below.
- * Sediments have characteristics that identify their transporting agent.
- * Gravity is the driving force behind most erosion.
- * Running water is the most dominant **<u>agent</u>** of erosion on Earth.
- * <u>Stream velocity</u> depends on <u>slope</u> and <u>discharge</u> and shape of channel.
- * Streams transport sediments in <u>solution</u>, <u>suspension</u>, and <u>rolling</u> (<u>saltation</u>).
- * In a straight section of stream, velocity is greatest in the middle just under the surface.
- \ast In a curved section of stream, velocity is greatest on the outside just under the surface.
- * Streams: sediments are *sorted*, *round* and *smooth*, and form *V-shaped valleys*.
- * Glaciers: sediments are unsorted, striated (scratched), and form U-shaped valleys.
- * Sorting = separation of particles during deposition based on size & density & shape.
- * The largest, roundest, densest particles are deposited first.

Unit Eleven: The Rock Cycle

- * Mineral physical characteristics depend on their internal arrangement of atoms.
- * Physical properties of minerals = color, streak, luster, hardness, cleavage, crystal form
- * 90% of <u>lithosphere</u> is composed of only 12 minerals.
- * <u>Sedimentary</u> Rocks can be <u>clastic</u> (particles), chemical (<u>evaporite</u>), or <u>organic</u> (shells) found in <u>strata</u>, flat layers <u>only type of rock that contains fossils</u>
- * Igneous Rocks: intrusive (plutonic) = below surface, cooled slowly = large crystals extrusive (volcanic) = above surface, cooled quickly = small (or no) crystals
- * Large crystals = $\underline{coarse grain}$ (texture). Small = $\underline{fine grain}$. No crystals = \underline{glassy}
- * <u>Metamorphic</u> Rocks: changed from <u>heat and pressure</u>, can be <u>Regional</u> or <u>Contact</u>. May show **banding**, <u>distortion of structure</u>, <u>mineral allignment</u>
- * A rock's characteristics indicate how (and where) it was formed.
- * Sedimentary rocks are found as a <u>thin veneer</u> over large areas.
- * Non-sedimentary rocks are usually found in areas of earthquake and volcanic activity.
- * Know the Igneous, Sedimentary, and Igneous Rock Schemes in the Reference Tables!
- * Know how to use the rock cycle chart in the reference tables!

Unit Twelve: Crustal Change

- * Earthquake Zones = Volcano Zones (both occur in specific zones = plate boundaries)
- * Boundaries: Convergent, Divergent, Transform
- * <u>Convection</u> cells in the earth's mantle (<u>Athenosphere</u>) move the plates.
- * Crust created at mid ocean ridges (sea floor spreading)
- * Crust is being destroyed at ocean trenches (subduction).
- * <u>Fault</u> = zone of weakness in crust
- * **Focus** = point of origin of an earthquake
- * **<u>Epicenter</u>** = point above focus on surface of earth.
- * Energy from earthquake is released in <u>Seismic waves</u> (recorded in a <u>seismogram</u> by a <u>seismograph</u>)
- * p-waves: faster than s-waves travel through solids, liquids, and gasses
- * <u>s-waves</u>: slower travel only through solids
- * We need info from three seismograph locations to find the epicenter.
- * Seismic data provides a model for the inside of the earth.
- * <u>Moho</u> = bottom of crust (interface) where density suddenly changes
- * <u>Shadow zone</u> = zone where no P or S waves received from a particular quake because waves are refracted.
- * Continental crust: thick granite. Sea floor crust: thin basalt
- * Density, temperature, and pressure all increase with depth.
- * Geosynclines = areas where crust appears to sink under weight of sediment.
- * **Isostasy** = earth's crust in equilibrium
- * Know how to use the Travel Time Chart in the Reference Tables !

Unit Thirteen: Geologic History

- * <u>Original Horizontality</u> = rock strata are deposited in horizontal layers.
- * Evidence of crustal movement: tilting, folding, faulting
- * Principle of <u>Superposition</u> = profiles are built from the bottom up. (bottom = older)
- * Intrusions and faults are relatively younger than the rock they are in.
- * <u>Unconformity</u> = buried erosional surface
- * Index fossils and Volcanic ash layers are good time markers.
- * Good time marker fossil: species existed briefly but was widespread.
- * **<u>Radioactive decay</u>** = breakdown of **<u>isotope</u>** into a more stable element.
- * The rate of radioactive decay is constant. (unaffected by heat and pressure)
- * <u>Half life</u> = time period in which one half of the remaining amount of isotope decays.
- * <u>Uranium-235</u> is used to date really old <u>rocks</u>.
- * Carbon-14 is used to date recent organic material.
- * Know how to use the Geologic Timescale in the Reference Tables !

Unit Fourteen: Landscapes

- * Landscape characteristics = topography = relief (elevation)
- * Landscape Regions are classified based on <u>hillslopes</u>, stream patterns, and soil <u>associations</u>.
- * There are three types of landscape regions: mountains, plateaus, and plains (lowlands).
- * Know how to use the NY State maps in the Reference Tables !
- * $\underline{\text{Uplift}}$ = constructive force, $\underline{\text{leveling}}$ (erosion) = destructive force.
- * Uplift and leveling may be in dynamic equilibrium but one is usually dominant.
- * <u>Climate</u> can affect landscape, landscape can affect climate.
- * Wet climate = rounded features (NYS). <u>Arid</u> climate = angular features (American SW)
- * Type of bedrock (<u>resistance</u>) can affect landscape.

MOST IMPORTANT:

There are 16 pages of earth science reference table. You **must** be **thoroughly familiar** with what's in them so that when you are asked a question, you will know to look for the answer. If you don't know that the answer is in the tables, you won't look for it! You must also know **how to use** the graphs and charts in the tables.