Review of Major/Important topics discussed
Earth Science

This might help you study. Note that the relative amount of space given a topic here will not necessarily have any bearing as to how important it will be for the test. This list is given to you as a public service. The absence of something on this list *does not necessarily mean* that it won't appear on the test.

- Electromagnetic Radiation
  - $E = h\nu = \frac{hc}{\lambda}$
  - $c = \lambda\nu$
  - $c = 3 \times 10^8 m/s$
  - $h = 6.6 \times 10^{-34} J \cdot s$
  - The colors comprising visible light, in order of increasing frequency and energy (and decreasing wavelength) are red, orange, yellow, green, blue, indigo, and violet.
  - Microwaves, radio waves, and infrared radiation has lower energy (and longer wavelength) than the color red.
  - Gamma rays, x-rays, and UV has higher energy (and shorter wavelength) than the color violet.
  - Electromagnetic radiation is transmitted in the form of transverse waves.
- Scientific Notation – Know and be able to use the following with ease.
  - $(A \times 10^B) \times (C \times 10^D) = (A \times C) \times 10^{(B+D)}$
  - $\frac{a \times 10^b}{c \times 10^d} = (a/c) \times 10^{(b-d)}$
  - $(ab)^c = a^c \cdot b^c$
  - $X^{-a} = \frac{1}{X^a}$
- Overview of the Universe
  - Know the relative sizes and basic properties of galactic clusters, galaxies, star clusters, multiple-star systems, planets, asteroids, and comets

  - Know how Mercury, Venus, Earth, and Mars are fundamentally different from Jupiter, Saturn, Uranus, and Neptune.

- Stellar Evolution / Fusion / HR Diagram
  - Have a general understanding of the competing forces that exist during stellar genesis, and explain if the forces tend to pull the star closer together or drive it apart.
  - Know the approximate composition of the universe by element.
  - Be able to read and correctly interpret an H-R diagram. Understand the main sequence, how stars evolve off of the main sequence, and be able to describe the ultimate fate of most stars.

- Spectroscopy
  - Be able to describe the basic process by which we come to view spectral lines in terms of the electron's motion in Bohr orbits around a nucleus.
  - Understand the difference between a spectral line and a spectral band.
  - Understand the Hydrogen spectrum.

- Redshift / Blueshift – Be capable of explaining the concepts, and inferring relative motion from an original and shifted spectrum. If given the equation $\lambda = \lambda_0(1 \pm \frac{v}{c})$, identify shifted wavelength given λ_0 and v and/or identify v given λ_0 and λ.

- Blackbody Radiation
  - Know the equation for the surface area of a sphere – $4\pi R^2$
  - $\sigma = 5.67 \times 10^{-8}$ J/(s m^2 K^4)
  - Know the equation for the energy flux from a perfect blackbody $\Phi = \sigma T^4$, and report results with proper units.
  - Be able to define and describe a blackbody.
  - Know the ranges of validity for the Rayleigh-Jeans law and Wien's law.
  - Know and understand Wien's displacement law – $\lambda_m T =$ constant. (You do not need to memorize this constant).

- Stefan-Boltzmann Law
  - Understand and be able to conceptually trace the process of going from $\Phi = \sigma T^4$ to identifying the equilibrium temperature of another object nearby due to radiative balancing.
  - Be able to calculate the solar constant for assorted astronomical bodies, given sufficient information about their radii, distance from other objects, and temperature of other objects nearby.
- Albedo
  - Be able to define and describe albedo
  - Be able to calculate the albedo of a composite body made up of elements with known individual albedos.
  - Be able to modify the equation for Φ in order to account for an object not being a perfect blackbody.
- Scattering
  - Be able to identify the three types of scattering, and determine which formalism is appropriate given the size of incoming radiation and the scattering object.
  - Be able to define and understand the purpose of the size parameter $x = 2\pi r/\lambda$.
  - Be able to explain the Polarization process, and know which values of the size parameter cause polarizing scattering.
  - Know that Rayleigh scattering is proportional to $1/\lambda^4$.
  - Be able to explain (in detail) why the sky is blue. Also, be able to explain why it isn't violet.
- Orbital Mechanics
  - Be able to paraphrase Kepler's three laws of planetary motion.
  - Know that all orbits are elliptical.
  - Know that a circular orbit is just a special case of an ellipse.
  - Convincingly demonstrate that you understand that no object orbits another object, but rather that each object orbits the center of mass between the two objects.

  - Understand what the word "precession" means.

- Earth's Orbit
  - Understand and be able to define the term "insolation".
  - Be able to explain why we have summer in July when we are closest to the sun in January.
  - Understand that we are spinning while orbiting.
  - Understand and know the difference between a sidereal day and a mean solar day.

- The Moon
  - Be able to describe the moon's orbit.
  - Have a general understanding of "phases"
  - Understand how tides are generated.

- Assorted subtopics
  - Be able to approximate calculations involving scientific notation without the aid of a calculator.
  - Be able to solve equations and include proper units.
  - Be able to make intelligible comments on the nature of how electromagnetic radiation and matter interact (via various methods of scattering/polarization, spectroscopy, absorption, reflection, etc.)
  - Be able to make critical, logical, and coherent statements about things you do not yet have experience with by using the concepts and ideas introduced in this course in a properly reasoned manner.
  - Evaluate the validity of scientific statements by applying the principles and ideas used in class.
  - Other