**Week 6**

1. Recognize that "color" is all about the movement of electrons from orbital to orbital.
2. Give a thumbnail sketch of why objects are colored, including orbital gaps, HOMO, LUMO, and the energy range of visible light (eV).
3. Describe the relationship between the color an object appears to be, and the wavelengths of light it absorbs and reflects.
4. Describe key characteristics of those parts of sunlight that are not visible to human eyes.
5. Describe the directions in which light can accelerate charged particles.
6. From the energy of a photon (eV), calculate the wavelength () and frequency () of the corresponding light wave.
7. Explain what is meant by the phrase "planetary radiative balance," and the component of this radiation (shortwave or longwave?) that anthropogenic greenhouse gases have altered to throw the planet out of radiative balance.
8. Given conversion factors, convert values from one unit to another.
9. Solve algebraic relationships for a desired quantity and figure out the units of the resulting value.
10. In a Global Energy Flows diagram, show where shortwave and longwave radiation appear.

**Week 7**

1. Describe Pauling's electronegativity scale, and use it to predict the coloration of an electrostatic potential map of a molecule, and the partial charges likely to be assigned to atoms in the molecule.
2. Predict kinds of motion that are likely to be IR-active and IR-inactive.
3. With the help of an absorption spectrum (like the "Radiation Transmitted by the Atmosphere" figure), describe and rank the contributions of the top three greenhouse gases on Earth, and explain the importance of the atmospheric window.
4. Convert wavenumbers () to wavelengths (), and back, for absorption features in an IR absorption spectrum.

**Week 8**

1. Use unit analysis to figure out the units of a multi-factor calculation (like the energy of a mole of photons from the wavelength of light).
2. With the help of a sketch or two, describe how cross-Coulombic attractions explain why atoms with unfilled shells tend to form covalent bonds.
3. Based on approximate values for the relevant bond strengths, explain why the energy of a molecular collision will likely break apart atoms that are merely "stuck" together, but not atoms that are bound by a covalent bond.
4. Given a molecular formula like "C2H4", use what you know about the number of bonds preferred by each atom to construct a molecular structure (i.e., the "valence method"); analyze such structures in terms of bond orders between atoms.
5. Add electrons to a given molecular structure to produce a Lewis structure.
6. Describe the correlation between bond order, bond strength, and bond length.
7. Predict the number of unpaired electrons resulting when covalent bonds break.
8. Show how bond strength appears in a reaction progress diagram.
9. Use Spartan to calculate bond strengths of covalent molecules.

**Week 10**

1. Given a Lewis structure, identify whether atoms do/don't satisfy the octet rule, and what the formal charges on the atoms are.
2. Explain how the magnetic properties of a substance (like O2) might make you favor certain resonance forms over others.
3. Give an example of a molecule having an allylic lone pair, and sketch the alternative resonance form you'd predict because of it.
4. Predict the consequences of resonance-averaging for bond orders, bond distances, and formal charges.
5. Predict the net charge of the molecule, given formal charges of all the atoms.
6. Describe Einstein's idea about the relationship between the intensity of light (e.g., in Watts) and the rate at which photons are emitted from a glowing object.
7. Given an absorption spectrum of photosynthesizing pigments (like chlorophyll and carotenoids), predict colors of light that would be more or less effective at promoting photosynthesis.
8. Describe key principles that you might use to predict how climate change could affect the rate of photosynthesis, including (light intensity and clouds, the effects of higher CO2 levels, and temperature).
9. Identify which elements in the periodic table one can reasonably expect the “octet rule” to apply to.
10. Describe where in the atmosphere the ozone layer exists.
11. Describe some basic ideas about stratospheric ozone: how it's responsible for the stratosphere getting warmer as you go up in a balloon, and chemical processes that led to ozone depletion (the "ozone hole") in the past.

**Week 11**

1. Sketch hot and cold blackbody curves (intensity as a function of) and explain how you know which is which.
2. Sketch how the total energy emitted by a blackbody varies as a function of temperature, and use the Stefan-Boltzmann expression to make quantitative predictions.
3. Describe what albedo is, and how you measure it in the laboratory.
4. Explain some key differences between shortwave and longwave radiance (e.g., what the wavelengths are, and whether or not you can see it).
5. Use the principle of radiative balance to describe how the earth is thought to respond automatically to changes in energy flows.
6. Use the Simple Radiative Balance (SRB) model to (a) calculate the temperature when the anthropogenic back radiation changes, and (b) calculate changes in albedo needed to offset a given anthropogenic back radiation.