Homework #6 GRADE SHEET
AS101 Summer 2006
Dr. Withers

Assigned: 2006.06.01
Due: 2006.06.02, start of class

1) Read Chapter 5

2) What is a photon and what are the properties and characteristics of a photon?

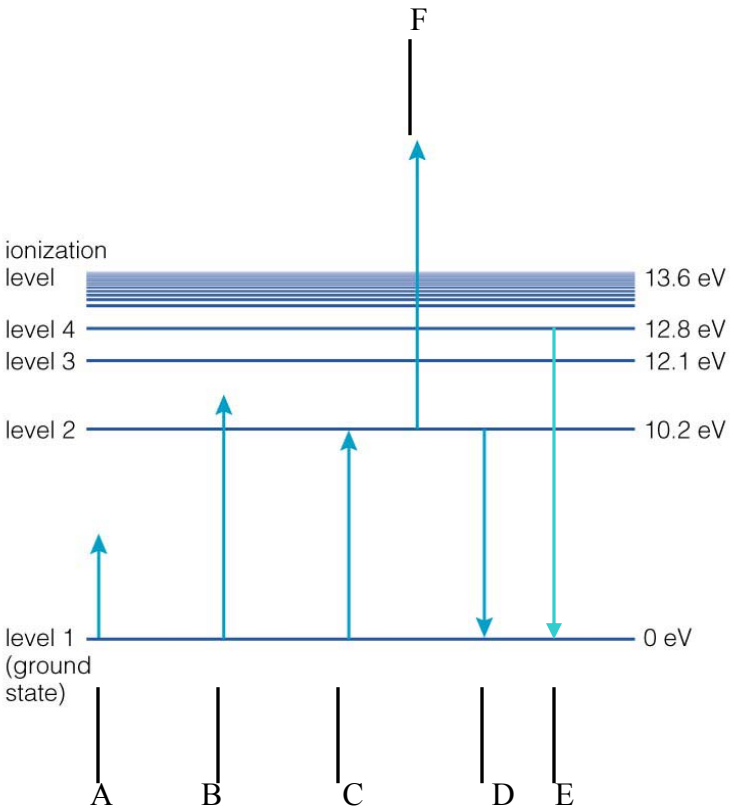
A photon is a "package" of light	10 points
Mention of at least three of speed, frequency, wavelength, and energy	5 points
Statements that $c = \lambda \times f$ and $E = h \times f$	5 points
Statement that a photon has properties of both particles and waves	5 points

3) Blue light has a higher frequency than red light. Is the wavelength of blue light greater than, the same as, or less than the wavelength of red light? Is the energy of one photon of blue light greater than, the same as, or less than the energy of one photon of red light?

15 points for one correct statement, 25 points for two correct statements.
The wavelength of blue light is less than the wavelength of red light
The energy of one blue photon is greater than the energy of one red photon

4) Is a star whose emission spectrum peaks in the infra-red hotter, cooler, or larger than our Sun? Will each square metre of this star's surface emit more or less photons whose wavelength is 550 nm than the Sun?

Cooler, because hotter objects have a shorter wavelength of peak emission, infra-red wavelengths are longer than visible wavelengths, and the Sun's peak emission is at visible wavelengths.
Less, because cooler objects emit fewer photons per square metre than hotter objects at all wavelengths.
10 points for each correct one-word answer.
5 points if each answer is accompanied by an explanation.



5) This picture shows labelled transitions that represent an electron moving between energy levels in hydrogen. Explain your answers to each of the following questions:
i) Which transition represents an atom that absorbs a photon with 10.2 eV of energy?
ii) Which transition represents an atom that emits a photon with 10.2 eV of energy?
iii) Which transition represents an electron that is breaking free from the atom?
iv) Which transitions are not possible?
v) Does transition E represent emission or absorption of light? How does the wavelength of the photon in transition E compare to that of the photon involved in transition D?

i) C. The electron is gaining energy. To conserve energy, a photon with the appropriate amount of energy must be absorbed.
ii) D. The electron is losing energy. To conserve energy, a photon with the appropriate amount of energy must be emitted.
iii) F. The electron goes beyond the ionization level, with the excess energy from the photon converting into kinetic energy of the free electron.
iv) A and B. They do not begin and end at allowed energy levels within the atom. Transition F is allowed because all energies beyond the ionization level, outside the atom, are allowed.
v) Emission. The photon in E has a higher energy, higher frequency, and shorter wavelength.
5 points for each correct letter answer for maximum of 25 points. 5 points deducted from this points score if the answers are not explained. (NOT 5 points deducted for each answer that lacks an explanation!)