

**Total points: 100**  
**ATOC 1060-002 Homework #2**  
**Due Thursday September 30, 2010**

**INSTRUCTIONS: Make sure that you answer all of the questions for maximum credit. Use appropriate units on all numerical answers and answer non-numerical questions with complete sentences. Please write neatly when completing this assignment – if we can't read your answer you will not get credit for it.**

1. 1a) Which one has higher energy, a photon of x-ray or a photon of UV? (3pts)  
Explain your answer using the relationship between the energy of a photon ( $E$ ) and the wavelength ( $\lambda$ ) of electromagnetic radiation. (5pts)

1b). If the air temperature is 25°C, how much it is in Fahrenheit? How much it is in Kelvin? (6pts)

2. Radiation laws

The mean temperature of the Earth's surface is about 15°C; the mean temperature of yourself is about 37.5°C; and the temperature of the Sun is about 5500°K. Assume radiation of the Earth, yourself, and the Sun can be viewed as blackbody radiation.

2a) At what specific wavelength (in  $\mu m$ ) does the Earth radiate its maximum (peak) energy? (5pts) Is this wavelength in the infrared or visible light range? (3pts)  
(Accurate to 2 decimal points)

2b) At what specific wavelength (in  $\mu m$ ) do you radiate your peak energy? (5pts) Is this wavelength in the infrared or visible light range? (3pts)  
(Accurate to 2 decimal points in your calculation)

2c) At what specific wavelength (in  $\mu m$ ) does the Sun radiate its maximum (peak) energy? (5pts) Is this wavelength in the infrared, visible light, or UV range? (3pts)  
(Accurate to 2 decimal points in your calculation)

2d) Use Stefan-Boltzmann Law to demonstrate that flux of the Sun's radiation is much larger than that of the Earth. (5pts)

3. Explain why O<sub>2</sub> and N<sub>2</sub> are not greenhouse gases. (5pts)

4. List all atmospheric greenhouse gases that are most important to the modern global warming. (6pts) What is the CO<sub>2</sub> concentration in 2008? (2pt)

5. Explain why atmospheric temperature decreases with altitude in the troposphere, but increases with altitude in the stratosphere. (10pts)

6. How do the low, thick stratus clouds affect the Earth's surface temperature? (4pts) How do the high and thin cirrus clouds affect the Earth's surface temperature? (4pts) What is the major difference between the effects of the cirrus clouds and stratus clouds? (2pts)
7. Describe the water vapor feedback loop in Earth's climates system. (5pts) Is this a positive or negative feedback loop, and why? (3pts)
8. Describe the snow and ice albedo feedback loop in Earth's climates system. (5pts) Is this a positive or negative feedback loop, and why? (3pts)
9. Describe the IR flux/temperature feedback loop in Earth's climates system. (5pts) Why is Earth's climate stable despite some destabilizing, positive feedbacks? (3pts)