Homework Question Set #1
NATS 101, Section 13
Fall 2010

The following questions cover Lectures 1-6. Provide thorough, complete answers for maximum credit. Three of the following questions will be randomly graded, with equal credit given to each question.

Due Friday, September 10 by 5pm. Submit completed assignment to D2L as .doc or .pdf file. Scanned copies of handwritten answers are fine, provided the document is neat and clearly legible. For the problems involving calculations, clearly label and provide appropriate accompanying textual description for equations used.

1. What is the difference between mass and weight?

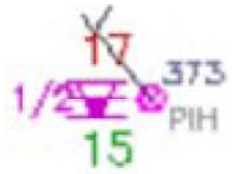
2. What does a mercury barometer measure? Describe this device and explain how it physically works.

3. Describe how atmospheric temperature changes going vertically upward toward outer space. How do these changes related to the various levels of the atmospheres (i.e. the "spheres") and the atmospheric lapse rate?

4. Given that mean sea level pressure is defined to be 1013 mb, what would the air pressure be at the top of Mt. McKinley (Denali) in Alaska, the tallest point on the North American continent at 6194 m? Show your work.

5. Define and differentiate between weather and climate. Give two examples of each.

6. Decode the following surface meteorological observation for Pocatello, Idaho, (PIH) taken at the same day as the Colorado snowstorm case discussed in Lecture 3.



7. Describe the three mechanisms of heat transfer and how they are illustrated in the example of a boiling pot of water on a stove.

8. Explain the concept of specific heat. How does the specific heat of water compare to other common substances and why is this important?

9. Suppose that 500 g of water vapor condense to make a cloud. Given a latent heat of condensation of 600 cal/g, how much heat is released to the air? If the total mass of the air is 100 kg, how much warmer would the air be after condensation? (Hint: Use the specific heat of air in Table 2.1 in the textbook). Show all work. Based on your answer, describe how phase changes of water are related to atmospheric energy, such as in phenomena like thunderstorms and hurricanes.

10. Assuming a normal human body temperature of 98.6 ºF, what is the wavelength of maximum radiation emission from your body? In what part of the electromagnetic spectrum does this fall? Show your work. What radiation law must be applied to solve the problem?

11. Following for the previous question, how much radiant energy per unit area ($W\ m^{-2}$) does your body emit? What radiation law must be applied to solve this problem?

12. Why are the shortest wavelength, highest frequency electromagnetic waves, like gamma or x-rays, the most dangerous type of radiation?

13. Explain how the earth's atmospheric greenhouse effect works. What atmospheric gases are primarily responsible for the greenhouse effect and why?

14. Why is the sky blue?

15. Describe how clouds affect the earth's energy budget in the solar (shortwave) and terrestrial (longwave) part of the radiative spectrum.