NATS 101 (006) Spring 2007
Midterm Examination #1

Name:_____ **Date: 2/14/2007** **SID: S**_____

Instructions:

- Each question is short answer or short calculation. Please make sure to read each question carefully and show your work where it is required. Should you need more room to answer your questions, you can use the other side, and indicate it with the answer.
- You can use a calculator for the short calculation questions.
- You are **NOT** allowed to use your book or notes on this exam.
- You are **NOT** allowed to talk about or look at anyone else's exam. If you commit such an offense, you will be awarded a **0** and the offense will be noted in accordance to **The Code of Academic Integrity**.
- Good luck!

Helpful Physical Constants:

Constant in Stefan-Boltzmann Law (σ) = 5.67 X 10^{-8} W m^{-2} K^{-4}

Constant in Wien's Displacement Law = 2900 μm K (approximately)

Score: _____/ 60 points

Midterm Examination #1
NATS 101, Spring 2007, Section 6
Introduction to Weather and Climate

Scoring: Point value of each question indicated.

1. Why is the sky blue? Make sure you give an appropriate physical definition for any terminology you may introduce in your answer. (**2 POINTS**)

2. Why are the top of cumulonimbus clouds anvil shaped? (**2 POINTS**)

3. What is an adiabatic process? (**2 POINTS**)

4. Give two examples of clouds that form in a stable environment. (**2 POINTS**)

5. Why are winters warmer, on average, in Seattle, Washington, than Bismark, North Dakota, even though these cities are at approximately the same latitude? (**2 POINTS**)

6. In which layers of the atmosphere does the temperature increase with height? Why does this occur in each of these layers? **(4 POINTS)**

Midterm Examination continued

7. From which direction would the sun rise in Sydney, Australia, on December 21? **(1 POINT)**

8. What causes the seasons? (**2 POINTS**)

9. Why would marine stratocumulus clouds appear gray on an infrared satellite image and bright white on a visible satellite image? (**2 POINTS**)

10. What is the greenhouse effect? (**2 POINTS**)

11. What does it physically mean when the air is saturated with respect to water vapor? What is the relative humidity when the air is saturated? (**2 POINTS**)

12. What is the dew point temperature? (**2 POINTS**)

13. Why do colder temperatures typically occur during clear and calm nights? (**2 POINTS**)

14. Suppose an Earth-like planet is discovered orbiting a star with a temperature of 10,000 K. Answer the following questions. Show all your work to receive full credit. **(5 POINTS TOTAL)**

a) What is the wavelength of most intense solar radiation from this star (λ_{max})? **(2 POINTS)**

b) What part of the electromagnetic spectrum is λ_{max}? **(1 POINT)**

c) Approximately how much more radiant energy per unit area does this star emit compared to our sun? (Hint: Assume the temperature of our sun is 6000 K). **(2 POINTS)**

15. A typical summer day in Tucson is 100 °F. What is the temperature in °C and K? Show all work to receive full credit. (**2 POINTS**)

16. What condition is necessary for atmospheric instability if the environmental lapse rate is 7.5° C per kilometer? (**2 POINTS**)

17. What type of fog is Tule fog, which forms in California's Central Valley during winter? How does this fog type form? (**2 POINTS**)

18. What process accounts for the growth of cloud drops to raindrops in a warm cloud? (**2 POINTS**)

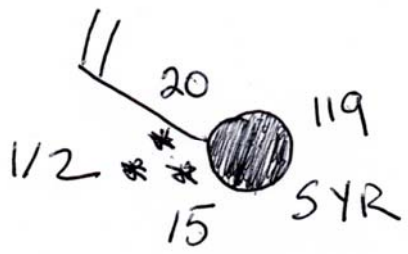
Midterm Examination continued

19. Why do ice crystals grow in the presence of supercooled cloud drops in a cold cloud? (**2 POINTS**)

20. Complete the following table **(5 POINTS):**

Physical Quantity	SI Units	Name (symbol)
Length	m	Meter
Time	s	Second
Mass	kg	Kilogram
Acceleration		
Force		Newton (N)
Pressure		
Energy		
Power		

21. Using the station model below, what are the surface weather conditions at Syracuse, New York (SYR)? **(7 POINTS)**



22. Given that it was not precipitating at the time in Watertown, New York, (50 miles north) or Binghamton, New York (about 70 miles to the south), what is the most likely explanation for the precipitation observed in Syracuse? (**2 POINTS**)

23. Identify each cloud displayed on the overhead projector **(1 POINT PER CLOUD).**

CLOUD A:

CLOUD B:

CLOUD C:

CLOUD D:

24. **BONUS QUESTION**: Physically explain how the cloud formed in the "cloud in a bottle" experiment presented in class (**5 BONUS POINTS**).