EXAM NUMBER _____

NATS 101, Section 4, Spring 2009
Midterm Examination #1
February 13, 2009

Name:_____ **SID: S**_____

Instructions:

- **Write your name and student ID on ALL pages of the exam.**
- In the multiple-choice/fill in the blank section, please write-in only **ONE** answer (unless directions state otherwise). **Tear off the multiple exam answer sheet at the end of the exam packet and write your answers on this sheet. Turn this sheet in separately when you hand in your exam.**
- In the short answer section, 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 **CANNOT** 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!

Score:

Multiple Choice Section:	_____/ 30 points
Short Answer Section:	_____/ 15 points
Bonus Questions:	_____/ 5 points
Total:	_____/ 45 points

Helpful constants

Constant in Stefan-Boltzmann law = 5.67×10^{-8} W m^{-2} K^{-4}

Constant in Wien's displacement law = 2900 μm K

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Midterm Examination #1
NATS 101, Section 4, Spring 2009
Introduction to Weather and Climate
Multiple Choice, One Word Answer Section

Scoring: Each question is worth 1 point in this section.

1. The typical wavelength of visible light is ____.
   a) 0.0005 μm
   b) 0.005 μm
   c) 0.05 μm
   d) 0.5 μm
   e) None of the above.

2. Wien's displacement law states that:
   a) The wavelength of maximum radiation emission from an object is proportional to its temperature.
   b) The wavelength of maximum radiation emission from an object is inversely proportional to its temperature.
   c) The total radiant energy per unit area emitted by an object is proportional to its temperature.
   d) The total radiant energy per unit are emitted by an object is inversely proportional to its temperature.
   e) None of the above.

3. Which of the following quantities is only related to the amount of water vapor present in the atmosphere?
   a) Relative humidity
   b) Saturation vapor pressure
   c) Dew point temperature
   d) All of the above
   e) None of the above

4. In Seattle during the winter, in direction does the sun set?
   a) West
   b) Southwest
   c) Northwest
   d) East
   e) Northeast

5. The phase change of water from its vapor to liquid form is called _____ and this process _____ the surrounding environment.
   a) Evaporation; consumes energy from
   b) Condensation; consumes energy from
   c) Evaporation; releases energy to
   d) Condensation; releases energy to
   e) None of the above

6. Moist air above Lake Erie, which has a surface temperature of 52°F, moves over the city of Erie, Pennsylvania, with has a surface temperature of 34°F. Immediately, fog forms. What type of fog is this?
   a) Upslope fog
   b) Radiation fog
   c) Advection fog
   d) Steam fog
   e) Frontal fog

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7. Which of the following stations, based on their temperature and dew point, has the highest relative humidity?
   a) Temperature: 83°F, Dew point: 79°F
   b) Temperature: 95°F, Dew point: 42°F
   c) Temperature: 27°F, Dew point: 27°F
   d) Temperature: 35°F, Dew point: -5°F
   e) None of the above because the relative humidity at all of the above stations is the same.

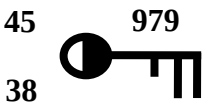
8. Which of the following stations, based on their temperature and dew point, has the greatest amount of water vapor in the air?
   a) Temperature: 83°F, Dew point: 79°F
   b) Temperature: 95°F, Dew point: 42°F
   c) Temperature: 27°F, Dew point: 27°F
   d) Temperature: 35°F, Dew point: -5°F
   e) None of the above because the amount of water vapor in the air at all of the above stations is the same.

9. At 700mb, approximately how much of the atmosphere is below you?
   a) 3%
   b) 7%
   c) 30%
   d) 70%
   e) None of the above

10. In which layer(s) of the atmosphere does temperature increase with height?
   a) Troposphere
   b) Stratosphere
   c) Mesosphere
   d) All of the above
   e) None of the above

11. Temperature is a measure of
   a) Electromagnetic radiation.
   b) Average speed of molecular motion.
   c) The charge of molecules in the atmosphere.
   d) The rate of chemical reactions that occur due to molecular collisions.
   e) None of the above

Given the station provided below, properly describe the weather conditions given to answer 9-12. Write the numerical answers in the blank for these questions.



12. The temperature is _____°F.

13. The dew point temperature _____°F.

14. The wind speed is _____ knots.

15. The sea-level-pressure is _____ mb.

16. A typical room temperature is 68°F. Convert this temperature to °C. Write the numerical answer in the blank for this question.

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17. The Stefan-Boltzmann law states that:
    a) The wavelength of maximum radiation emission from an object is proportional to its temperature.
    b) The wavelength of maximum radiation emission from an object is inversely proportional to its temperature.
    c) The total radiant energy per unit area emitted by an object is proportional to its temperature.
    d) The total radiant energy per unit are emitted by an object is inversely proportional to its temperature.
    e) None of the above.

18. Carbon dioxide is a trace gas whose levels are increasing annually primarily because of
    a) Vegetative decay
    b) Volcanic eruptions
    c) Animal exhalation
    d) Combustion of fossil fuels
    e) All of the above

19. Wax rising and falling in a lava lamp is a good example of which mode of heat transfer?
    a) Conduction
    b) Convection
    c) Radiation
    d) Latent heat
    e) None of the above

20. Which of the following statements about radiation, if any, are true?
    a) Any object that has a temperature greater than 0K emits radiation.
    b) Radiation is in the form of electromagnetic waves.
    c) Radiation does not need matter to propagate
    d) All of the above
    e) None of the above.

21. At night, the presence of clouds makes the surface temperature _____than it otherwise would be because the clouds _____
    a) Colder; deepen the temperature inversion near the surface
    b) Warmer; provide a mechanical mixing mechanism to transport warm air toward the surface.
    c) Warmer; emit infrared radiation to the surface.
    d) Warmer; conduct heat through the air to the surface.
    e) None of the above.

22. Which of the following are the two most abundant gasses in the atmosphere?
    a) Neon, Argon
    b) Oxygen, Water Vapor
    c) Nitrogen, Oxygen
    d) Nitrogen, Water Vapor
    e) None of the above

23. The sun emits its most intense radiation in which part of the electromagnetic spectrum?
    a) Visible
    b) Ultraviolet
    c) Microwave
    d) Radio
    e) X-ray

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24. If you are vacationing in the Mexican cities of Cancun or Mazatlan, during which month would you expect the solar zenith angle to be near zero at noon?
    a) December
    b) March
    c) June
    d) September
    e) None of the above

25. Greenhouse gases are very effective absorbers and emitters of what kind of radiation?
    a) Ultraviolet
    b) Visible light
    c) Infrared
    d) Microwaves
    e) Radio waves

26. What are the SI units of a Joule, the physical measure to describe energy?
    a) kg m s^{-1}
    b) kg m s^{-2}
    c) kg m^2 s^{-2}
    d) kg m^2 s^{-3}
    e) None of the above

27. The terms "global warming" and "the greenhouse effect" refer to basically the same physical process in the atmosphere, and so can thus be used interchangeably. Answer True or False.

28. If an object is heated to three times original temperature its total radiant energy per unit area will increase by how many times? Write the numerical answer in the blank for this question.

29. Which of the following cities is most likely to have the largest annual variation in temperature due to its geographical location?
    a) San Diego, California
    b) Atlanta, Georgia
    c) Seattle, Washington
    d) Minneapolis, Minnesota
    e) None of the above. The annual variation in temperature at all of these places is the same. .

30. Warming in the thermosphere is caused by:
    a) Ionization of gases
    b) Photodissociation of gases
    c) Molecular collisions that increase energy
    d) Increasing pressure with decrease in altitude
    e) Condensation of water

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Name:_____ **SID: S**_____

Midterm Examination #1
NATS 101, Section 4, Spring 2009
Introduction to Weather and Climate
Short Answer Section

Scoring: Each question is worth points as indicated.

31. Define and differentiate the two terms weather and climate. Give at least six examples of items that may be defined as either weather or climate (three for each category). (**4 points**)

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32. Give two reasons why the Earth experiences seasons. Provide as much physical detail as you can in your answer. Draw pictures to assist you in answering this question. (**6 points**)

33. What are cloud condensation nuclei? What processes create them, and why are they necessary for the formation of clouds? (**5 points**)

BONUS QUESTION: Thermometers used to record official temperature measurements are typically housed in elevated, ventilated boxes called Cotton Region Shelters. Explain why these boxes are painted white and why it is best to place them in open field to obtain the best temperature readings. (**5 Points Extra Credit**)

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Name:_____ SID: S_____

FINAL EXAM ANSWER SHEET
Mark answers TO RIGHT of question number.

Question	Answer	Question	Answer
1		19	
2		20	
3		21	
4		22	
5		23	
6		24	
7		25	
8		26	
9		27	
10		28	
11		29	
12		30	
13			
14			
15			
16			
17			
18			

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