

Name: TA Connie

**ATOC 1050-001 Homework #1**  
**Due Tuesday February 8, 2010—BEGINNING OF CLASS!**

**Instructions:** Make sure that you answer all of the questions and complete all of the tables 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. Humidity**

Use the weather observations from the ATOC weather station on the roof of Duane Physics listed in this table to complete the table in problem 1a and to answer questions 1b through 1d.

Date	Time (MST)	Temperature	Dewpoint Temperature
13 Jan 2011	5AM	38°F	23°F
13 Jan 2011	10AM	49°F	22°F
13 Jan 2011	1PM	51°F	21°F
13 Jan 2011	4PM	50°F	29°F
13 Jan 2011	9PM	40°F	28°F

1a. Complete the table below using the weather observations listed above. The first row of the table has already been completed for you.

Use the vapor pressure and saturation vapor pressure tables on the class web site (under the *Homework* link) to find the vapor pressure and saturation vapor pressure. Hint: Find the vapor pressure using the dew point temperature and the saturation vapor pressure using the temperature.

Calculate the relative humidity using the following formula:

$$\text{Relative humidity} = (\text{vapor pressure}) / (\text{saturation vapor pressure}) \times 100\%$$

Date (UTC)	Time (UTC)	Vapor Pressure	Saturation Vapor Pressure	Relative Humidity
13 Jan 2011	1200	4.2 mb	7.8 mb	53.8 %
13 Jan 2011	1700	4.0 mb	11.8 mb	33.9%
13 Jan 2011	2000	<del>3.9 mb</del> 3.9 mb	12.7 mb	30.7%
13 Jan 2011	2300	5.4 mb	12.3 mb	43.9%
14 Jan 2011	0400	5.2 mb	8.4 mb	61.9%

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1b. How has the relative humidity changed from 5AM to 1PM MST?

*Decreased by 23.1%*

1c. What caused the relative humidity to change in this way?

*Temperature increased while dewpoint temp slightly decreased  
(vapor pressure)*

1d. Assume that the air inside of your house has the same dew point temperature as the air on the roof of Duane Physics at 1 PM MST and that the temperature in your house is 68°F.

What is the saturation vapor pressure inside of your house? 23.4 mb

What is the vapor pressure inside of your house? 3.9 mb

What is the relative humidity inside of your house? 16.7%

How does the relative humidity inside of your house compare to the relative humidity on the roof of Duane Physics at 1 PM MST?

*significantly lower*

Why is the relative humidity inside of your house different from that on the roof of Duane Physics?

*The temperature inside is higher*

## 2. Surface Weather Maps

Use the surface weather map at the end of this homework assignment to complete the tables in problems 2a and 2b and to answer questions 2c through 2g.

2a. Complete this table based on the circled station models on the surface weather map at the end of this assignment.

Station	Temperature	Dew point Temperature	Sea-level Pressure	Wind Speed	Wind Direction
Portland, ME	25	22	999.4	20	N
Phoenix, AZ	59	43	1017.6	10	W or NW
Minneapolis, MN	13	10	1028.2	5	S

*(decoded)*

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2b. Find the vapor pressure, saturation vapor pressure, and relative humidity using the weather observations listed in the table for problem 2a and the vapor pressure and saturation vapor pressure tables on the class web site.

Station	Vapor Pressure	Saturation Vapor Pressure	Relative Humidity
Portland, ME	4.0	4.6	87.0%
Phoenix, AZ	9.4	17.0	55.3%
Minneapolis, MN	2.4	2.7	88.9%

2c. At which weather station does the air contain the most water vapor?

Phoenix, AZ

2d. What variable(s) did you look at when answering question 2c?

Vapor Pressure or dew point temperature

2d. At which weather station does the air contain the least water vapor?

Minneapolis, MN

2e. What variable(s) did you look at when answering question 2d?

Vapor Pressure or dew point temperature

2f. At which weather station is the air closest to being saturated?

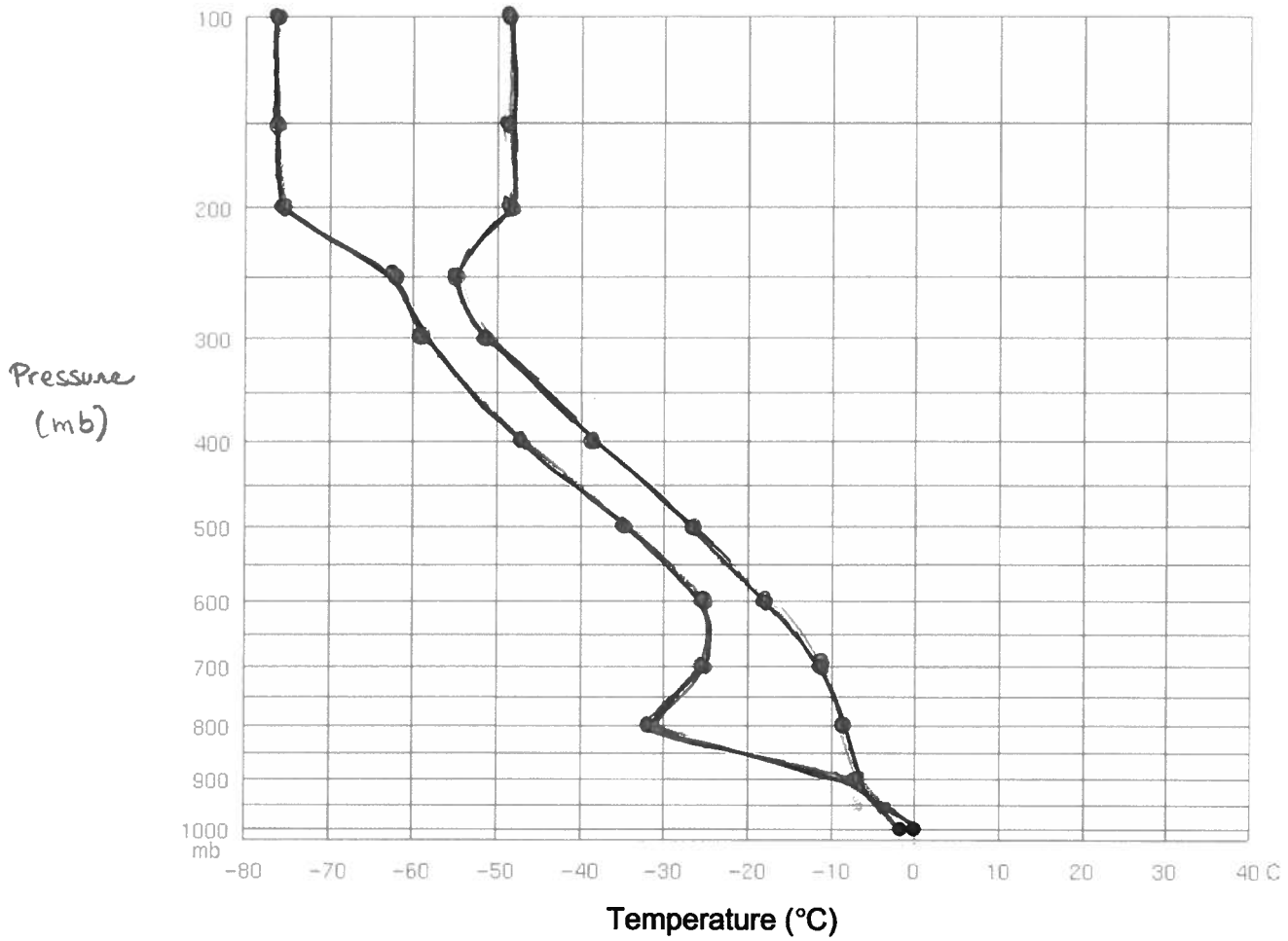
Minneapolis, MN

2g. What variable(s) did you look at when answering question 2f?

Relative Humidity

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Blank sounding diagram for problem 3a.



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### 3. Rawinsonde Data and Soundings

3a. Use the blank sounding diagram at the end of this homework assignment to plot the following data from a rawinsonde launched from Barrow, AK on September 1, 2005 at 00 UTC.

Pressure	Temperature	Dew point Temperature
1000 mb	0°C	-1°C
900 mb	-6°C	-6°C
800 mb	-8°C	-32°C
700 mb	-11°C	-25°C
600 mb	-18°C	-25°C
500 mb	-26°C	-34°C
400 mb	-38°C	-47°C
300 mb	-52°C	-59°C
250 mb	-55°C	-62°C
200 mb	-48°C	-76°C
150 mb	-48°C	-76°C
100 mb	-48°C	-76°C

For each pressure level draw a dot to represent the temperature and another dot to represent the dew point temperature. The temperature and dew point temperature at 1000 mb have already been plotted on the sounding diagram for you.

Once you have plotted the temperature and dew point temperature at each pressure level listed in the table connect all of the temperature dots with a line and all of the dew point temperature dots with another line.

3b. At what pressure level is the tropopause located in this sounding?

*Around 250mb*

3c. Why did you choose this pressure level to answer question 3b?

*the temperature begins increasing significantly*

3d. At what pressure level would you expect a cloud to be present?

*900mb*

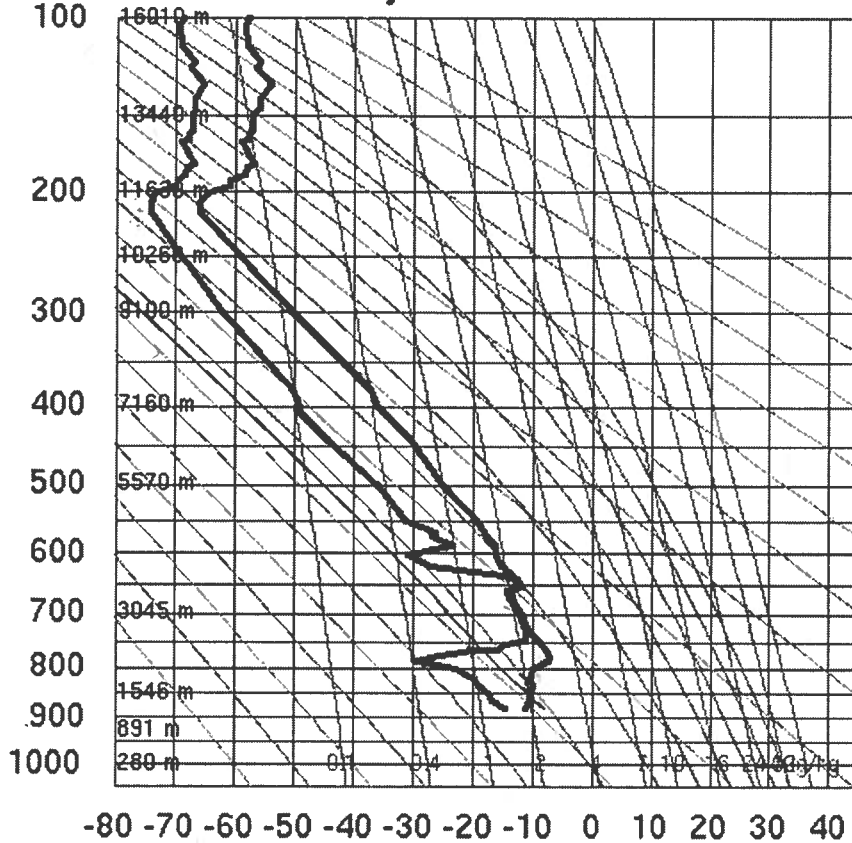
3e. Why did you choose this pressure level to answer question 3d?

*The temperature and dew point temperature  
are the same*

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Use the sounding from Salt Lake City, UT, shown below, to complete the table in problem 3f and to answer questions 3g through 3h.

**72572 SLC Salt Lake City**



SLAT 40.77  
 SLON -111.95  
 SELV 1289.  
 SHOW 20.14  
 LIFT 20.27  
 LFTV 20.31  
 SWET 29.00  
 KINX -3.50  
 CTOT 7.40  
 VTOT 14.40  
 TOTL 21.80  
 CAPE 0.00  
 CAPV 0.00  
 CINS 0.00  
 CINV 0.00  
 EQLV -9999  
 EQTV -9999  
 LFCT -9999  
 LFCV -9999  
 BRCH 0.00  
 BRCV 0.00  
 LCLT 254.3  
 LCLP 761.7  
 MLTH 274.9  
 MLMR 1.15  
 THCK 5290.  
 PWAT 5.15

**12Z 02 Jan 2011 University of Wyoming**

3f. Complete this table using the sounding shown above.

Pressure	Temperature	Dewpoint Temperature
850 mb	-10°C	-18°C
700 mb	-12°C	-12°C
500 mb	-25°C	-36°C
300 mb	-50°C	-63°C

3g. At what pressure level is the tropopause located in this sounding? 200mb

3h. At what pressure level would you expect a cloud to be present? 650-750 mb

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**Surface Weather Map for Problem 2**

