

Exercise #5 Lab Activity

Name(s): _____

Atmospheric Moisture

Please show your work. If necessary, please use additional paper to show work.

1. Describe the relationship between air temperature and saturation mixing ratio.

2. Based on Table 5.1, what is the saturation mixing ratio of:

a. -20°C air mass? _____

b. 15°C air mass? _____

c. 35°C air mass? _____

3. What is the relative humidity of a parcel of air at 30°C with an actual mixing ratio of 14 g kg^{-1} ?

4. If the same parcel from #3 dropped in temperature to 10°C , what would the relative humidity be? How did the relative humidity change with the decrease in temperature?

5. What is the actual mixing ratio for a parcel with a temperature of 30°C and a relative humidity of 25%?

6. What is the dewpoint of a 25°C parcel with an actual mixing ratio of 14 g kg^{-1} ?

7. On a cold day in December, the relative humidity measures 20%. On a hot day in August, the relative humidity also measures 20%. Does this indicate that the same amount of water vapor is in the air on both days? Explain your answer.

WEATHER & CLIMATE
SALEM STATE UNIVERSITY

8. An air mass with a temperature of 5°C is saturated. If this air is brought into a house and heated up to 25°C , what is the relative humidity of this air in the house?

9. Question #8 helps explain why it can feel so much drier inside a house on a cold, humid day. In order to compensate for this phenomenon, many people utilize an appliance to keep their homes comfortable. What appliance do the people use?

10. Why can we see our breath on a cold day? What is physically happening to make that possible?

11. On hot and humid summer days, cold beverages can sweat. Why does this occur?

Exercise #4b Lab Activity

Moisture

Please show your work. If necessary, please use additional paper to show work.

12. An air mass has a dry-bulb temperature of 28°C and a wet-bulb temperature of 16°C.

- a. What is the wet-bulb depression? _____
- b. What is the dewpoint temperature? _____
- c. What is the relative humidity? _____

13. An air mass has a dry-bulb temperature of 4°C and a wet-bulb depression of 2°C.

- a. What is the wet-bulb temperature? _____
- b. What is the dewpoint temperature? _____
- c. What is the relative humidity? _____

14. If the relative humidity of an air mass is 20% and the temperature of the air is -6°C,

- a. What is the wet-bulb temperature? _____
- b. What is the dewpoint temperature? _____

15. If the amount of water vapor in the air **decreases** (a new air mass arrives) and the temperature of the air **stays the same**, will the dew point temperature **Increase, Decrease, or Stay the same?** **WHY?**

16. If the amount of water vapor in the air **stays the same**, and the temperature of the air **decreases**, will the relative humidity **Increase, Decrease, or Stay the same?** **WHY?**

Table 5.2: DEW POINT TEMPERATURE

| Dry-Bulb Temp (C°) | Difference Between Wet-Bulb and Dry-Bulb Temperatures (C°) | | | | | | | | | | | | | | | |
|--------------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| -20 | -20 | 33 | | | | | | | | | | | | | | |
| -18 | -18 | -28 | | | | | | | | | | | | | | |
| -16 | -16 | -24 | | | | | | | | | | | | | | |
| -14 | -14 | -21 | -36 | | | | | | | | | | | | | |
| -12 | -12 | -18 | -28 | | | | | | | | | | | | | |
| -10 | -10 | -14 | -22 | | | | | | | | | | | | | |
| -8 | -8 | -12 | -18 | -29 | | | | | | | | | | | | |
| -6 | -6 | -10 | -14 | -22 | | | | | | | | | | | | |
| -4 | -4 | -7 | -12 | -17 | -29 | | | | | | | | | | | |
| -2 | -2 | -5 | -8 | -13 | -20 | | | | | | | | | | | |
| 0 | 0 | -3 | -6 | -9 | -15 | -24 | | | | | | | | | | |
| 2 | 2 | -1 | -3 | -6 | -11 | -17 | | | | | | | | | | |
| 4 | 4 | 1 | -1 | -4 | -7 | -11 | -19 | | | | | | | | | |
| 6 | 6 | 4 | 1 | -1 | -4 | -7 | -13 | -21 | | | | | | | | |
| 8 | 8 | 6 | 3 | 1 | -2 | -5 | -9 | -14 | | | | | | | | |
| 10 | 10 | 8 | 6 | 4 | 1 | -2 | -5 | -9 | -14 | -28 | | | | | | |
| 12 | 12 | 10 | 8 | 6 | 4 | 1 | -2 | -5 | -9 | -16 | | | | | | |
| 14 | 14 | 12 | 11 | 9 | 6 | 4 | 1 | -2 | -5 | -10 | -17 | | | | | |
| 16 | 16 | 14 | 13 | 11 | 9 | 7 | 4 | 1 | -1 | -6 | -10 | -17 | | | | |
| 18 | 18 | 16 | 15 | 13 | 11 | 9 | 7 | 4 | 2 | -2 | -5 | -10 | -19 | | | |
| 20 | 20 | 19 | 17 | 15 | 14 | 12 | 10 | 7 | 4 | 2 | -2 | -5 | -10 | -19 | | |
| 22 | 22 | 21 | 19 | 17 | 16 | 14 | 12 | 10 | 8 | 5 | 3 | -1 | -5 | -10 | -19 | |
| 24 | 24 | 23 | 21 | 20 | 18 | 16 | 14 | 12 | 10 | 8 | 6 | 2 | -1 | -5 | -10 | -18 |
| 26 | 26 | 25 | 23 | 22 | 20 | 18 | 17 | 15 | 13 | 11 | 9 | 6 | 3 | 0 | -4 | -9 |
| 28 | 28 | 27 | 25 | 24 | 22 | 21 | 19 | 17 | 16 | 14 | 11 | 9 | 7 | 4 | 1 | -3 |
| 30 | 30 | 29 | 27 | 26 | 24 | 23 | 21 | 19 | 18 | 16 | 14 | 12 | 10 | 8 | 5 | 1 |

Table 5.3: RELATIVE HUMIDITY

| Dry-Bulb Temp (C°) | Difference Between Wet-Bulb and Dry-Bulb Temperatures (C°) | | | | | | | | | | | | | | | |
|--------------------|--|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| -20 | 100 | 28 | | | | | | | | | | | | | | |
| -18 | 100 | 40 | | | | | | | | | | | | | | |
| -16 | 100 | 48 | | | | | | | | | | | | | | |
| -14 | 100 | 55 | 11 | | | | | | | | | | | | | |
| -12 | 100 | 61 | 23 | | | | | | | | | | | | | |
| -10 | 100 | 66 | 33 | | | | | | | | | | | | | |
| -8 | 100 | 71 | 41 | 13 | | | | | | | | | | | | |
| -6 | 100 | 73 | 48 | 20 | | | | | | | | | | | | |
| -4 | 100 | 77 | 54 | 32 | 11 | | | | | | | | | | | |
| -2 | 100 | 79 | 58 | 37 | 20 | 1 | | | | | | | | | | |
| 0 | 100 | 81 | 63 | 45 | 28 | 11 | | | | | | | | | | |
| 2 | 100 | 83 | 67 | 51 | 36 | 20 | 6 | | | | | | | | | |
| 4 | 100 | 85 | 70 | 56 | 42 | 27 | 14 | | | | | | | | | |
| 6 | 100 | 86 | 72 | 59 | 46 | 35 | 22 | 10 | | | | | | | | |
| 8 | 100 | 87 | 74 | 62 | 51 | 39 | 28 | 17 | 6 | | | | | | | |
| 10 | 100 | 88 | 76 | 65 | 54 | 43 | 33 | 24 | 13 | 4 | | | | | | |
| 12 | 100 | 88 | 78 | 67 | 57 | 48 | 38 | 28 | 19 | 10 | 2 | | | | | |
| 14 | 100 | 89 | 79 | 69 | 60 | 50 | 41 | 33 | 25 | 16 | 8 | 1 | | | | |
| 16 | 100 | 90 | 80 | 71 | 62 | 54 | 45 | 37 | 29 | 21 | 14 | 7 | 1 | | | |
| 18 | 100 | 91 | 81 | 72 | 64 | 56 | 48 | 40 | 33 | 26 | 19 | 12 | 6 | | | |
| 20 | 100 | 91 | 82 | 74 | 66 | 58 | 51 | 44 | 36 | 30 | 23 | 17 | 11 | 5 | | |
| 22 | 100 | 92 | 83 | 75 | 68 | 60 | 53 | 46 | 40 | 33 | 27 | 21 | 15 | 10 | 4 | |
| 24 | 100 | 92 | 84 | 76 | 69 | 62 | 55 | 49 | 42 | 36 | 30 | 25 | 20 | 14 | 9 | 4 |
| 26 | 100 | 92 | 85 | 77 | 70 | 64 | 57 | 51 | 45 | 39 | 34 | 28 | 23 | 18 | 13 | 9 |
| 28 | 100 | 93 | 86 | 78 | 71 | 65 | 59 | 53 | 47 | 42 | 36 | 31 | 26 | 21 | 20 | 12 |
| 30 | 100 | 93 | 86 | 79 | 72 | 66 | 61 | 55 | 49 | 44 | 39 | 34 | 29 | 25 | 17 | 16 |