

ANSWER KEY

Exercise #4a 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.

As Air Temp Rises, the saturation mixing ratio (capacity) also rises exponentially

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

a. -20°C air mass?

0.75

b. 15°C air mass?

10.0

c. 35°C air mass?

35.0

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

$$\frac{A}{C} \sim T \quad \frac{14g}{26.5g \sim 30^\circ}$$

52.8%

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?

$$\frac{A}{C} \sim T \quad \frac{14g}{7g \sim 10^\circ}$$

100% + condensation = cloud formation

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

$$\frac{A}{C} \sim T \quad 25\% = \frac{x}{26.5 \sim 30^\circ} \quad \frac{1}{4} = \frac{x}{26.5}$$

6.625g

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

$$100\% = \frac{A_{act}}{C_{DPT}} \leftrightarrow DPT$$

$$\frac{14}{x} = 14 \text{ cap} \leftrightarrow$$

20° DPT

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.

No. Since the capacity of the air changes with the temperature, they will be different. for example:

25°	15°
5g H ₂ O	2g H ₂ O
summer	winter
20%	20%

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?

OUTSIDE	INSIDE
5g	25° and 5g
$100\% = \frac{5g}{5g} \sim 5^\circ$	$25\% = \frac{5g}{20g} \sim 25^\circ$

Adding moisture into the home in winter requires a humidifier.

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?

Humidifier

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

The air inside us is Hot and Humid....

when this Hot + Humid air meets the cold air, it drops in ~~Temp~~ Temp, reaches saturation and Condenses into a mini cloud.

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

The Hot + Humid air begins to cool right next to the Cold beverage container, as it cools, it reaches saturation and then condensation clings to the container.

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?

12°

b. What is the dewpoint temperature?

7°

c. What is the relative humidity?

26%

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?

2°

b. What is the dewpoint temperature?

-1°

c. What is the relative humidity?

70%

14. If the relative humidity of an air mass is 20% and the temperature of the air is -6°C , (WBD = 3)

a. What is the wet-bulb temperature?

-9°

b. What is the dewpoint temperature?

20° -22°

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?

DECREASE! First, the temperature doesn't enter into the

Dew Point Calculations.

The lower the Actual Water Vapor, the lower the Capacity (DPT) and thus a lower DPT.

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?

INCREASE! With no change in the actual amount of water vapor.

And a decrease in air temperature, the capacity would go down.

This means that the same amount of H_2O would fill the capacity more.

Ex.

