Earth Science Regents
Dewpoint and Relative Humidity

Name_____

Period _____

Introduction:

You've learned in class that *evaporation* of water at the surface of the liquid phase is happening all the time. You've also learned that as long as there are water vapor molecules above the liquid, there is *condensation* going on. It is important to know that evaporating molecules take heat, leaving the environment they left cooler, while condensing molecules release heat, making the environment warmer (this will be a recurring theme in weather and you MUST know it). This is why as water evaporates from your skin it makes your skin cooler.

ADDING heat to the environment (raising the temperature) will make energy available for evaporation, and will cause the amount of evaporation to increase. Taking heat away (cooling things off) will favor condensation because a cooler environment will take heat from the water vapor molecules more readily.

The amount of water vapor in the air above the liquid will have an effect on the cooling effect of evaporation. As more water molecules enter the air, more of them will condense. At some point (the *dewpoint*), the rate of condensation will just equal the rate of evaporation. At this point the air is said to be saturated with water vapor. Evaporation seems to stop because for every molecule that evaporates another one condenses. At this point there will be no *net energy loss* due to evaporation (or gain due to condensation), and being wet (or sweaty) will not cool you off.

To summarize, in air which has very few water vapor molecules (dry or *arid* air), evaporation will greatly exceed condensation and cooling will exceed heating. As the amount of water vapor in the air (*humidity*) increases, more and more condensation occurs and the net energy loss decreases until at saturation, there is no net cooling. Therefore the temperature of a wet cloth is an indication of the humidity of the air around it. The more the temperature of the wet cloth is below the air temperature, the more evaporation from it exceeds condensation on to it, and the LESS humid the air is. It is the DIFFERENCE in temperature that is the telling number. A psychrometer measures this temperature difference to help us determine humidity.

On a separate sheet of paper define the terms in italics above. You should be able to write good definitions after reading the introduction, and you may use a dictionary or any other reliable source.

Materials:

Lab Stand (base and threaded rod)
Burette clamp/thermometer hanger
2 lab thermometers
1 psychrometer wick
1 40 ml beaker of room temperature water

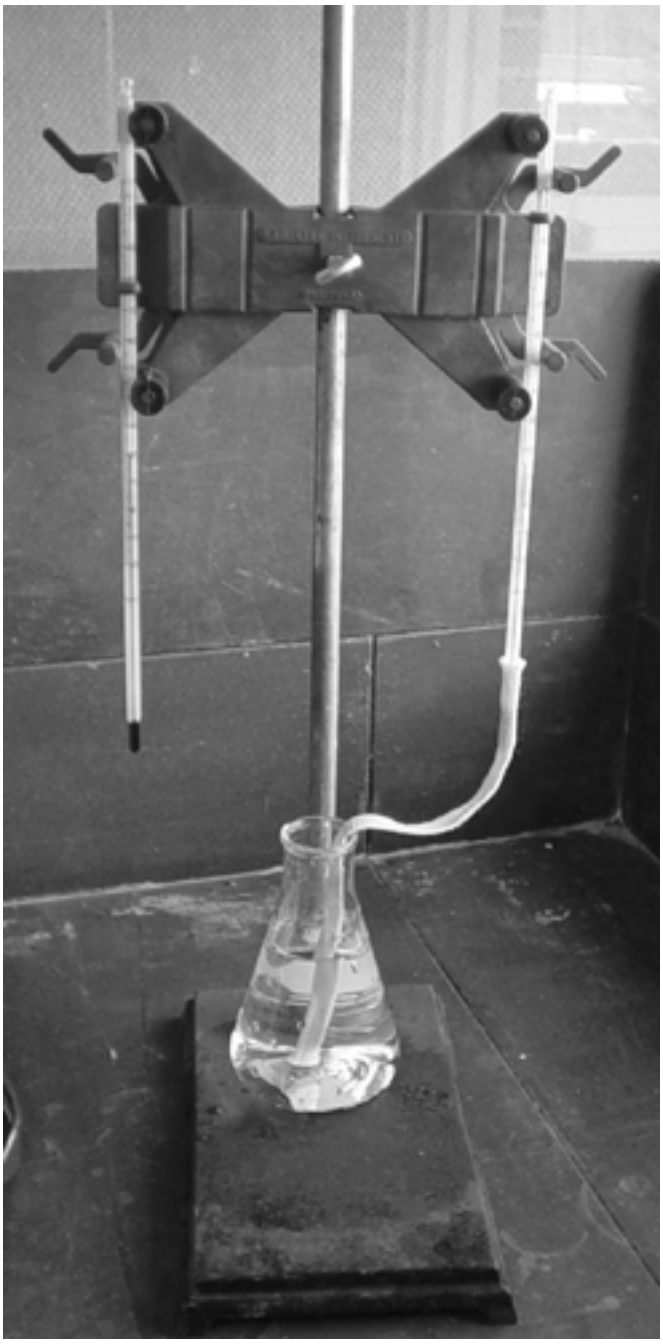
Procedure:

Read this entire Lab so that you know where you are going and can anticipate what will need to be done next.

Break into groups as instructed by your teacher, and do the following:

- Send one group member to get the equipment necessary, while one member figures out how to set it up. Refer to the photo on the next page
- Lay the two thermometers on the table next to each other but out of the way (so that you don't break them.

- Place the stand on the table in front of you with the flat base facing you.
- Attach the burette clamp to stand, tightening the set screw securely
- Mount 2 thermometers in the clamp as shown in the diagram to the right.
- Read the two thermometers and make sure they read the same temperature (be careful not to hold the bulb of the thermometer with your fingers). If they do not read the same temp, you'll have to find two that do.
- Once you're sure the two read the same under the same conditions, slide a wet wick on the bulb of one of them so that it just covers the whole bulb and hangs off the bottom of the thermometer.
- Put the beaker of water on the base of the stand, and immerse the free end of the wick in the water as shown. You may have to adjust the position of the burette clamp and/or thermometers. Make sure you don't get the other thermometer wet.
- Read the thermometers every minute or so, note what happens to the temperature reading of the wet thermometer. When the temperature(s) stop changing, record the values on the data record sheet.
- After the class has measured the temperatures in dry air you will be instructed to use your spray mister to spray mist into the air. Answer Questions 1, 2, and 3 now.
- While the thermometers adjust to the new conditions, take your sling Psychrometer outside to get the outside temperatures (make sure the wick is wet before you go). Spin the gizmo for about a minute, then read the thermometers. Spin for another minute and read them. When the temps stop changing record the values.
- Come back inside and read the stationary thermometers on your desk.
- Return all equipment as you found it.



Dewpoint and Relative Humidity
Data Sheet

Name_____

Period _____

Use your readings from class, the information below, and your Earth Science Reference Tables to fill in the blanks below. Use the completed table to figure out the answers to the questions that follow.

Date _____Time _____	ºF	ºC
Classroom Dry		
Dry Temperature	_____	_____
Wet Temp	_____	_____
Difference		_____
Dewpoint		_____
Relative Humidity		_____
Classroom Humid		
Dry Temperature	_____	_____
Wet Temp	_____	_____
Dewpoint		_____
Relative Humidity		_____
Outside		
Dry Temperature	_____	_____
Wet Temp	_____	_____
Difference		_____
Dewpoint		_____
Relative Humidity		_____
1. Dry Temperature	_____	12
Wet Temp	_____	10
Difference		_____
Dewpoint		_____
Relative Humidity		_____
2. Dry Temperature	_____	22
Wet Temp	_____	15
Difference		_____
Dewpoint		_____
Relative Humidity		_____
3. Dry Temperature	_____	0
Wet Temp	_____	_____
Difference		2
Dewpoint		_____
Relative Humidity		_____
4. Dry Temperature	_____	-4
Wet Temp	_____	-8
Difference		_____
Dewpoint		_____
Relative Humidity		_____
5. Dry Temperature	_____	4
Wet Temp	_____	0
Difference		_____
Dewpoint		_____
Relative Humidity		_____
6. Dry Temperature	_____	_____
Wet Temp	_____	_____
Difference		5
Dewpoint		4
Relative Humidity		_____
7. Dry Temperature	_____	_____
Wet Temp	_____	_____
Difference		7
Dewpoint		_____
Relative Humidity		40
8. Dry Temperature	_____	_____
Wet Temp	_____	16
Difference		4
Dewpoint		_____
Relative Humidity		_____
9. Dry Temperature	_____	18
Wet Temp	_____	18
Difference		_____
Dewpoint		_____
Relative Humidity		_____
10. Dry Temperature	_____	_____
Wet Temp	_____	_____
Difference		_____
Dewpoint		8
Relative Humidity		40

Dewpoint and Relative Humidity
Questions

Name_____

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Answer the following questions:

1. As more mist is sprayed into the air, what should be happening to the humidity in the classroom?

2. What should adding water vapor to the do to the RATE at which water evaporates from the wet wick?

3. How should the temperature of the wet thermometer change?

4. What is the difference between **ABSOLUTE HUMIDITY** and **RELATIVE HUMIDITY**.

5. What factors affect or determine the relative humidity of the air?

6. What is the dewpoint temperature? What can be said about air which is at its dewpoint?

7. Determine the Dewpoint Temperature and the Relative Humidity of air when:
   Dry Bulb = 20ºC
   Wet Bulb = 12ºC

   Dry Bulb = 10ºC
   Wet Bulb = 7ºC

8. If all other factors remain unchanged, what happens to the relative humidity of an air mass when the temperature rises? Explain.

9. If all other factors remain unchanged, what happened to the relative humidity of an air mass as more water evaporates into the air? Explain.

10. Imagine an air mass, temperature 12ºC, Dewpoint 8ºC. What is the relative humidity of that air mass? Explain how you got that answer.

11. What would happen to the air mass above (#7) if the air were cooled to 6ºC? What would the relative humidity be?