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Earth Science

Lesson Plan #2
TI Activity

Objective ~ There are many relationships within Meteorology that can be interpreted through math. Specifically, the relationship between air temperature and evaporation is a linear relationship. As air temperature increases, then evaporation increases and there is more water vapor in the air.

Science Concepts ~

1. Evaporation of water increases with an increase in temperature
2. As evaporation increases, the air will have more water vapor in it.

Lesson Steps ~

Students will first read short reading and answer questions regarding the relationship between air temperature and water vapor in air.

We will discuss the reading as a class in order to confront any misconceptions.

Students will have 1 Liter soda bottles with the following: A GoTemp! Probe stuck inside, some water in the bottle, and a match (to create condensation nuclei).

Students will record data using laptops and through Logger Lite graphing software. The 2 data points will be gathered as events.

We will gather the data points as a class and perform linear regression. This will be done using Excel and a SmartBoard. We will discuss the meaning of the data as a class.

Students will also complete there graphs using their data. They will also answer questions.

Assessment will be done throughout the lesson and then the lab will be graded.

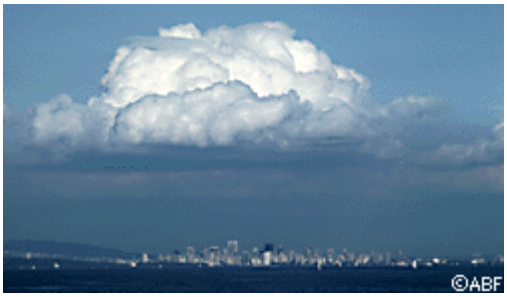
Name: _____ Period: _____

Formation of a Cloud

Air Temperature vs. Water Vapor in Air

Instructions: Please read the short explanation below and answer a few questions.

Can Air "hold" Water Vapor?



When moist air cools, a cloud can form. This much is true. The process is responsible for the cumulus cloud over Vancouver shown to the right. Ascending air always cools. The cumulus cloud formed when air over the sun-warmed ground became buoyant and rose.

But did the clouds form because the colder air had a lower holding capacity for water vapor than the warm air? NO!!

Water molecules are constantly moving back and forth between phases (another word for the three states: vapor, liquid, and solid). If more molecules are leaving a liquid surface than arriving, there is more evaporation; if more arrive than leave, there is more condensation. It is these relative flows of molecules which determine whether a cloud forms or evaporates, not some imaginary holding capacity that air has for water vapor.

What appears to be cloud-free air (virtually) always contains sub microscopic drops, but as evaporation exceeds condensation, the drops do not survive long after an initial chance clumping of molecules. As air is cooled, the evaporation rate decreases more rapidly than does the condensation rate with the result that there comes a temperature (the dew point temperature) where the evaporation is less than the condensation and a droplet can grow into a cloud drop.

Evaporation increases with temperature, not because the holding capacity of the air changes, but because the more energetic molecules can evaporate more readily.

(Adapted from http://fraser.cc/BadScience/BadMeteorology.html)

Some thinking questions…

1. Does Air "hold" water vapor?
2. Is air needed for water vapor to evaporate?
3. What is needed for water to evaporate?
4. What do you think is the relationship between air temperature and amount of water vapor in the air?

The Experiment

Instructions ~

1. Record the starting temperature of the water bottle
2. Ask for match from Mr. Ruder
3. Squeeze the bottle until you see a cloud. Record the temperature you get when the cloud forms.

Starting Temperature

_____

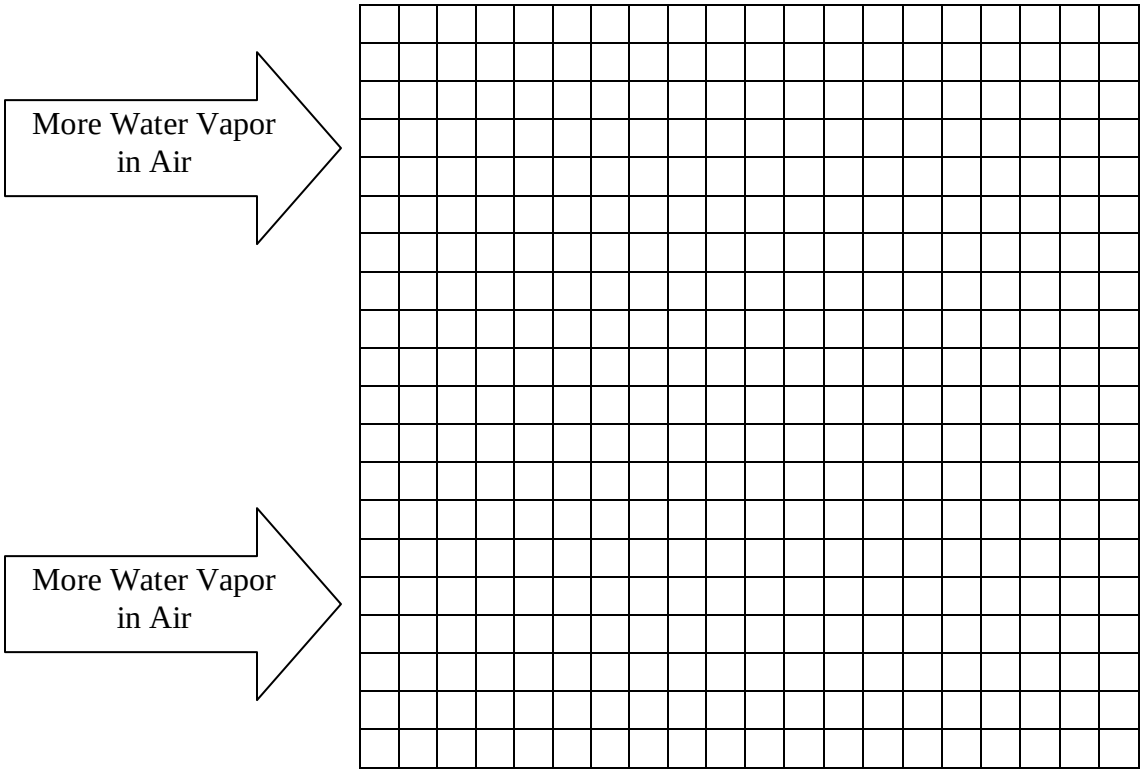
I can not see a cloud, so this means that there is **more or less** (circle one) **water vapor in the air**

Final Temperature

_____

I can see a cloud, so this means that there is **more or less** (circle one) **water vapor in the air**

Graph Interpretation



Questions ~

1. Can you ever see water vapor in the bottle?

2. What phase is the water when you can see it?

3. Does Air “hold” water vapor?

4. Is air needed for water vapor to evaporate?

5. What is needed for water to evaporate?

6. What is the relationship between air temperature and water vapor in air?