

Activity 2.2 “Dew-ing” the Dew Point

Teacher Background

In 1751 French physicist Charles Le Roy sealed damp air in a glass container. As he observed the container, droplets of water began to appear on the surface of the glass. He heated the container and the droplets disappeared: conversely when he cooled the container the droplets reappeared. Le Roy’s experiments led to the conclusion that the amount of water vapor air can contain *increases* as the temperature *increases*, and that any specific volume of air has a specific temperature at which the water vapor in it will begin to return to liquid form by condensation.

Following Le Roy, we call the temperature at which the air is saturated the “dew point.” Since molecules in warm air are moving faster than molecules in cold air, more molecules have enough energy to continue to exist as water vapor than at cooler temperatures.

Temperature is not the only factor that explains how hot it feels on a particular day or how cold. The “humidity” is also a factor. On a hot day when the humidity is high you will feel the heat more than on a day when the humidity is low. Humidity is a measure of the amount of water vapor in the air. When we speak about humidity, however, we usually refer to “relative humidity” which is a measurement of the amount of water vapor actually in the air versus the amount of water vapor that could be in the air at a particular temperature. When the weather forecaster says that the humidity is 50% he or she really means that the air contains half of the amount of water vapor possible at that temperature.

This Activity allows students to record the dew point at school and wrestle with what are likely to be some discrepancies in data collected by their team, and then compare results to official readings for your region. It should both help them understand some principles relating temperature and water’s phase changes and also some real-world consequences.

Objectives

To find the dew point of the classroom.

To use online resources to compare this result to the official local dew point.

Vocabulary

average

dew point

humidity

relative humidity

saturated

Materials (per team of students)

shiny soup can, empty and with label removed

thermometer

150 ml of water

6-7 ice cubes

Student Worksheet 2.2 “Dew-ing” the Dew Point

WEATHERlogs

LFSTORM Standards Correlation sheet (for teacher reference)

Engage

Have students think about a hot, sunny day in the middle of summer. Give the students, working in teams, 5 minutes working to list as many factors as they can think of which contribute to how hot that day feels, and record these in their WEATHERLogs. (Amount of cloud cover, amount of sunlight during the day, relative humidity, temperature, whether the wind is blowing or not, city versus country, amount of open space and/or paved surface.)

Discuss these factors as a class and then ask what might happen the next morning if there was a big drop in temperature overnight. (Students should eventually suggest that there may be fog at night or in the morning or at least dew on the ground and cars.)

Procedure

Hand out Student Worksheet 2.2. Discuss the procedure and all its steps with the students. Ensure they realize that if moisture immediately forms on the outside of the can they should pour the first batch of water out and use warmer water. What they are looking for is the point at which a shiny can begins to look cloudy, after the ice is added, or when water droplets are able to be seen on the exterior surface of the can. That's when they should record the temperature of the ice water. Have them repeat the experiment 2 more times and find the average of the three temperatures, allowing all 3 members of the team a chance to undertake each aspect of the experiment.

Explain/Explore

Have the student teams then go online and compare the dew point they recorded with the official NWS (see below) dew point for your area. How accurate were their results. (Remember if this experiment is done in a room where the heating system or air-conditioning is on your results may not compare with the actual dew point. Depending on local conditions (e.g. just how hot it is inside your room and how chilly outside) you may wish to have students do this Activity outside. If your school is very warm, this will result in a closer correspondence of student results and official readings. If outside conditions are too adverse, a window ledge might allow the young investigators to stay comfortable, and the experiment still to be conducted outside. Caution, of course, with students, open windows, and objects—large and small—that may fall on those below.

Record the humidity.

Repeat the entire procedure on days when the humidity is lower and higher than on the day of the original test. Have students hypothesize how humidity affects the dew point.

Expand/Adapt/Connect

Have student teams share their results with the whole class: review of their different findings may trigger some useful discussion of how successful the various groups were in controlling their experimental variables. If you undertake this Activity with several different classes over different days at different times of the day, you may also want to present the varying results, and have students account for variations in the data by time of day or other variables.

Using the National Weather Service website, the local weather forecast on TV and other resources, have students record the dew point and the temperature in the late afternoon in their WEATHERLogs for a period of two weeks. They should also record the low temperature during the night, whether any fronts passed through in the previous 24 hours, and any other weather data they can collect, such as clear or overcast skies or fog.

Specific URLs for this section of the Activity:

<http://weather.noaa.gov/>

“Current Isotherms, Fronts and Data”

http://www.comet.ucar.edu/dstreme/images/sfc_adv.gif

At the end of the two week period of recording this information, have students review their data and write a summary paragraph describing any correlations they can observe. (Students should note that the temperature does not fall below the dew point. Some may also discover that when the temperature in the late afternoon and the dew point are no more than 4 or 5 degrees apart, there will be fog at night.)

Suggested URLs (General background) for Activity 2.2 “Dew-ing” the Dew Point

<http://www.nws.noaa.gov/er/mhx/dewg.htm>

Basic explanation of dew and frost, including why we don’t see those interesting frost patterns on our windows any more!

<http://wxnet4.nbc4.com/chap4/humdedew.html>

Simple explanation of the difference between relative humidity and dew point, including a discussion of their effects. (You’ll find the entire WeatherNet4 [NBC, Washington] site has excellent resources about both meteorology and space science.)

<http://www.protimer-usa.com/Support/supdpair.htm>

Simple explanation of dew point.