Dew Point Temperature

On hot summer days, you may notice water droplets forming on the outside of a glass of ice water. It is commonly said that the glass is "sweating." Since the glass cannot actually sweat, the liquid on the glass must come from the air outside the glass. This liquid forms by the condensation of water vapor that is near the surface of the glass. The air next to the cold glass has been cooled to the *dew point* or *dew point temperature*. The dew point temperature is the temperature to which air would have to be cooled to become saturated. Once the air is saturated, the water vapor condenses to form a liquid. The same process occurs when dew forms on the lawn.

In this experiment, you will use a temperature probe to make two investigations. In the first, you will measure the temperature of air next to a can of ice water to see if it is colder than room temperature. In the second investigation, you will determine the dew point temperature of the air in the classroom. You will do this by slowly adding ice to water and watching for condensation to form on the outside of the container. Throughout this process, you will continuously record the temperature of the water. When condensation first forms on the container, the temperature of the water is the dew point temperature.

OBJECTIVES

In this experiment, you will

- Compare room temperature to the temperature of air next to a can of ice water.
- Record the temperature of water while ice is slowly added.
- Observe the formation of condensation.
- Determine the dew point temperature.

MATERIALS

TI-Nspire handheld **or**
  computer and TI-Nspire software
EasyTemp **or** Go!Temp **or**
  Temperature Probe and data-collection interface
room temperature water
plastic spoon
ice cubes and ice chips
ring stand
utility clamp
paper towels

PRE-LAB QUESTIONS

1. To determine the dew point temperature, you will slowly add small pieces of ice to room temperature water. After each piece is added, you will wait for the ice to melt. Throughout this process, you will graph the temperature of the water. Draw a rough sketch of what the temperature *vs*. time graph will look like while the ice melts.

2. In the experiment, you will continue to collect temperature data after the small pieces of ice have melted. Draw a rough sketch of what the temperature *vs*. time graph will look like after the ice has melted.

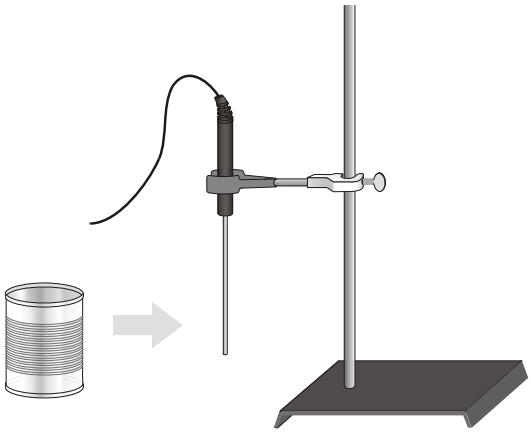

Figure 1

PROCEDURE

Part I Measure the Temperature of the Air Next to a Can of Ice Water

1. Use a utility clamp to suspend the Temperature Probe on a ring stand as shown in Figure 1. The end of the Temperature Probe should be about 1 cm above the tabletop.

2. Connect the Temperature Probe to the data-collection interface. Connect the interface to the TI-Nspire handheld or computer. (If you are using an EasyTemp or Go!Temp, you do not need a data-collection interface.)

3. Choose New Experiment from the Experiment menu. Choose Collection Setup from the Experiment menu. Enter **1** as the rate (samples/second) and **900** as the experiment duration in seconds. The number of points collected should be 901. Choose the Data Marker option and select OK.

4. Read the room temperature displayed on the screen. Record it in the data table.

5. Place 5 or 6 ice cubes in the metal can, fill it with water, and place it away from the Temperature Probe.

6. Start data collection ( ). Wait 30 seconds and then place the can about 1 mm from the tip of the Temperature Probe. Do not touch the probe to the can.

7. Watch the outside of the can. When condensation forms on the can, click the Add Data Marker button ( ) to mark the dew point temperature. Stop data collection ( ).

8. A graph of temperature *vs*. time will be displayed. The temperature you marked with the Data Marker will be highlighted in the graph with a large point icon. Double-click on this point, label it **Dew Point**, and then select OK. The point label is displayed in the Graph View Details box. Record the dew point temperature in the data table.

9. Print or sketch copies of the graph as directed by your instructor.

10. Empty the can and dry the outside.

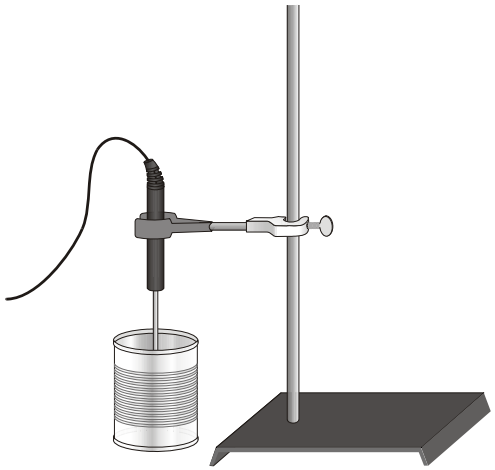

Figure 2

Part II Determine the Dew Point Temperature

11. Fill the dry can half full with room temperature water.

12. Lower the Temperature Probe into the water (to about 1 cm from the bottom) as shown in Figure 2. Click the Store Latest Data Set button ( ) to save the first run data.

13. Click the Meter View tab ( ). Monitor the temperature of the water. Once the temperature is stable, go to Step 14.

14. Start data collection ( ). Wait about 30 seconds and then add a spoonful of ice chips to the water. Stir the water while the ice melts. After the ice has melted, continue to stir the water for about 10 seconds.

15. Add another spoonful of ice chips and again stir the water until it melts. Again wait about 10 seconds after the ice has melted. Observe the can to see if water has condensed on the outside.

16. Repeat Step 15 until you observe condensation. When condensation forms on the can, click the Add Data Marker button ( ) to identify the dew point temperature. Stop data collection ( ).

17. A graph of temperature *vs*. time will be displayed. The temperature you marked with the Data Marker will be highlighted in the graph with a large point icon. Click on this point, label it **Dew Point**, and then select OK. Record the dew point temperature in the data table.

18. Print or sketch copies of the graphs as directed by your instructor.

DATA

Part I	
Room temperature (°C)	
Air temperature close to the can of ice water (°C)	

Part II	
Dew point temperature (°C)	

QUESTIONS

1. Compare the room temperature to the temperature of the air next to the can of ice water. How much colder was this air than room temperature?

2. Compare the room temperature, the temperature of the air next to the can, and the dew point temperature.

EXTENSIONS

1. Repeat Part II of this experiment four more times and determine the average dew point temperature.

2. Collect results from other lab groups and determine the average dew point temperature.

3. Repeat the experiment outside and compare the dew point temperature of the outside air to that of the inside air. Explain any differences.