Activity 4 – Measuring dew-point temperature by condensation

Another way to determine the dew-point temperature is to cool a vessel until condensation begins to form on the outside of it. When you do this, it is very important that you change the temperature in small increments, and carefully monitor for the appearance of condensation. To get a feel for this activity, put about 100 mL of water into a 250 mL beaker. Dry the outside of the beaker. Measure the temperature with a digital thermometer. Put about 50 mL of ice into the water. Stir gently with the thermometer. Notice the drop in temperature. Touch the outside of the beaker to find out if there has been condensation. Now you realize how much the temperature drops with addition of ice, and how to feel condensation on the beaker.

Instructions to determine relative humidity by cooling air to the dew-point: Begin the measurement of the dew-point temperature by starting with a dry beaker at room temperature. Put about 150 mL of tap water into it. Add ice in 5 to 10 mL amounts, allowing it to completely melt before noting temperature and checking for condensation. You should add only enough ice each time to bring the temperature down about 1° C. Continue until you notice condensation on the beaker. The temperature is your dew-point temperature. Record it below:

Dew-point temperature (°C) _____

Questions

18. Compare your measured dew-point temperature above with the value you determined using the psychrometer in Activity 3?

19. If the values are different, what factors might explain those differences?

Use Table 1 or Figure 1 to determine the values in questions 21 and 22.

20. What is the water vapor capacity of 59°F air? _____

21. What is the water vapor capacity of 41°F air? _____

22. If saturated air at 59°F is cooled to 41°F, how much water vapor will condense out of the air?

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The water vapor capacity of air is directly related to, and limited by, its temperature. The table below presents the water vapor capacity of a kilogram of air at various temperatures. Use the table to answer the following questions.

Table 1: Water vapor capacity of a kilogram of air at average sea level pressure.

Temperature (ºF)	**Temperature (ºC)**	**Grams of water vapor per kg of air (g/kg)**
- 40	- 40	0.1
- 22	- 30	0.3
-4	- 20	0.75
14	- 10	2
32	0	3.5
41	5	5
50	10	7
59	15	10
68	20	14
77	25	20
86	30	26.5
95	35	35
104	40	47