



Name: _____

Date: _____

Student Exploration: Relative Humidity

Vocabulary: condense, dew point, evaporate, humidity, psychrometer, relative humidity, saturated, water vapor, wet bulb depression

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

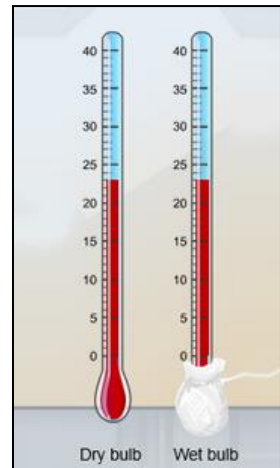
1. When you go outside on a hot summer day, usually your body begins to sweat. Why does your body do this? _____

2. **Humidity** is the amount of moisture in the air. Do you think sweating cools you down more on a dry day or a humid day? _____

Gizmo Warm-up


When sweat **evaporates**, heat energy is removed from our skin and our bodies cool down. But the amount of **water vapor** air can hold is limited, so sweat can only evaporate if the air still has the capacity to hold more water. If the humidity is high, less water can evaporate from the sweat on your skin.

The amount of water vapor in the air compared to the maximum amount air can hold is known as **relative humidity**. In the *Relative Humidity* Gizmo, you will use a **psychrometer** to determine relative humidity. A psychrometer has two thermometers. The dry bulb thermometer measures air temperature. The second thermometer has a wet bulb. As water evaporates from the wet bulb, its temperature decreases relative to the air temperature.



1. Do you think the wet bulb will cool down more on a dry or humid day? _____
2. Click **Play** (▶) and observe the thermometers for about 24 simulated hours. Describe some of the changes in temperature for both thermometers:



Activity A: Measuring relative humidity	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> • Click New. • Turn on Show relative humidity. 	
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Question: How can you use a psychrometer to measure relative humidity?

1. Predict: How will relative humidity relate to the temperature of the wet bulb thermometer?

2. Gather data: Click **Play**, and click **Pause** (⏸) at several random times. Record the dry bulb temperature, wet bulb temperature, and relative humidity.

Trial	Dry bulb temp. (°C)	Wet bulb temp. (°C)	Relative humidity (%)
1			
2			
3			
4			

3. Analyze: What patterns do you notice? _____

4. Measure: Select the TABLE tab. This table will help you to determine relative humidity.

A. Click **Play** and then **Pause**. What is the dry bulb temperature? _____

B. What is the wet bulb temperature? _____

C. What is the difference between the dry bulb and wet bulb temperature? _____

This value is called the **wet bulb depression**.

D. Find the dry-bulb temperature on the table's left column. Then find the wet bulb depression along the top row. (Use the dropdown menu to see different temperature differences.) The relative humidity is found at the intersection of this row and column.

What is the relative humidity? _____

Click on the CONTROLS tab to check your answer. (Your value should be close.)

(Activity A continued on next page)



Activity A (continued from previous page)

5. Practice: Select the TABLE tab again. Click **Play**, and click **Pause** at several random times. Each time, record the dry bulb temperature, wet bulb temperature, wet bulb depression, and the relative humidity.

Trial	Dry bulb temp. (°C)	Wet bulb temp. (°C)	Wet bulb depression (°C)	Relative humidity (%)
1				
2				
3				
4				

6. Interpret: Examine the psychrometer table on the TABLE tab.

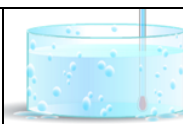
A. As the wet bulb depression increases, what happens to the relative humidity?

B. As the dry bulb temperature increases with a constant temperature difference, what happens to the relative humidity? _____

C. How do you think the amount of water vapor air can hold changes as air temperature increases? _____

7. Think about it: Warm air is able to hold much more water vapor than cold air before it becomes **saturated** (100% relative humidity). How would you expect the relative humidity of air to change as air warms up in the morning? How would you expect it to change as air cools in the evening? Test your ideas using observations from the Gizmo and describe your results below.



Activity B: Measuring dew point	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> • Click New. • Turn on Show water bucket. 	
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Introduction: Air is saturated when the relative humidity reaches 100%. If saturated air is cooled down, the amount of water vapor the air can hold will decrease, so water vapor in the air will begin to **condense** into drops of liquid water. The temperature at which condensation begins is called the **dew point**.

Question: How can you measure the dew point?

1. **Observe:** Set the temperature (**T**) of the water bucket to 50.0 °C.
 - A. Look at the sides of the bucket. Is there any condensation there? _____
 - B. Slowly decrease the temperature of the water bucket until you see condensation form. What temperature does condensation first form on the bucket? _____

This temperature is the dew point. Turn on **Show dew point** to check your answer.

2. **Measure:** Click **Play** and watch the dry bulb temperature, relative humidity, and dew point for several days. Click **Pause** at random times and record your readings in the table below. Take readings at least once for a relative humidity above 70% and below 30%.

Trial	Dry bulb temp. (°C)	Relative humidity (%)	Dew point (°C)
1			
2			
3			
4			

3. **Analyze:** Compare the dew point to the dry bulb temperature and the relative humidity.
 - A. For which relative humidity was the dew point closest to the air temperature?

 - B. Why do you think this is the case? _____

(Activity B continued on next page)



Activity B (continued from previous page)

4. Gather data: Now, gather data for a whole day. Fill in the table below.

Time	Dry bulb temp. (°C)	Relative humidity (%)	Dew point (°C)
1:00 A.M.			
5:00 A.M.			
9:00 A.M.			
1:00 P.M.			
5:00 P.M.			
9:00 P.M.			

5. Describe: Look at the data in your table. What patterns do you see? _____

6. Interpret: Based on your data, describe what the weather probably was like that day.

7. Apply: Think about real-life situations when condensation occurs.

A. Why do water droplets form on the outside of a cold can of soda? _____

B. Why does dew form on grass in the early morning? _____

C. Describe another example of condensation, and explain why it occurs. _____

