

Name: \_\_\_\_\_

Date: \_\_\_\_\_

### LAB: Dew Point and Cloud Formation

Adapted from Exploration in Earth Science, The Physical Setting, United Publishing Company, Inc.

**Introduction:** Cumulus clouds are our “puffy” fair weather clouds. They are often flat on the bottom and rounded on the top. The distance from the Earth’s surface to the bottom of these clouds is often the same for a large group of them. Clouds can only form if a specific temperature, called the **dewpoint**, is reached. Since the air temperature decreases with height above Earth’s surface, clouds may form if the air temperature is cold enough to be at the dewpoint at some altitude.

**Objective:** In this lab, you will study the relationship between the dewpoint temperature and the height above Earth’s surface at which clouds form.

**Hypothesis:** Make a statement about what you believe about the relationship between the dewpoint temperature and the height at which clouds form.

#### Vocabulary:

Dewpoint Temperature:

Psychrometer:

Cloud Base:

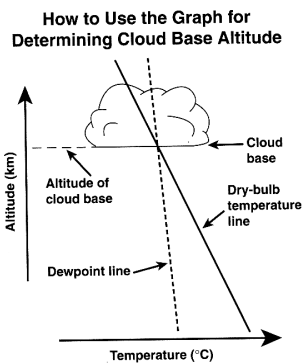
#### PROCEDURE A

Refer to the *Dewpoint Temperature Chart* on page 12 of your *Earth Science Reference Tables* to answer questions 1 - 3.

1. What is the wet-bulb depression if the dry-bulb temperature is 20°C and the wet bulb is 17°C? \_\_\_\_\_
2. What is the dewpoint temperature if the dry-bulb is 16°C and the wet bulb depression is 5°C? \_\_\_\_\_
3. What is the dewpoint temperature if the dry-bulb temperature is 24°C and the wet-bulb temperature is 20°C? \_\_\_\_\_

#### PROCEDURE B

The altitude at which clouds form (called the **cloud base**) can be determined using the *Generalized Graph for Determining Cloud Base Altitude* chart (page 3 of this lab). The diagram below shows how the cloud base is determined using the graph.



Refer to the *Generalized Graph for Determining Cloud Base Altitude* on the next page of the lab to answer questions 1 - 5 below.

1. What change occurs in the dewpoint as altitude increases? (look at the dashed lines)  
\_\_\_\_\_
2. How does the air temperature (dry-bulb temperature) change with increasing altitude? (look at the solid lines)  
\_\_\_\_\_
3. Which changes more rapidly with increasing altitude, air temperature (dry-bulb temperature) or the dewpoint temperature?  
\_\_\_\_\_
4. At what altitude do the dewpoint and dry-bulb (air) temperatures become the same if the dry-bulb temperature at the ground level is 0°C and the dewpoint temperature at the ground level is -8°C? ***(Draw the cloud on the chart at the appropriate altitude where the lines meet and label the cloud #4)***  
\_\_\_\_\_
5. What would be the altitude of the bottom of a cloud mass if the dry-bulb temperature at the ground level is 30°C and the dewpoint at the ground level is 12°C? ***(Draw the cloud on the chart at the appropriate altitude where the lines meet and label the cloud #5)***  
\_\_\_\_\_

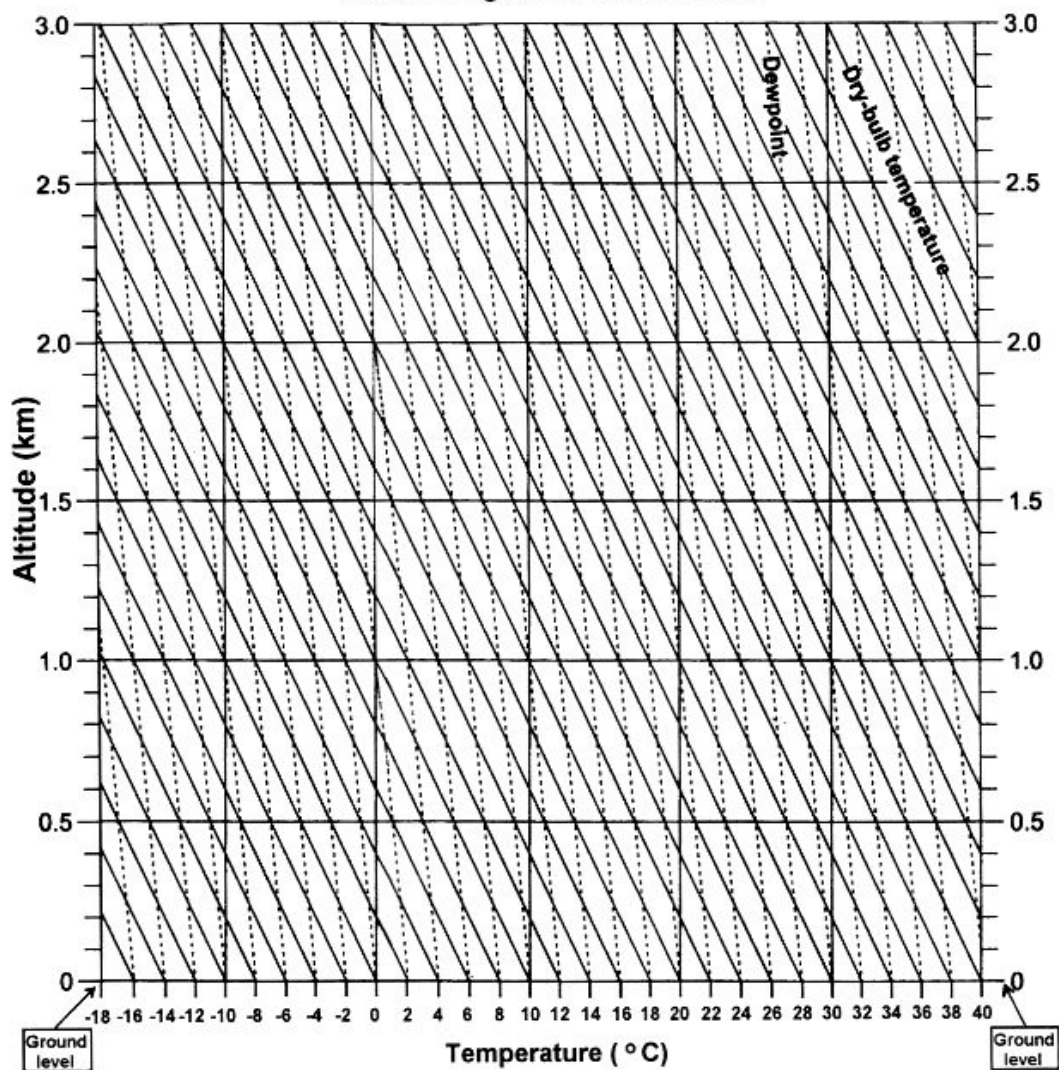
**PROCEDURE C**

Using the information given on the Report Sheet below to determine the dewpoint temperatures and cloud base altitudes. You will need to use your *Earth Science Reference Tables* to find the dewpoint temperatures and the *Generalized Graph for Determining Cloud Base Altitude* to find the altitude at which the clouds form. ***Draw the clouds for each on the chart at the appropriate altitude where the lines meet and label each: #1, #2, and #3.***

REPORT SHEET

	#1	#2	#3
Dry-Bulb Temperature	20°C	4°C	28°C
Wet-Bulb Temperature	12°C	-1°C	19°C
Wet-Bulb Depression	_____	_____	_____
Dewpoint Temperature	_____	_____	_____
Cloud Base Altitude	_____	_____	_____

### Generalized Graph for Determining Cloud Base Altitude



#### Discussion Questions:

1. Why does the height of the cumulus cloud base change from day to day?
2. What would happen to the height of the cloud base if the dewpoint temperature were lower?

3. How would it be possible to have a day without clouds?
  
4. What relationship would you expect to find between the air temperature and dewpoint temperature at ground level if the area is covered by fog?
  
5. What happens to the air temperature of a descending mass of air?
  
6. What happens to the dewpoint temperature of a descending mass of air?
  
7. Explain why a descending mass of air would tend to become dryer.

**Conclusion:** Describe the relationship between the air temperature and dewpoint temperature and the altitude at which a cloud forms.

**Reading Comprehension** Read the portion of the article on Cloud Formation below and answer the following questions based on the reading. Use complete sentences.

## How are Clouds Formed?

by John Carl Villanueva on December 1, 2009  
<http://www.universetoday.com/46489/how-are-clouds-formed/>

I bet some of you are fascinated with certain cloud formations. My eldest son once pointed to the sky, excited upon seeing a bunch of clouds taking shape of a menacing dragon. He was however disappointed after a few minutes when the dragon cloud slowly began to deform and fuse with the rest. So how are clouds formed?

First, water evaporates, rises, and fills up the atmosphere. The evaporated water, a.k.a. water vapor then clings to other numerous particles or dust found in the atmosphere. This dust comes from automobiles, fires, volcanoes, bacteria, and sea spray.

As water vapor rises, it cools. Now, the lower the temperature of air, its capacity to hold water vapor (also known as the saturation point of air) also drops.

Eventually, the rising water vapor condenses and forms the structure of the cloud. You can't however see this structure unless it has its own color. Well, we know that clouds are either white or dark, and that's why we're able to see them.

Most clouds are white. That's because water and ice particles that make up a cloud have just the right amount and sizes to scatter light in all possible wavelengths. When light of practically all wavelengths combine, the result is white light.

However, when too many water and ice particles build up, just like in a storm cloud, much of the scattered light is simply re-scattered into the cloud. In other words, too much particles prevent some of the light from escaping. Hence is the reason why storm clouds are dark.

Try slowly adding milk in water and notice how its color slowly shifts from white to dark as more milk is added.

I'm sure you've noticed that clouds easily form on mountains. How are clouds formed on mountains? When a wall of air and water vapor encounters a mountain side, it has nowhere else to go but up the slopes. Well, if you recall, rising water vapor cools and eventually condenses to form clouds.

Thus, mountains don't have special particles that enhance cloud formation. Rather, it is the barriers that they so form that forces the water vapor to rise and hence develop into cloud structures. A cloud formed due to topographical features is called an orographic cloud.

1. What happens to water vapor as it rises and why does this happen?
2. What causes clouds to be white or grey in color?
3. Why does one side of a mountain receive more rain than the other?
4. Using what you have learned, explain why the Adirondack Mountains receive a lot of annual lake effect snow.