

Name \_\_\_\_\_

Partners \_\_\_\_\_

Question: which holds more moisture, warm air or cold air? \_\_\_\_\_ As air rises, it expands and becomes \_\_\_\_\_, so it can hold \_\_\_\_\_ moisture.

## LAB E-4: DEW POINT AND CLOUD FORMATION

Air also \_\_\_\_\_ as it sinks, so it can hold \_\_\_\_\_ moisture.

**INTRODUCTION:** Cumulus clouds are our “puffy” fair weather clouds. They are often flat on the bottom and rounded on top. The distance from 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 dew point, 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 dew point at some altitude.

In other words, the bottom of the cloud is the height at which the temperature has dropped to the dewpoint, the  $T^0$  where condensation (a

**OBJECTIVE:** In this lab you will study the relationship between the dew point temperature and the height above the earth’s surface at which clouds form.

Question: what’s fog? \_\_\_\_\_

### VOCABULARY:

- dew point temperature: - the temperature at which condensation occurs - the air is “saturated,” or at 100% relative humidity, at that  $T^0$ .
- psychrometer: - an instrument for measuring dewpoint and relative humidity.
- wet-bulb depression:
- cloud base: - the difference in temperature between the dry bulb and the wet bulb on a psychrometer.  
- the bottom of a cloud (altitude at which dewpoint is

### PROCEDURE A:

Refer to the Dew Point Temperature Chart in the Earth Science Reference Tables to answer questions 1 through 3.

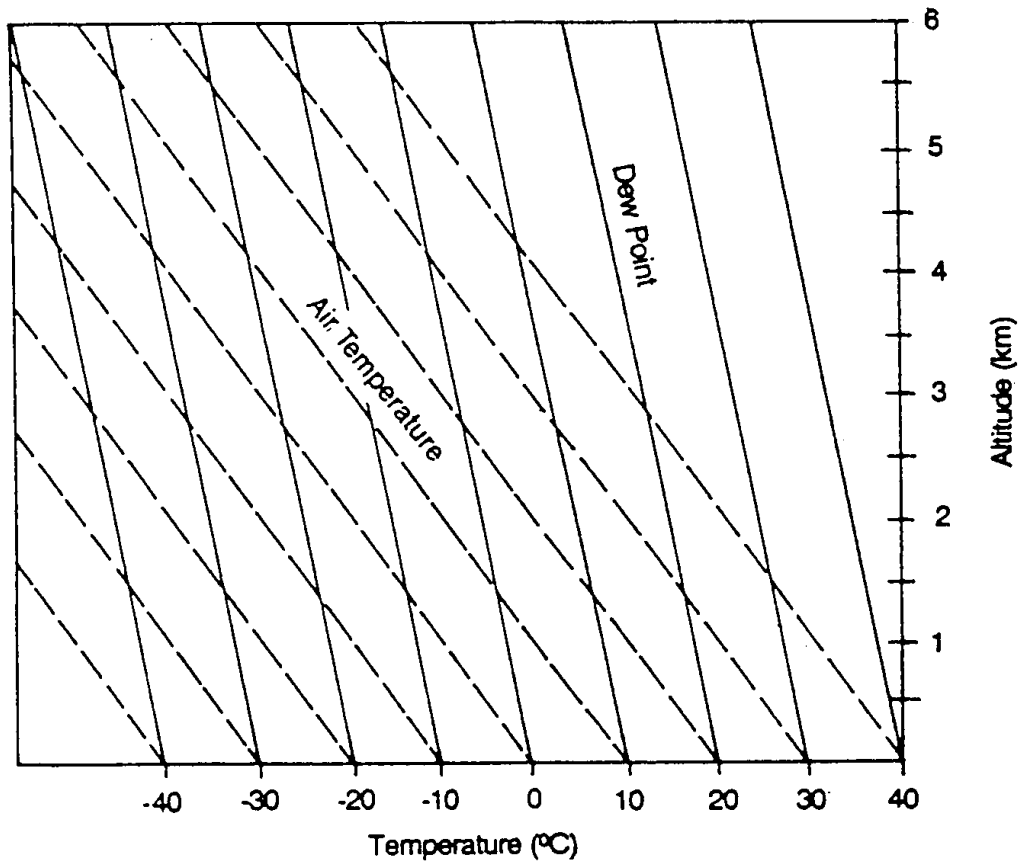
1. What is the wet-bulb depression if the dry-bulb temperature is  $20^{\circ}\text{C}$  and the wet-bulb is  $17^{\circ}\text{C}$ ? \_\_\_\_\_
2. What is the dew point temperature if the dry-bulb is  $16^{\circ}\text{C}$  and the wet-bulb depression is  $5^{\circ}\text{C}$ ? \_\_\_\_\_
3. What is the dew point temperature if the dry-bulb temperature is  $24^{\circ}\text{C}$  and the wet-bulb temperature is  $20^{\circ}\text{C}$ ? \_\_\_\_\_

**PROCEDURE B:**

Refer to the “Cloud Base Altitude Chart” which shows decreasing temperature with changing altitude and answer questions 1 through 5 below.

1. What change occurs in the dew point as altitude increases? (Look at the solid lines.)  
\_\_\_\_\_
2. How does the air temperature (dry-bulb temp.) change with increasing altitude? (Look at the dashed lines.)  
\_\_\_\_\_
3. Which changes more rapidly with increasing altitude, air temperature or dew point temperature?  
\_\_\_\_\_
4. At what altitude do the dew point and air temperature become the same if the surface air temperature is 0°C and the dew point temp. at the surface is -20° Celsius? \_\_\_\_\_
5. What would be the altitude of the bottom of a cloud mass if the surface temperature is 30°C and the surface dew point temp. is -10°C? \_\_\_\_\_

**CLOUD BASE ALTITUDE CHART**



**PROCEDURE C:**

Use the information given on Report Sheet 1 to determine the dew point temperatures and cloud base altitudes.

**REPORT SHEET #1**

	(1)	(2)	(3)
DRY-BULB TEMPERATURE	<u>24°C</u>	<u>4°C</u>	<u>25.00°C</u>
WET-BULB TEMPERATURE	<u>12°C</u>	<u>-2°C</u>	<u>18.75°C</u>
WET-BULB DEPRESSION	<u>                    </u>	<u>                    </u>	<u>                    </u>
DEW POINT TEMPERATURE	<u>                    </u>	<u>                    </u>	<u>                    </u>
CLOUD BASE ALTITUDE	<u>                    </u>	<u>                    </u>	<u>                    </u>

**PROCEDURE D:**

1. Go outside and use a sling psychrometer to measure the wet and dry bulb temperatures. Record these data on the report Sheet #2.
2. Complete Report Sheet #2 by determining and entering the wet-bulb depression and the dew point temperature.
3. Using the dry-bulb and dew point temperatures determined above, use the Cloud Base Altitude Chart to find the cloud base altitude for this day. Record this altitude on Report Sheet 2. Be sure to draw lines on Chart #1 showing the air temperature and the dew point temperature coming together.
4. On the Cloud Base Altitude Chart, draw in a cloud picture with the cloud base at the correct altitude.

**REPORT SHEET #2**

DRY-BULB TEMPERATURE:                      °C

WET-BULB TEMPERATURE:                      °C

WET-BULB DEPRESSION:                      °C

DEW POINT TEMPERATURE:                      °C

CLOUD BASE ALTITUDE:                      km

**DISCUSSION QUESTIONS:** *(Answer in Complete Sentences)*

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 dew point temperature were lower?
3. How would it be possible to have a day without any clouds?
4. What relationship would you expect to find between the air temperature and dew point 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 dew point temperature of a descending mass of air?
7. Explain why a descending mass of air would tend to become drier.

**CONCLUSION:** Describe, step by step, how you can determine the base altitude at which clouds form?