Laboratory Investigation Name _____

Chemistry: Form L6.4A Date _____ Period _____

Vapor Pressure and Evaporative Cooling

PROBLEM

How does vapor pressure effect evaporation?

INTRODUCTION

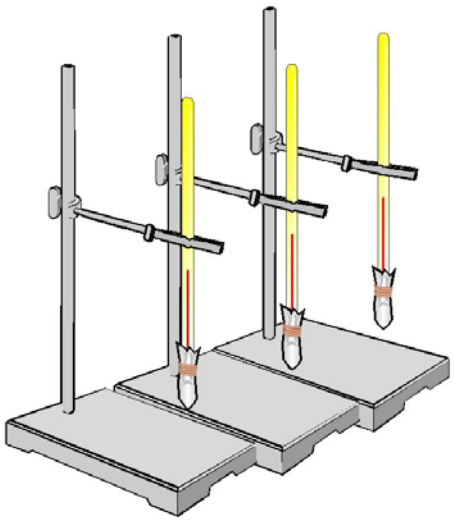
When a liquid evaporates, the distance between its particles increases tremendously, causing a significant increase in their potential energy. The energy needed to evaporate 1 g of a liquid, known as the heat of vaporization, is much greater than the energy needed to cause a 1°C rise in the temperature of a liquid. When a liquid evaporates, it takes the energy needed for the process from its surroundings. This is why sweating cools you and you may feel chilled when you step from the shower. Some liquids cool your skin even faster than water. Did you ever notice how cold it feels when the doctor cleans your skin with alcohol prior to giving an (ouch!) injection? In this laboratory investigation, you will explore this phenomenon.

MATERIALS *(per group)*

Ethanol; filter paper; propanone (acetone); ring stand(3); rubber bands; thermometer clamp (3); thermometers(3); water

PROCEDURE

1. Set up three beakers, each containing one of the following liquids: propanone; ethanol; and water.
2. Place a piece of filter paper in the liquid in each of the beakers, and allow it to soak for several minutes.
3. Using a thermometer, measure the temperature in the room. Record the result in the data table on the next page.
4. Set up three thermometers on ringstands with thermometer clamps as shown in the diagram to the right.



5. Wrap the bulbs of each of the thermometers with one of the soaked pieces of filter paper. Keep track of which liquid is in contact with each thermometer.
6. Secure each piece of filter paper by wrapping it with a rubber band.
7. Watch the temperatures on each of the thermometers for several minutes. As the liquid evaporates, the temperature will begin to drop. Note which one begins to drop first, and which drops fastest.
8. Make note of the lowest temperature each thermometer reaches, and record it in the data table on the next page.
9. Calculate the absolute value of the temperature change for each by subtracting the coldest temperature reached by each from room temperature.
10. Determine the normal boiling point of each liquid by looking at Table H, ***Vapor Pressure of Four Liquids***, on your reference tables. Record the boiling points in your data table on the next page.

11. On a separate sheet of graph paper, prepare a graph of boiling point versus temperature change. Use the x-axis for boiling point and the y-axis for temperature change. Plot the points and draw the best straight line or curve through the points.

OBSERVATIONS

Room temperature . . . . . _____

Liquid	Normal Boiling Point	Lowest Temperature Reached	Temperature Change
Propanone			
Ethanol			
Water			

CONCLUSIONS

1. Why does the temperature drop when the thermometer covered with wet filter paper is left to dry? _____

2. What is the relationship between the normal boiling point of a liquid and how well it cools by evaporation? _____

3. Predict the lowest temperature a thermometer wet with isopropyl alcohol would reach if its boiling point is 82.4°C. _____

4. Which of the liquids tested has the highest vapor pressure at room temperature? Which has the lowest vapor pressure? What is the relationship between the vapor pressure of a liquid and how well it cools by evaporation? _____

5. Which of the liquids you tested has the strongest forces holding its molecules to each other? What evidence does the laboratory investigation provide to support your answer?