EXPERIMENT (2)
DETERMINATION OF BOILING POINTS

Purpose:

The purpose of this experiment is to determine the boiling points of various organic compounds and to determine the purity of liquid organic compounds.

Theory:

The boiling point of a compound is the temperature at which it changes from a liquid to a gas when the vapor of the liquid is equal to the atmospheric pressure. This is a physical property often used to identify substances or to check the purity of the compound. It is difficult, though, to find a boiling *point*. Usually, chemists can only obtain a boiling range of a 2 - 3^{o}C accuracy.

Factors Influencing Boiling Point

a) Molecular Weight:
Increased molecular weight increases boiling point A higher molecular weight compound need more energy(higher boiling point temperature) that is necessary to break the non-covalent interactions to transform the compound from the liquid phase to the gas phase.
Ex: Octane is more boiling point from Hexane .

b) Branching:
Branching decreases boiling point. Thus, molecules that are forced to be farther away from each other due to branching have weaker non-covalent interactions. Less energy (lower temperatures) is needed to induce a phase change from the liquid phase to the gas for branched compounds relative to straight chain compounds. (Fig. below)

Which of these molecules are more boiling point ? Why ?

c)External pressure :

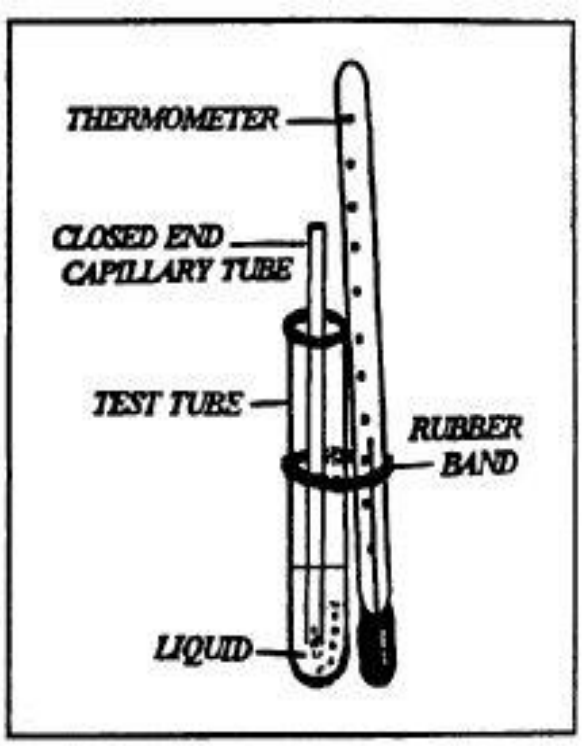
d) Polarity :
polar covalent bonds in a molecule tend to increase the boiling point. More polar elements in a molecule increase the total number of H-bonding interactions. More energy (higher boiling point temperature) is necessary to break these interactions

apprates / Materials:

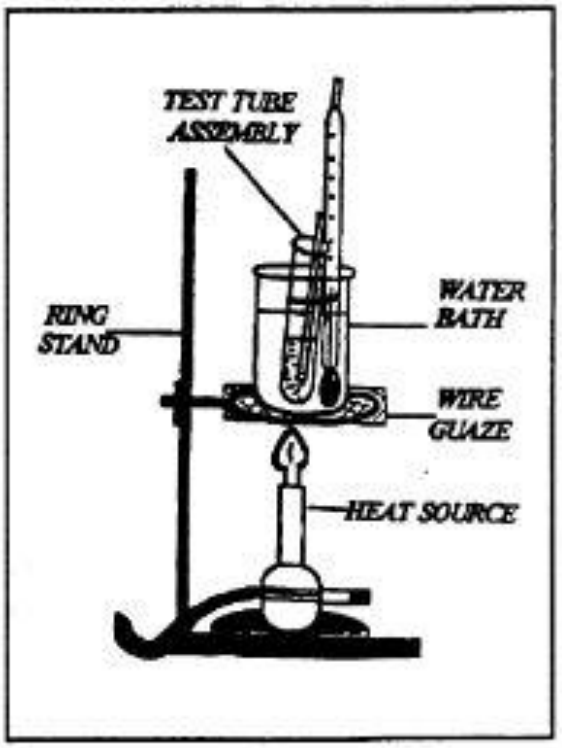
Benzen burner
thermometer
50 mL beaker
Tripod stand
wire gauze
closed end capillary tube
boiling tube
liquid organic compounds
glass rod
stand and clamp
oil bath

Procedure:

1. Place a few ml. of a known liquid organic compound in a (boiling tube).
2. Place the capillary tube into the boiling tube with the closed end upward.Fig1a
3. Attach a boiling tube to the thermometer through by the ring tube. Fig1a
4. Fill a 50 mL beaker 3/4 full with water, and place on the benzene burner. Carefully immerse the boiling tube and thermometer combination into the beaker of water so that the test tube is half way in the water.
5. Begin to heat the burner /water slowly. As the liquid approaches its boiling point, a few bubbles will be observed flowing out of the end of the capillary tube. When a steady stream of bubbles are observed, turn off the hot plate , When the liquid begins to flow into the capillary tube, record the temperature of the liquid as its boiling point temperature. Fig1a



Test Tube Assembly ↑



Heating Assembly↑

Questions:

1. How would the boiling point change if the atmospheric pressure increased or decreased?

2. Boiling point determination can be used for several purposes. What are those purposes

3. What is the effect of a small amount of impurity on the boiling point of an organic compound?