



Lab of Organic Chemistry 1st stage

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Lecture 3

" Boiling point Determination Experiment"

Department of Life Sciences

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Aim of the Experiment ✨

Determining the boiling point of a liquid accurately.

Using the boiling point as a means to identify the substance.

Checking the purity of the liquid by comparing its boiling point with standard values

Theoretical Principle

This is the temperature at which the vapor pressure of a liquid equals the atmospheric pressure (the external pressure). The boiling point is the temperature at which a substance begins to boil, changing from a liquid to a gaseous (vapor) state. Since the boiling point varies with external pressure, the pressure at which the boiling point is measured must be specified. The purity of a liquid is indicated by determining its boiling point. The Siwoloboffs method is used to determine the boiling point, and simple distillation can be used if the quantity of liquid material is sufficient.

Factors Affecting the Boiling point

Factors Affecting Boiling Point

1-Nature of the Organic Compound: A branched compound has a lower boiling point than an unbranched compound of the same type and with the same molecular weight, due to the fewer bonds holding the molecules together.

2-Molecular Weight of the Liquid: The higher the molecular weight of the compound, the higher its boiling point.

3-External Pressure: Many liquids decompose and break down at their boiling point and at normal atmospheric pressure. Therefore, their boiling point must be reduced by decreasing the external pressure. External pressure is directly proportional to the boiling point; as the temperature increases, the boiling point increases, and consequently, the vapor pressure increases. Vapor pressure is directly proportional to temperature.

4-Purity of the Compound: Impurities affect the boiling point of a compound. There are two types of impurities:

Moisture increases the boiling point of the compound.

Organic or inorganic compounds also increase the boiling point.

Procedure

1-Prepare the capillary tube by sealing one end. Heat it using a Bunsen burner with a cylindrical motion.

2-Fill a small Pyrex test tube with a small amount of the liquid sample. Place the capillary tube vertically inside the Pyrex test tube, with the sealed end facing up and the open end facing down, immersed in the liquid sample.

3-Connect this capillary tube vertically to the thermometer stem with a rubber ring, ensuring its base is parallel to the thermometer bulb.

4-Fill a small 50 ml beaker halfway with paraffin oil.

5-After connecting the apparatus as shown in the figure below, the paraffin is gradually heated over a low flame. A gradual increase in temperature is observed while continuously stirring the oil bath using a glass stirrer.

6-The specimen and the thermometer temperature are monitored, and the temperature at which the liquid enters the capillary tube is recorded. This temperature is called the boiling point.

Discussion Questions

Q1. Define the boiling point and what factors affect it?

Q2. How can you measure the boiling point of a liquid in the laboratory?

Q3. What is meant by the boiling range?

Multiple Choice Questions (MCQ)

1-What is the boiling point?

A) The melting point of a substance

B) The temperature at which a liquid turns into a gas when its vapor pressure equals the external pressure

C) The freezing point of a substance

D) The temperature at which a gas turns into a liquid

2-What happens when a liquid reaches its boiling point?

A) It freezes

B) It evaporates only from the surface

C) It turns into vapor throughout the entire liquid

D) Its viscosity increases

3-Which of the following factors affects the boiling point?

A) Color

B) Mass only

C) Intermolecular forces

D) Shape

4-How do impurities affect the boiling point?

A) They decrease it

B) They have no effect

C) They increase it

D) They keep it constant

5-What is the main purpose of measuring the boiling point in the laboratory?

A) To determine color

B) To determine volume

C) To determine the purity of a substance

D) To measure mass