

ACTIVITY NO – 3 – Measurement of molality with boiling point

Subject	Chemistry
Class	XII
Chapter/Unit	Solution
Topic	Elevation in boiling point
Time	15 minutes
Nature of Activity	Individual work

What will I learn(Learning Outcome)?

To derive the relation between boiling point elevation and molal concentration of a solution.

Skills: Applying, Analyzing and Creating.

What I have to do?

To derive the relation between boiling point elevation and molal concentration of water and sugar solution by plotting graphs.

What do I require?

- Salt/sugar (non-volatile substance)
- Water
- Thermometer
- Bunsen burner
- Tripod stand
- Wire gauze

What do I need to know?

- **Boiling point:** The boiling point of a pure liquid. When the vapor pressure of the liquid matches the atmospheric pressure, the liquid will boil.
- **Boiling point elevation:** The temperature at which a substance's vapor pressure equals the external pressure increases when another compound is added.
- **Colligative property:** A property of solutions that is directed by the ratio of solute to solvent, regardless of the identity of the solute. Colligative properties are those properties of a solution that depend on the number of molecules or ions dissolved in a solution, and not on the identity of the species in solution. Examples of these properties are boiling point elevation, freezing point depression, and osmotic pressure.

➤ Teacher's Activity

Teacher will

1. Ask students to recall colligative property and all properties depend on the amount of solute added and vapour pressure (except in osmotic pressure).
2. Make pairs of the students and will explain the steps of the activities.
3. Ensure that each participant perform the activity on his/her own.

How will I proceed?

➤ Student's Activity

Determining the Boiling Point of Water and Sugar Solutions

1. Fill 3 600ml glass beakers with 400ml Of Deionized Water.
2. Pick 3 different sugar masses in the range of 20-80g. These 3 masses should be spread over the range to provide a nice spread of data points (one ~20g, one ~80g and one between). Calculate and record the molality of each salt solution based on the salt mass.

3. Add the chosen amount of Salt to each beaker to create the 3 different solutions.
4. Insert 1 magnetic stirrer into each beaker.
5. Place one beaker on hot plate and heat solution until boiling (until temperature is stabilized for 2-3 minutes).
6. Record temperature value (boiling point temperature).
7. Take solution off hot plate carefully using folded paper towels.
8. Repeat Steps 5-7 for each of the 2 other solutions and record boiling temperature.
9. Repeat the experiment one time for each solution, recording boiling point temperatures.
10. Once cooled, dump solutions down drain, clean beakers and return to cabinet. Turn off hot plate and return to cabinet.

What have I observed?

- **Observation Table:**

S.No	Temperature (°C)	molality of sucrose
1		
2		
3		
4		
5		

- Data plot having the X-axis as molality and the Y-axis as the boiling point temperature elevation from pure water (100 °C) shows the following behavior:

What have I learnt?

Liner relation between boiling point elevation and molality

The extent of the boiling point elevation is directly proportional to the _____ of the solution.

What am I curious to learn?

- How can we relate the equation to the given equation in the lab introduction, and see how the slope of the line relates to the boiling point constant and Van't Hoff factor From this, determine the boiling point constant of water
- How Molality is independent of temperature,

Let me evaluate myself

1. What are the units of Molality?

2. What is bolilng point elevation?

3. What would be the molar mass of a compound if 6.21g of it dissolved in 24.0g of chloroform form a solution that has a boiling point of 68.04⁰ C? The boiling point of pure chloroform is 61.7⁰C and the boiling point elevation constant, K_b for chloroform is 3.63⁰ C/m.

4. Is molality is temperature independent?

5. Out of two 0.1 molal solution of glucose and of potassium chloride, which one will have higher boiling point and why?
