

Practical Work N°3 :

PHYSICAL TRANSFORMATIONS OF MATTER (VAPORIZATION AND SOLIDIFICATION)

1. INTRODUCTION

Water comes in three physical states: liquid, gaseous and solid. In this worksheet, we propose to study experimentally the transformation that changes water from a liquid to a gaseous state and from a liquid to a solid state.

2. PURPOSE OF P.W

- Determine the vaporization and solidification temperatures of distilled water and salt water at atmospheric pressure.
- Construct liquid-vapor change-of-state curves.
- Construct liquid-solid change-of-state curves.

3. MATERIAL USED

- Beaker.
- Thermometer.
- Graduated test tube.
- Test tube.
- Hot plate
- Erlenmeyer flask
- Distilled water flask

4. OPERATION 1: (VAPORIZATION OF DISTILLED WATER AND SALT WATER).

4.1 Procedure

- Pour 100ml of distilled water into an Erlenmeyer flask and place on a hot plate.
- A thermometer attached to the support is immersed in the liquid (distilled water) without touching the bottom of the Erlenmeyer (see diagram below).

- Use the thermometer and stopwatch to fill in **Table 1**.

Table1: Variation in distilled water temperature as a function of time

Time (min)	0	1	2	3	4	5	6	7	8	9	10	11	12	13
T(H ₂ O) _{dis}	T°													
State Observations														

T₀: Initial temperature of distilled water.

4-2-Reperform the same procedure with salt water.

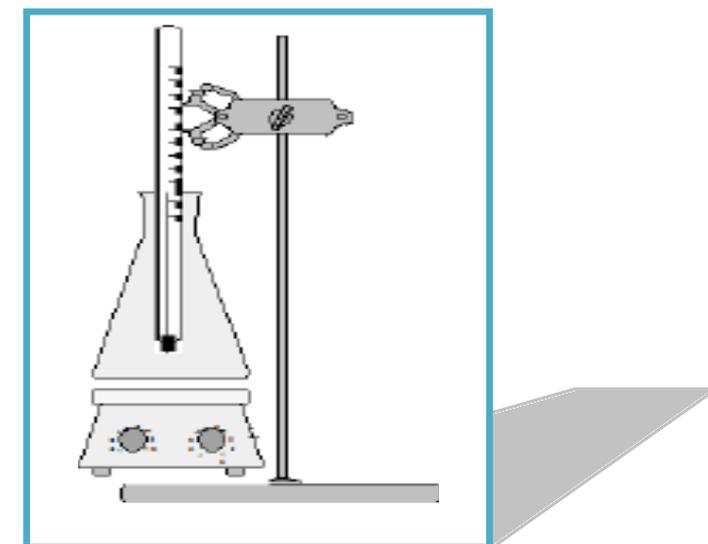


Figure 1: Experimental device for vaporizing water.

4. 3. EXPERIMENT 2: (CRYSTALLIZATION OF DISTILLED WATER AND ROOM WATER.

4.2.PROCEDURE :

-A mixture of crushed ice and cooking salt (NaCl) is prepared in a beaker (approximately four parts ice to one part salt); this mixture enables a temperature of -20°C to be obtained; it is called a cooling mixture.

- Read the temperature of the ice-salt mixture: T mixture =°C .

A test tube containing a certain volume of distilled water and a thermometer are immersed in this mixture.

- Measure the temperature of the water in the test tube at regular intervals until the water has completely turned to ice.
- Record the results of these measurements in Table 2.

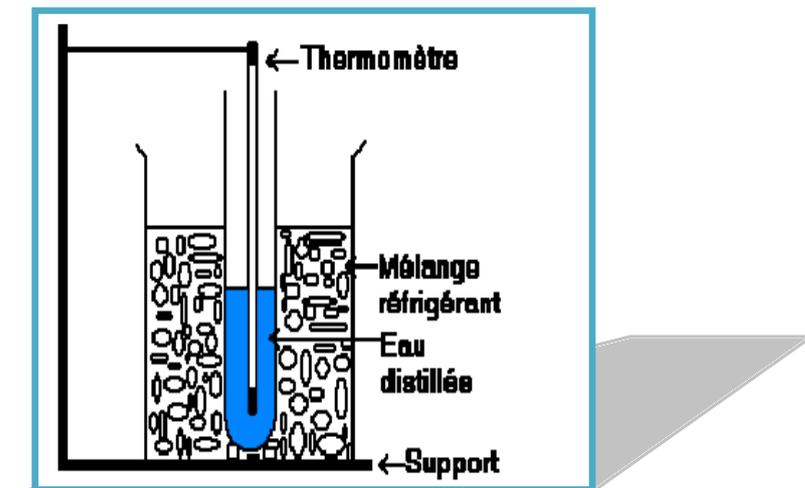


Figure 2: Water solidification experiment.

4-4-Reperform the same procedure with salt water.

Table2: Temperature variation of distilled water as a function of time.

Time(min)	0	1	2	3	4	5	6	7	8	9	10	11	12
T(H ₂ O)dis	T ₀												
State Observations													

5. QUESTIONS :

- a) Complete table 1 (vaporization).
- b) Complete table 2 (solidification).
- c) From Tables 1 and 2, draw the following graphs:
 - 1- $T = f(t)$ in the case of vaporization ?
 - 2- $T = f(t)$ for solidification?

- d) Explain the different stages of the graphs for the two cases?
- e) Answer the same questions as above for salt water?
- f) Give the heat expression corresponding to each stage of the two graphs.
- g) Determine the boiling and solidification temperatures of pure (distilled) water.
- h) Compare and comment on the value of the vaporization temperature and the solidification temperature of water under experimental conditions with the theoretical value (T for solidification of pure water: 0°C and T for vaporization of pure water: 100°C under a pressure of 1 atm). (i.e. T_{exp} with T_{the})
- i) What are the factors influencing the experiment?
- j) conclusion