Melting Point Of Ice & Boiling Point Of Water – Experiment, Viva Voce

EXPERIMENT

Aim
To determine the melting point of ice and boiling point of water.

Theory

1. **Melting Point:** The temperature at which the solid changes into liquid at the atmospheric pressure is called melting point. For example, ice melts at 0°C to form water.
2. **Boiling Point:** The temperature at which the liquid boils and changes into gaseous state at the atmospheric pressure is called boiling point. For example, water boils at 100°C to form water vapour (at 76 cm pressure).
3. **Latent Heat of Fusion:** The heat energy absorbed during the melting of ice is stored in the water formed, this energy is called latent heat of fusion. The amount of heat energy that is required to change 1 kg of a solid into liquid at atmospheric pressure at its melting point is known as the latent heat of fusion.
4. **Latent Heat of Vaporisation:** The heat energy absorbed by water when it changed its phase to steam, this hidden heat is called latent heat of Vaporisation.

Conditions Affecting Melting Point and Boiling Point

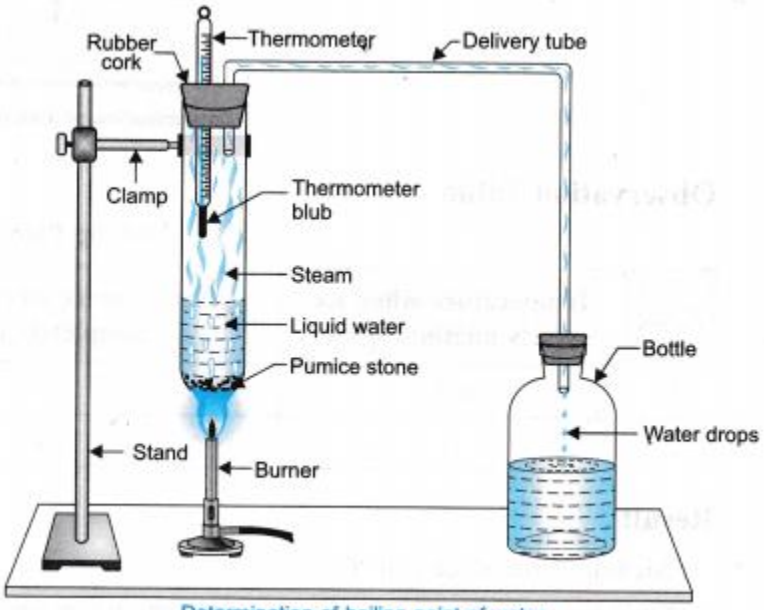
	Melting Point	Boiling Point
Pressure	If pressure increases, M.P. decreases.	If pressure increases, B.P. increases.
Addition of impurities (soluble salts)	M.P. will decrease on addition of soluble salts.	B.P. will increase on addition of soluble salts.

Materials Required
Two thermometers, (Celsius scale), boiling tube, a glass rod, two iron stands, a Bunsen burner, wire gauze, beakers, tripod stand, distilled water, ice cubes prepared from distilled water.

Procedure
(A)To determine the boiling point of water.

1. Take 25-30 ml of water in a boiling tube and add few pumice stones to it.

2. Clamp the boiling tube on iron stand with two holed cork, in one hole fix the thermometer and in the other one fix the delivery tube.
3. Place the thermometer above the water in the flask as shown in the figure and record its temperature.
4. Place a burner under the boiling tube.
5. Read the temperature and record it in the given observation table till the water boils. Record the reading after the time interval of 1 minute.



Determination of boiling point of water.

Observation Table

Boiling Point of Water

S.No.	Temperature when water starts boiling (t_1°C)	Temperature when water continues to boil till constant (t_2°C)	Boiling point of water $\left(\frac{t_1+t_2}{2}\right)$° C
1.	99.8	100	99.9
2.	100	100	100

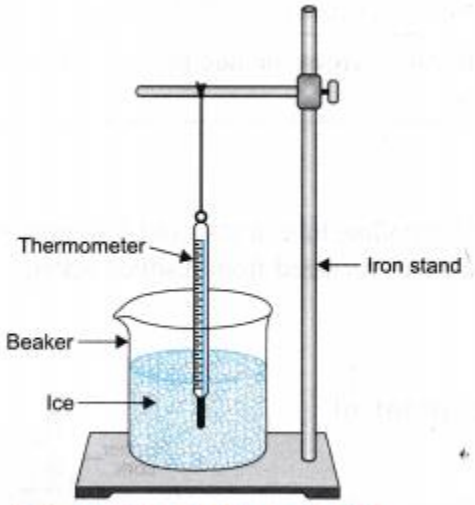
Result

1. Boiling Point of water is 100 °C.
2. Once the boiling point is attained the temperature reading on thermometer does not change for some time.

(B)To determine the melting point of ice.

1. Take a beaker half-filled with the dry crushed ice obtained from distilled water.

2. Suspend a Celsius thermometer from the clamp stand such that the bulb of the thermometer is completely surrounded by ice.
3. Read the thermometer reading and record the temperature after every 1 minute till the ice melts and the thermometer reading remains stationary for 2 minutes.
4. Note the readings in the observation table.



Determination of melting point of ice

Observation Table

Melting Point of Ice

S.No.	Temperature when ice starts melting (t_1°C)	Temperature when ice melts completely (t_2°C)	Melting point of ice $\left(\frac{t_1 + t_2}{2}\right)$
1.	0.5	0	0.25
2.	0	0	0

Result

1. Melting point of ice is 0 °C.
2. Once the melting of ice begins the temperature remains constant for some time.

Precautions

1. Choose a better quality thermometer whose graduated scale is clearly readable.
2. Record the temperature in whole numbers.
3. While reading the thermometer the eye level should be parallel with mercury level.
4. Dip only the bulb of thermometer into water/ice.
5. Thermometer should not touch the walls of beaker or boiling tube.

VIVA VOCE

Question 1:
What is the melting point of pure water ice cubes?
Answer:
0°C.

Question 2:
What is the boiling point of pure water?
Answer:
100°C.

Question 3:
At what temperature is the density of water maximum?
Answer:
At 4°C.

Question 4:
At what temperature will you get the latent heat of fusion for water?
Answer:
At 0°C.

Question 5:
What is the latent heat of fusion of ice?
Answer:
336 kJ/kg.

PRACTICAL BASED QUESTIONS

Question 1:
What is the principle of working of a pressure cooker?
Answer:
In pressure cooker the pressure is increased. The water boils at temperature more than 100°C.

Question 2:
Which of the two contains more heat energy, water at 100°C or steam at 100°C?
Answer:
Steam at 100°C, contains more heat energy.

Question 3:
When ice and cold water both are at 0°C then why does ice floats on water?

Answer:
Density of ice is less than water.

Question 4:
In cold countries why do people sprinkle common salt over it?
Answer:
The ice melts faster when salt is sprinkled over it and the clearance of ice from the path becomes easier and faster impurities decreases the melting point.

Question 5:
State the temperature at which water and ice co-exist.
Answer:
Water and ice co-exist at 0°C/ 273 K.

NCERT LAB MANUAL QUESTIONS

Question 1:
Why is the bulb of thermometer kept above the surface of water while determining the boiling point of water?
Answer:
The water boils and the steam is formed at its boiling point. Hence to get the accurate boiling point of water the thermometer is placed above the surface of water.

Question 2:
Why does the temperature remain unchanged until the entire solid changes into liquid even if we are heating the solid?
Answer:
The temperature remains unchanged until the entire solid changes into liquid even if we are heating the solid; it is because the heat is used up by the molecules in overcoming the force of attraction.

Question 3:
Why do we fix a two holed-cork in the round bottom flask while determining the boiling point of water?
Answer:
The two holed-cork is fixed in the round bottom flask while determining the boiling point of water. Through one hole fix the thermometer and through the other hole the delivery tube is fixed which allows the steam to pass through.

MULTIPLE CHOICE QUESTIONS (MCQs)
Questions based on Procedural and Manipulative Skills

Question 1:
When do ice and water co-exist under atmospheric pressure?
(a) At 0°C
(b) below 0°C
(c) above 0°C
(d) at 5°C.

Question 2:
For determining the melting point of ice we should prefer.
(a) ice made from distilled water
(b) ice made from tap water
(c) dry crushed ice mixed with salt
(d) a mixture of ice and salt.

Question 3:
For the accurate determination of the boiling point of water, we use
(a) tap water
(b) distilled water
(c) salt solution
(d) sugar solution.

Question 4:
If pure water is heated it will start boiling at:
(a) 173 K
(b) 100 K
(c) 373 K
(d) 273 K.

Question 5:
While determining the boiling point of water, pumice stone pieces are added to
(a) spread the heat uniformly
(b) prevent loss of heat energy
(c) avoid bumping
(d) avoid cracking of the glass container.

Question 6:
Which of the following would you choose to determine the melting point of ice in your laboratory?
(a) Dry crushed ice
(b) Ice cubes

(c) Ice added to water
(d) Slab of ice.

Question 7:
Which of the following apparatus is required to determine the boiling point of water?
(a) Tripod stand, conical flask, thermometer, wire gauze, stand with clamp, pair of tongs,
(b) Funnel, burner, clamp and stand, test tube, thermometer, wire gauge, stand with clamp
(c) Boiling tube, beaker, thermometer, burner cork with one hole, stand with clamp, wire gauze
(d) Round bottom flask, burner, thermometer, wire gauze, stand with clamp, cork with two holes, glass tube.

Question 8:
What is not a correct precaution to be followed by a student to determine the melting point of ice?
(a) Zero mark of the thermometer should remain above the ice surface
(b) Keep stirring the mixture and look at the thermometer
(c) Crush the ice into small pieces
(d) Do not dip the thermometer in crushed ice.

Question 9:
While heating a liquid, it has to be stirred properly. This is to let:
(a) the dust particles not settle at the bottom
(b) the liquid get uniform temperature throughout
(c) the liquid get heated quickly
(d) the liquid evaporates faster.

Question 10:
A student set up an apparatus for the determination of boiling point of a sample of water supplied to him in his lab. He recorded the boiling point as 102°C. Assuming that the thermometer is accurate, the error in the determined value of boiling point is due to
(a) the water may be containing large amounts of dissolved air
(b) the water may not be distilled
(c) the bulb of the thermometer is not kept above the water surface
(d) The bulb of the thermometer is touching the bottom of the vessel containing water.

Question 11:
The boiling point of water at the atmospheric pressure is
(a) 373 K
(b) 273 K
(c) 372 K
(d) 723 K

Question 12:
Boiling point of water is
(a) 0°C
(b) 100°C
(c) 40°F
(d) 212°C

Question 13:
In the determination of boiling point of water, it is advised to put the bulb of the thermometer above the water rather than in water, it is to:
(a) reduce the error due to atmospheric pressure
(b) make sure that boiling point is accurate even when water sample contains non-volatile impurities dissolved
(c) reduce the error due to expansions of glass because of heat
(d) obtain the boiling point accurately even in a much short time.

Question 14:
To find the melting point of ice what should be taken in the beaker?
(a) Salt + ice
(b) Ice cubes
(c) Crushed ice
(d) Ice cubes & crushed ice

Question 15:
At 0°C or 273 K, the physical state of water is observed as:
(a) solid
(b) liquid
(c) vapour
(d) both solid and liquid

Question 16:
What is the state of water at 100°C?
(a) solid
(b) vapour
(c) liquid
(d) liquid and vapour.

Question 17:
Water in a container is heated uniformly from 0°C to 100°C. The volume
(a) increases continuously
(b) decreases continuously
(c) decreases up to 4°C and increases further
(d) increases up to 4°C and decreases further.

Question 18:
At room temperature a student sets up an apparatus to determine the melting point of ice. He takes a beaker half filled with crushed ice and dips a mercury thermometer in it. After this he would observe that:
(a) mercury in the thermometer keeps on falling till it reads – 1 °C, it remains constant thereafter
(b) temperature falls, reaches 0°C and remains constant only as long as both ice and water are present in it
(c) the temperature falls, reaches 0°C and remains constant even after the whole of ice has melted
(d) the temperature falls at the starting but starts rising as soon as the ice starts melting.

Question 19:
When we observe the melting of ice, the melting point of ice is a constant temperature at which
(a) both ice and water are present
(b) only water is present
(c) only ice is present
(d) first ice and then only water

Question 20:
What will be boiling point of water at hill stations?
(a) 100° C
(b) < 100° C
(c) > 100° C
(d) Either less than 100° C or more than 100°C.

Question 21:
When some common salt is added to water, the boiling point of water
(a) decreases
(b) increases
(c) does not change at all
(d) depends on the amount of salt. It may increase or decrease.

Question 22:
When water boils, its temperature
(a) remains constant
(b) first increases then decreases
(c) first decreases then increases
(d) keeps on increasing

Questions based on Reporting and Interpretation Skills

Question 23:
When a thermometer is kept in ice, the reading shows that
(a) temperature keeps increasing
(b) temperature keeps decreasing
(c) temperature increases first and then decreases
(d) temperature first decreases and then remain constant at 0°C.

Question 24:
A thermometer has 20 equal divisions between 90°C and 100°C mark. A student while determining the boiling point of water finds that the mercury thread becomes stationary at the 19th mark above 90°C. He should record the boiling point of water as:
(a) 90.19°C
(b) 99.5°C
(c) 109°C
(d) 119°C.

Question 25:
When water boils, its temperature then
(a) decreases
(b) increases
(c) remains the same
(d) first increases then decreases

Question 26:
In the determination of boiling point of water, correct reading in the thermometer is noted when
(a) water starts boiling
(b) whole of the water evaporates
(c) temperature starts rising
(d) temperature becomes constant

Question 27:
Which experiment set-up is correct for determining the melting point of ice?
(a) A
(b) B
(c) both A & B
(d) none of the above

Question 28:
When ice is heated continuously, its temperature does not rise because
(a) heat is converted into latent heat
(b) heat is not used at all

(c) heat escape from the system
(d) none of these.

Question 29:
Which of the following statements is right with reference to the melting of ice?
(a) At melting point only ice exists
(b) At melting point only water exists
(c) At melting point both ice and water exist
(d) At melting point ice, water and steam exist.

Question 30:
A thermometer shows 20 divisions between 10°C and 20°C. What is the least count of thermometer?
(a) 1
(b) 0.1
(c) 2
(d) 0.5

SCORING KEY WITH EXPLANATION

1. (a) Ice is formed at 0 degree and ice melts at 0 degree.
2. (a) Distilled water is pure and will give the correct readings.
3. (b) Distilled water is pure and will give the correct readings.
4. (c) Boiling point of water is 100 degree Celsius which is 373 in kelvin (0 degree=273K).
5. (c) On boiling, the water starts bumping in the flask, to prevent it the pumice stones are added which gives the nucleation site for calm boiling and are inert.
6. (a) Ice just removed from the freezer is dry and the crushed ice is used to find the melting point of ice.
7. (d) Two holed cork and the glass tube to collect the water vapour is essential.
8. (d) Dip only the bulb of the thermometer in crushed ice.
9. (b) To spread the heat uniformly throughout the water we need to stir continuously.
10. (d) When the bulb of the thermometer touches the container then the temperature shown by it would be more than 100 degree Celsius.
11. (a) The boiling point of water is 100 degree Celsius i.e., 373 K
12. (b) Water boils at 100 degrees Celsius and steam is formed.
13. (a) The boiling point of an element or a substance is the temperature at which the vapour pressure of the liquid equals the atmospheric pressure surrounding the liquid. Hence the thermometer is placed above the water.
14. (c) Crushed ice is preferred for determining the M.P. of ice.
15. (d) Ice is formed at 0 degree and ice melts at 0 degree.
16. (d) Water boils at 100 degrees and steam is formed.
17. (c) The water molecules are close enough at 4 degree Celsius and thereafter the molecules moves further apart to increase the volume of water.

18. (b) The temperature read by thermometer will be 0 degree until all the ice is converted into water, thereafter the temperature may start rising.
19. (a) At 0 degree Celsius both ice and water exists.
20. (b) Boiling point of water changes with altitude because atmospheric pressure changes with altitude.
21. (b) On adding impurities to water its BP will increase.
22. (a) When water attain its boiling point the temperature remains the same until all the water is changed into steam.
23. (d) The thermometer will read the temperature of ice that is 0 degree, lower than the room temperature.
24. (b) The least count of thermometer is 0.5 and hence the reading will be 99.5
25. (c) When water attain its boiling point the temperature remains the same until all the water is changed into steam.
26. (d) The correct method of recording the B.P. of water is when the water is seen boiling and the thermometer reading is constant.
27. (b) Crushed ice is preferred for determining the M.P. of ice.
28. (a) When ice at -10 degrees C is heated, its temperature rises until it reaches 0 degrees C.
29. (c) The melting point of ice is 0 degree Celsius and the freezing point of water is also the same hence both ice and water exists at this temperature.
30. (d) Least count = range/number of divisions, 10/20=1/2=0.5