EXPERIMENT-5

To determine the melting point of a solid substance having low melting point.

5.1 OBJECTIVES

After performing this experiment, you should be able to :

- *set up an apparatus to determine the melting point;*
- *determine the melting point of a given solid substance; and*
- *relate the melting point of a substance with its purity.*

5.2 WHAT YOU SHOULD KNOW

The melting point of a solid is that constant temperature at which the solid and liquid phases of the substance are in equilibrium with each other.

This is an imporatant physical constant used for establishing the identity and determining the purity of a solid substance. A sharp melting point is usually indicative of high purity of a substance. The presence of impurities lower down the melting point. Thus, an impure solid substance has a lower melting point than that of its pure form.

5.3 MATERIALS REQUIRED

(1) Apparatus	(2) Chemicals
Beaker (100 ml), Thermometer, Glass capillary tube (5-6 cm long), Burner, Iron stand, Clamp and boss, Tripod-stand, Wire gauze, Stirrer Spatula, Glass tube (25-30 cm), Watch glass, Cork with one bore,	Liquid paraffin (~60 ml), Naphthalene, Urea, Oxalic acid, Benzoic acid.

5.4 HOW TO PERFORM THE EXPERIMENT

(1) Take a glass capillary tube of about 5-6 cm in length and seal one end of it. This is done by heating the tip of tube with the side of the flame of the Bunsen burner. The end of the capillary tube melts and seals itself. It is indicated by the formation of a small glass bead at the tip. Fig 5.1.

(2) Take a small quantity of a solid (about 50 mg) in watch glass, powder it by crushing it with the help of a spatula.

(3) Fill the powdered substance in the capillary tube upto about 1 cm height. This is done by pushing the open-end of the capillary tube into the heap of powdered substance kept in a watch glass. Now drop the capillary tube with the seated end down through a glass-tube (25-30 cm length) kept verticallv on a plane surface so that the powder reaches the closed end of the capillary.

(4) Take a beaker of 100 ml capacity. Fill it nearly half with paraffin oil. Place this beaker (paraffin bath) over a wire gauze kept on a tripod stand.

(5) Take a thermometer and dip it in the paraffin bath so as to wet its lower end. Bring the capillary tube near to the wet end and spread a thin film of paraffin oil on one side of capillary tube. Bring the wet side of the capillary tube in contact with the thermometer. The capillary tube sticks to the thermometer due to the surface tension of paraffin. (Fig.5.2 a). Now hang it on a clamp such that its bulb dips completely in the liquid paraffin but the open end of capillary is above it.

Fig. 5.1. *Sealing of Capillary tube*

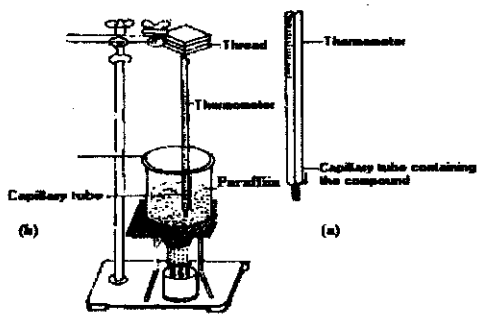

Fig. 5.2 : *Determination of melting point*

(6) Heat the paraffin bath slowly with a burner and keep the oil stirring so as to maintain a uniform temperature.

(7) Continue heating till the substance melts. Note down the temperature (t_1) at which the substance begins to melt. Observe carefully whether the substance melts at a fixed temperature or it melts over a range of temperature. A melting point is said to be sharping when the compound melts at a fixed temperature.

(8) Remove the burner and allow the temperature to come down. Note the temperature (t_2) at which the solid just reappears.

(9) The average of the readings ($t_1 + t_2$) is the correct melting point.

5.5 PRECAUTIONS

1. The substance whose melting point is to be determined should be completely dry.
2. The thermometer and the capillary should not touch the bottom or the sides of the beaker.

3. The heating of bath should be very slow with the help of a low flame so that the change in the state of the substance (solid to liquid) is clear.
4. The bath should be stirred gently to maintain a uniform temperature.

5.6 OBSERVATIONS

Temperature at which the substance begins to melt (t_1)= .....°C
Temperature at which the substance re solidifies melts (t_2)=.....°C
Melting point (T_1) = = ... °C

Note: In case of pure substance values t_1 and t_2 are almost the same or the difference between t_1 and t_2 is very small. In case of impure substance, t_1 and t_2 are different and the difference between t_1 and t_2 depends upon the amount of impurity.

5.7 CONCLUSION

i) The melting point of the given substance is .....°C.

ii) The melting point of the substance is sharp / not sharp. Hence the substance is of a pure / impure quality.

5.8 CHECK YOUR UNDERSTANDING

1. *Define the melting point of a substance.*

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2. *What will be the effect of impurity on melting point of a substance ?*

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3. *How can you keep the temperature of the bath uniform while heating ?*

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4. *What is the usefulness of determination of melting point ?*

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5. *What is meant by sharp melting point ?*

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6. *What will be the effect on melting point of the substance if the oil in the bath is not stirred regularly.*

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5.9 NOTE FOR THE TEACHER

Following substances may be given to the students for determination of melting point:

	Compound	M.P. (°C)
1.	Nephathalene	80
2.	Citric Acid	100
3.	Oxalic Acid	101
4.	Benzoic Acid	121
5.	Urea	132

5.10 CHECK YOUR ANSWERS

Ans.1: Melting point of a substance is the temperature at which the solid and liquid phase of the substance are in equilibrium.

Ans.2: The presence of impurity lowers the melting point of a substance.

Ans.3: By stirring the paraffin oil gently.

Ans.4: To establish the identity and determining the purity of a solid substance.

Ans.5: The temperature at which a solid melts almost completely.

Ans.6: The lower part of the oil will have higher temperature than upper part and thus observed melting point will differ from the actual value.