EXPERIMENT

AIM

To determine the melting point of the given substance.

THEORY

Melting point of a substance is the temperature at which a solid changes into liquid at atmospheric pressure. When a solid is heated, the kinetic energy of a molecules increases and exceed a limit resulting in the melting of a solid. The liquid formed can move freely.

MATERIAL REQUIRED

Thermometer, 100 ml or 150 ml beaker, tripod stand, stirrer, iron stand, wire gauze, capillary tube 8 to 10 cm long and 1 to 2 mm diameter, spatula.

PROCEDURE

(i) The powder is a crystalline substance. Take a capillary tube and seal its one end by heating (Fig. 1).

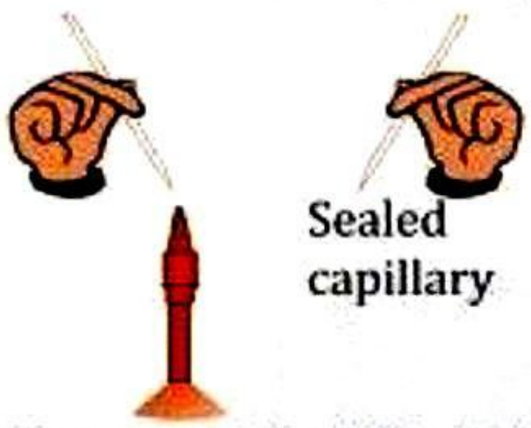

Fig. 1 Sealing one end of the capillary tube

For filling the substance make a heap of the powdered substance on the porous plate. Push the open end of the capillary tube into the heap. Some substance will enter into it. Now tap the sealed end of the capillary tube on the porous plate gently. Fill the capillary tube up to 2-3 mm.

Fig. 2 Charging the capillary tube

(ii) Attach the capillary tube to a thermometer which is immersed in a bath of liquid paraffin. The surface tension of the bath liquid is sufficient to hold the capillary tube in position.

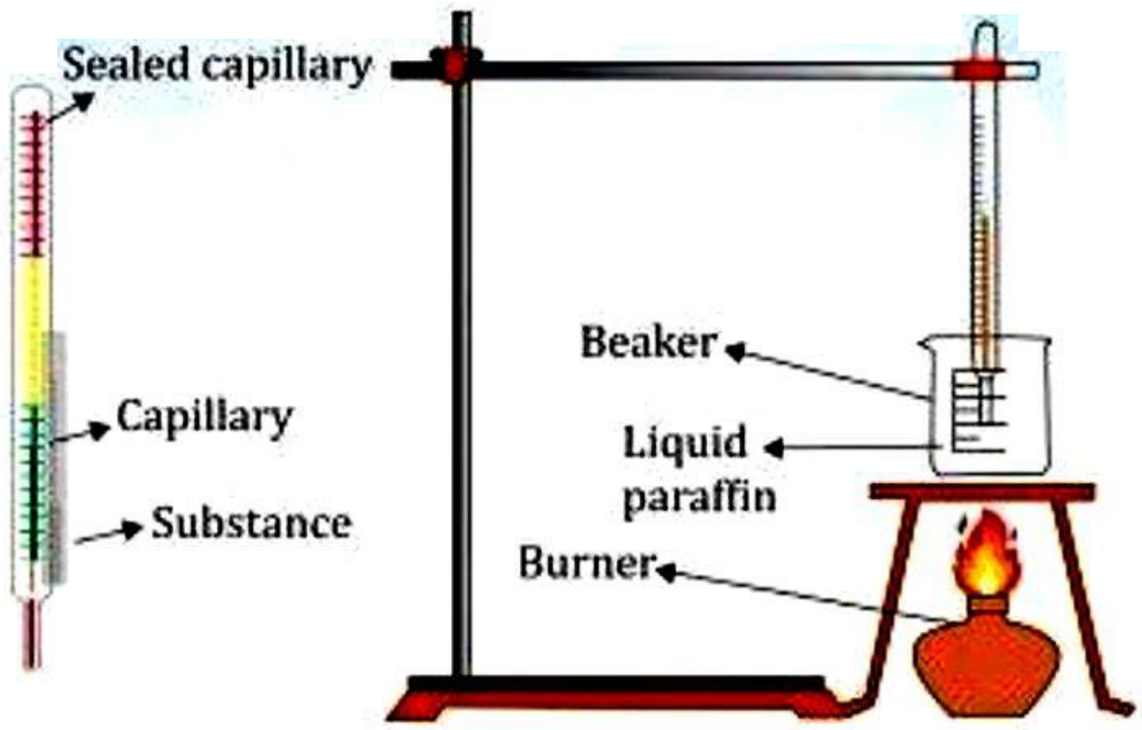

Fig. 3 Taking the melting point.

(iii) Heat the beaker slowly and go on stirring the liquid in the beaker so that the temperature remains uniform throughout. For this, a glass loop stirrer is moved up and down. When the temperature is within 15° of the melting point of the pure substance, the flame is lowered. Now, the temperature is allowed to rise slowly.

(iv) The temperature is noted when the substance starts melting. The temperature is noted again when it is completely melted. The average of the two readings gives the melting point of the substance.

Melting Points of Some Organic Compounds

Compound	Melting point (°C)	Compound	Melting point (°C)
Phenol	42	Acetamide	82
α-Naphthol	95	Benzamide	128
β-Naphthol	123	Urea	132
Oxalic acid	101	Fructose	103
Benzoic acid	121	Glucose	146
Cinnamic acid	133	Sucrose	160
p-Toluidine	43	Naphthalene	80
α-Naphthylamine	50	Benzophenone	46

OBSERVATION

The temperature at which the unknown substance begins to melt, t_1 = _____ °C

The temperature at which the substance completely melts t_2 = _____ °C

Average melting point = $\frac{(t_1\text{°C} + t_2\text{°C})}{2}$ = _____ °C

RESULT

The melting point of the unknown substance is ____°C

PRECAUTIONS

(i) Use dry and powdered samples for the determination of melting point.

(ii) Keep the lower end of the capillary tube and the thermometer at the same level.

(iii) The packing of the powder should be uniform without any big air gaps in between the solid particles.

(iv) Heating should be gradual, and the bath should be stirred regularly to maintain a uniform temperature.

(v) The bulb of the thermometer and the capillary sticking to it should not touch the side or the bottom of the beaker.

(vi) Do not attach the capillary tube with the thermometer by a rubber band.

VIVA VOCE

Q 1. Why is it important to determine the melting point of a substance in chemistry?

Ans. The melting point is a physical property that helps identify and characterize substances. It can be used to determine the purity of a substance, identify unknown compounds, and understand their chemical behaviour.

Q 2. Describe the process of determining the melting point of a substance.

Ans. The substance is placed in a melting point apparatus, such as a melting point apparatus or a capillary tube. The temperature is gradually increased, and the temperature range over which the substance melts is recorded.

Q 3. What factors might affect the accuracy of the melting point determination?

Ans. Factors such as impurities in the sample, heating rate, atmospheric pressure, and calibration of the melting point apparatus can affect the accuracy of the melting point determination.

Q 4. How can the purity of a substance be assessed using its melting point?

Ans. A pure substance will have a sharp and narrow melting point range, while impurities will lower the melting point and broaden the range. Thus, a wider or lower melting point range indicates impurity.

Q 5. Can you explain the phenomenon that occurs during melting?

Ans. Melting is the process in which a solid substance changes into a liquid phase upon reaching its melting point. At this point, the intermolecular forces holding the solid lattice together are overcome by the thermal energy, allowing the particles to move freely.

Q 6. What are some common techniques used to determine melting points?

Ans. Common techniques include using a melting point apparatus, such as a Mel-Temp apparatus or a capillary tube method. Automated methods such as differential scanning calorimetry (DSC) are also used in modern laboratories.

Q 7. How does the melting point of a substance relate to its molecular structure?

Ans. The melting point is influenced by the strength and type of intermolecular forces present in a substance. Substances with stronger intermolecular forces typically have higher melting points.

Q 8. Can the melting point be used to identify unknown substances?

Ans. Yes, the melting point can be compared to known values in reference books or databases to help identify unknown substances. However, it should be used in conjunction with other analytical techniques for confirmation.

Q 9. What is the significance of recording the melting point range rather than a single value?

Ans. The melting point range provides information about the purity and identity of the substance. A narrow range indicates high purity, while a wider range suggests impurities or multiple components.

Q 10. Are there any safety precautions to consider when determining melting points?

Ans. Safety precautions include wearing appropriate personal protective equipment, such as goggles and gloves, ensuring proper ventilation in the laboratory, and following standard laboratory