ACTIVITY 8

AIM

To observe the change of state and plot a cooling curve for molten wax.

APPARATUS AND MATERIAL REQUIRED

A 500 mL beaker, tripod stand, wire gauge, clamp stand, hard glass boiling tube, celsius thermometer of least count 0.5 °C, a stop-watch/ stop-clock, burner, parraffin wax, cork with a hole to fit the boiling tube and hold a thermometer vertically.

PRINCIPLE

Matter exists in three states – solid, liquid and gas.

On heating a solid expands and its temperature increases. If we continue to heat the solid, it changes its state.

The process of conversion of solid to a liquid state is called melting. The temperature at which the change takes place is called melting point. Melting does not take place instantaneously throughout the bulk of a solid, the temperature of solid-liquid remains constant till the whole solid changes into liquid. The time for melting depends upon the nature and mass of solid.

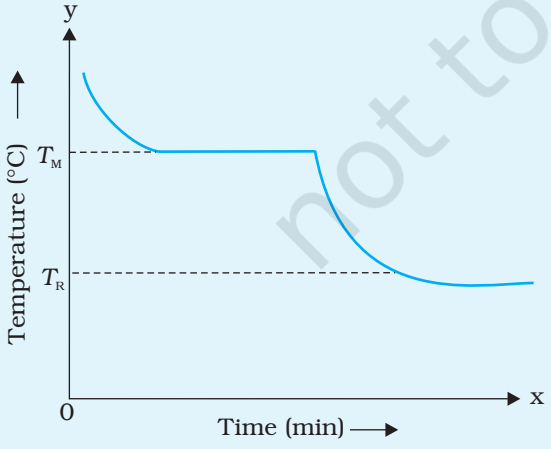

Fig. A 8.1: *Cooling curve*

A liquid when cooled freezes to solid state at the same temperature as its melting point. In this case also the temperature of liquid-solid remains constant till all the liquid solidifies.

Paraffin wax is widely used in daily life. We can determine the melting point of wax by plotting a cooling curve. The temperature of molten wax is recorded at equal intervals of time. First the temperature of wax falls with time then becomes constant at T_M, the melting point, when it solidifies. On further cooling the temperature of solid wax falls to room temperature T_R as shown in Fig. A 8.1.

PROCEDURE

1. Note the least count and range of the thermometer.
2. Note the least count of the stop-clock.
3. Record the room temperature.
4. Set up the tripod, burner, heating arrangement as shown in Fig A 8.2.
5. Adjust the boiling tube and the thermometer such that the graduation marks could be easily read by you.
6. Heat the water and observe the state of wax. Continue to heat till all the wax melts, note the approximate melting point.
7. Continue to heat the wax in the water bath till the temperatue is atleast 20°C above the approximate melting point as observed in Step 6.
8. Turn off the burner, and carefully raise the clamp to remove the boiling tube from the water bath.
9. Record readings of temperature after every 2 minutes.
10. Plot a graph of temperature of wax versus time, (temperature on y – axis).
11. From the graph

(i) determine the melting point of wax.

(ii) mark the time interval for which the wax is in liquid state/solid state.

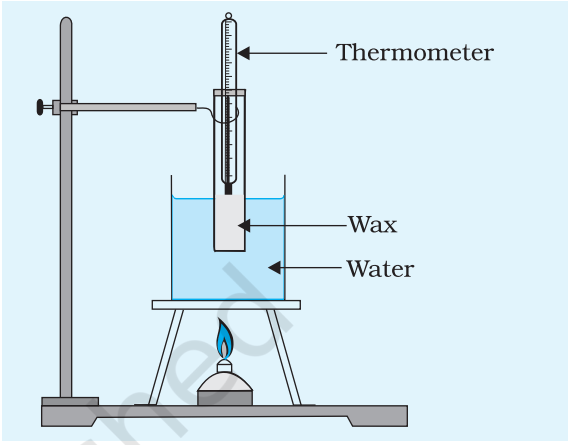

Fig. A 8.2: *Experimental set up*

OBSERVATIONS

Least count of thermometer = ... °C

Thermometer range ... °C to ... °C

Room temperature = ... °C

Least count of stop clock = ... s

Table A 8.1: Change in temperature of molten wax with time

S. No.	time s	temperature °C
1		
2		
3		
4		

RESULT

The cooling curve of molten wax is shown in the graph. From the graph (i) the melting point of wax is ... °C and (ii) the wax remains in liquid state for ... s and in solid state for ... s.

PRECAUTIONS

1. The boiling tube with wax should never be heated directly on a flame.
2. The stop clock should be placed on the right hand side of the apparatus as it may be easy to see.
3. Wax should not be heated more than 20°C above its melting point.

SOURCES OF ERROR

Simultaneous recording of temperature and time may give rise to some errors.

SELF ASSESSMENT

1. Why should we never heat the wax directly over a flame?
2. Why is water bath used to melt the wax and heat it further?
3. What is the maximum temperature to which molten wax can be heated in a water bath?
4. Would this method be suitable to determine the melting point of plastics? Give reason for your answer.
5. Will the shape of the curve for coding of hot water be different than that for wax?

SUGGESTED ADDITIONAL EXPERIMENTS/ACTIVITIES

1. Find melting point of ice.
2. Study the effect of addition of colour/fragrance on the melting point of a given sample of colour less wax. Find the change in melting point of wax by adding colour/fragrance in different proportions.