ACTIVITY

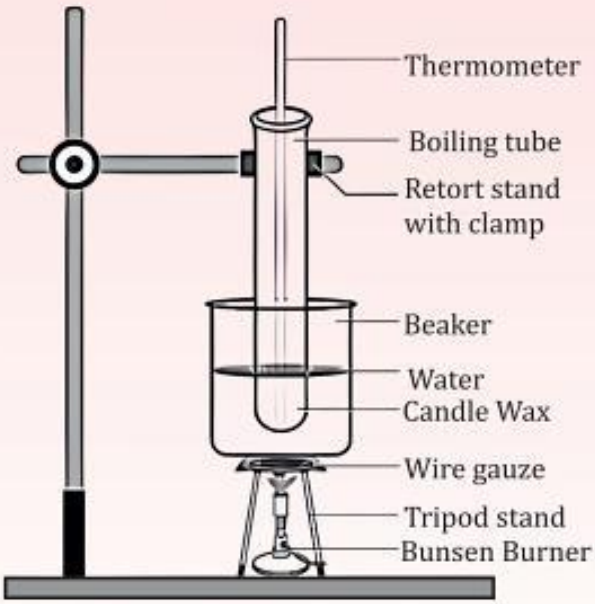
AIM

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

MATERIAL REQUIRED

A tripod stand, a wire gauze, a burner, an iron stand with clamp, paraffin wax in the form of small pellets, a sensitive thermometer, a beaker, a stopwatch, a hard glass tube fitted with a cork and a hole at its center stirrer and a graph paper.

DIAGRAM



To observe change of state of wax

THEORY

Every substance may exist in three states: Solid, liquid and gas. The change of a solid on heating from its solid state is called fusion or melting. On heating a solid, its temperature increases until a certain temperature. The solid begins to melt and the temperature of the solid substance remains constant throughout the process of melting. The temperature at which change of state from solid to liquid takes place is called the melting point of the substance. When whole of the solid changes into liquid and supply of heat is continued, temperature of liquid (molten wax say) starts increasing.

when the supply of heat is discontinued the temperature of molten wax starts falling with time. A graph between the temperature and the time is known as cooling curve. Flat part of the curve when temperature timings constant even though the cooling continues shows the change of state from the liquid state to solid. This change of state is known as solidification. After changing the whole mass of liquid to solid state, the temperature of the solid falls till it attains room temperature. During the change of state, the heat given out as wax changes from liquid to solid state is called latent heat.

PROCEDURE

Preliminary Observations Prior to Apparatus Setup

1. Record the thermometer's least count and range.
2. Document the least count of the stopwatch or stop clock in use.
3. Record the initial room temperature before commencing the experiment.
4. Arrange the tripod stand, wire gauze.
5. The hard glass tube is placed in the beaker containing water with the help of a clamp.
6. Put enough wax in a hard glass tube. Fix a cork along with a thermometer as shown in the figure.
7. Light up the burner and let water in the beaker be heated up slowly.
8. When the temperature of water rises, the temperature of the content of the tube (i.e., wax) also rises.
9. It is observed that the temperature of wax in a glass tube remains steady (known then as melting point of wax) till the whole amount of wax melts. If the heat supply is continued, then its temperature starts rising.
10. When the temperature of molten wax becomes 25°C more than that of its melting point, heat supply is discontinued.
11. Now record the temperature of gradually cooling wax inside the glass tube after a regular time interval of 2 minutes.
12. At a certain temperature, you will find that molten wax starts getting solidified. It becomes thicker and translucent and finally becomes an opaque solid wax.
13. The temperature of solid wax still falls rapidly with time.
14. Record the observations in tabular form and plot a graph of observations when temperature starts falling with time.

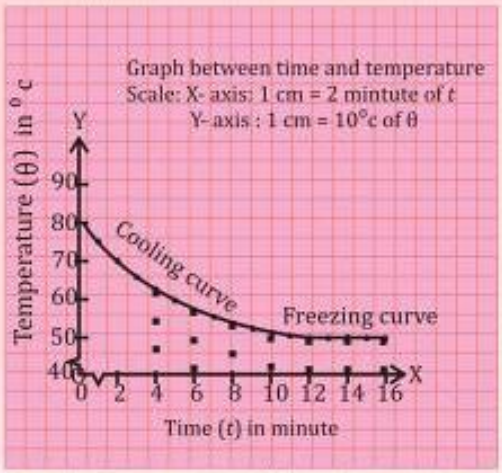
OBSERVATIONS

1. Range of the thermometer = _____ °C
2. Least count of the thermometer = _____°C
3. Least count of stopwatch = _____ s

TABLE FOR VARIATION OF TEMPERATURE WITH TIME

S. No.	Time (minutes)	Temperature of molten wax (°C)	S. No.	Time (minutes)	Temperature of molten wax (°C)
1.			11.		
2.			12.		
3.			13.		
4.			14.		
5.			15.		
6.			16.		
7.			17.		
8			18.		
9.			19.		

GRAPH (Cooling Curve)



Graph between time (t) and temperature (θ)

Plot a graph between temperature and time, taking time on x-axis and the temperature on y axis. The graph is known as a cooling curve.

RESULT

It is observed that:

1. On heating, the solid wax melts into the liquid and on cooling, the liquid wax solidifies back into solid state.
2. Graphical representation of falling temperature versus time, i.e., cooling curve for wax is shown in the figure.
3. During the change of state, the temperature of the wax remains almost constant.

PRECAUTIONS

1. Small wax pellets should be taken in the test tube.
2. Correct timing stopwatch should be used.
3. The temperature and the time reading should be recorded every two minutes.
4. The level of water outside the test tube should be higher than the level of wax inside it.

SOURCES OF ERROR

1. The surrounding temperature may change.
2. There may be impurity present in the experimental wax.
3. The stopwatch and the thermometer may be defective.

VIVA VOCE

Q1. What do you mean by melting point of a substance?

Ans. Melting point is the temperature of a substance at which the substance changes its state from solid to liquid.

Q2. Ice has a very sharp melting point (0°) while wax melts over a range of 52 °C to 55 °C. Explain

reason.

Ans. Ice is a crystalline solid, but wax is an amorphous solid.

Q3. At the temperature of melting point, does a solid always change in liquid only?

Ans. No, some substances like camphor, iodine, and ammonium chloride changes directly to gaseous state.

Q4. What do you mean by sublimation?

Ans. Sublimation is the phenomenon in which the substance on heating changes from its solid state to gaseous state without passing through its liquid state.

Q5. What is the special term used for substances like ammonium chloride or camphor, etc.?

Ans. Sublime substance.

Q6. How is a solid substance converted into its liquid state?

Ans. On heating, the bonds between the molecules break and separation increases between the molecules.

Q7. Is there an increase in the separation between the particles at the melting of ice?

Ans. No, there is a slight decrease in the separation of molecules on melting of ice.

Q8. What is latent heat?

Ans. It is the latent or hidden heat energy which does not bring about a temperature change in the substance while change of state is taking place.

Q9. What is Newton's law of cooling?

Ans. Newton's law of cooling state that the rate of loss of heat from a hot body is directly proportional to the difference of temperature with its surroundings.