

## COOLING IN A LIQUID

### Purpose

To show how the temperature changes in the centre and edge of a cooling and crystallising liquid.

### Activity

1 Set up a table like this but with 60 lines:

time	Thermomete r		comment
	1	2	

- 2 Set up the apparatus as shown in the diagram. Place the two thermometers so that they are in the tin, one at the side and one at the edge but not touching the tin. The clamps should hold the thermometers high on the stem so that all temperatures less than  $60^{\circ}\text{C}$  can easily be seen.
- 3 Put lots of ice in the outside container but no water yet.
- 4 Record the temperature of the salol and then pour it into the tin.
- 5 Pour cold water into the outer container.
- 6 Start recording the temperature when the thermometers reach their maximum. Record the temperature of both thermometers every 60 seconds.
- 7 Observe and comment on the process of crystallisation. Record the beginning of crystallisation and when it appears complete. Sketch the solid when it has crystallised.
- 8 Carefully remove the thermometers by remelting the solid by pouring hot water into the surrounding dish.
- 9 Plot your data and try to explain in detail the shapes of the cooling curves.

## Teacher's Section

### Requirements

2 thermometers

2 clamps and one retort stand

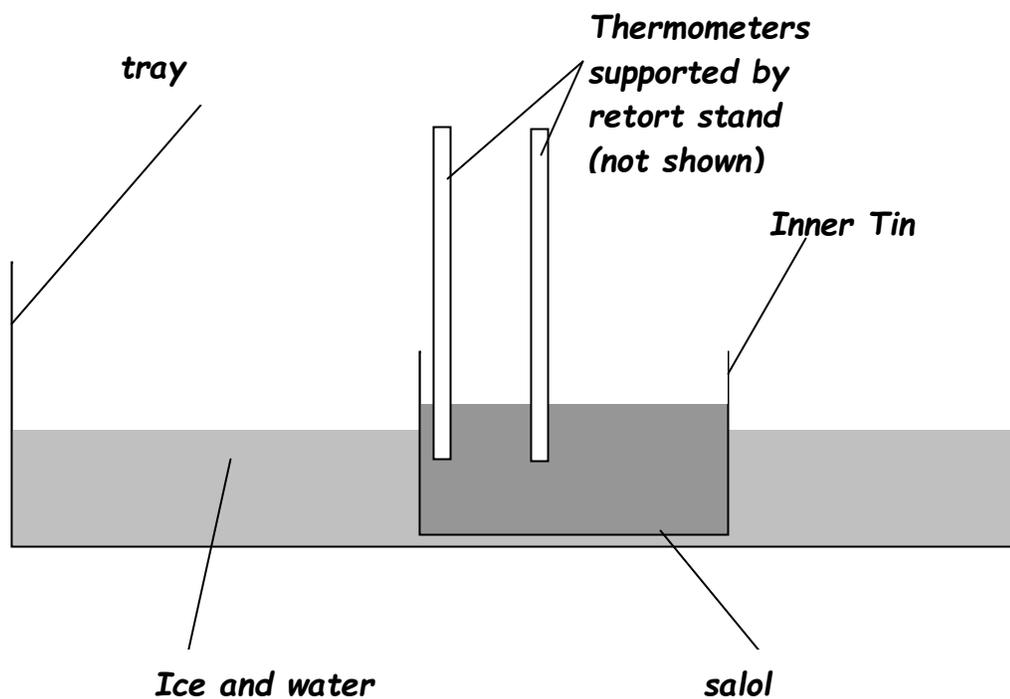
Tin about 8cm diameter and 3 cm deep

Salol ( phenyl salicylate, enough to fill tin)

Container or tray 5cm deep

Ice

Timer



### Notes

Care must be taken removing the clamps as it is easy to snap the ends off the thermometers. Students should read up about crystallisation and super cooling. A good reference is *Advanced Chemistry* by Philip Mathews 1992 Cambridge.

### Checks

Students may falsify their readings because they do not believe the temperature can rise.

### Results

*The temperatures should drop quickly at the beginning and both thermometers will cool at about the same speed because the liquid is able to mix. The temperatures should then level out as crystallisation begins because the latent heat of fusion is released. Once crystallisation is complete the temperatures will again decrease but the outside one will drop much faster than the central one because the latter is insulated and the solid cannot mix. If the liquid supercools temperatures will increase during crystallisation by up to 10°C.*

#### ***Preparation***

*Determine the amount of salol needed and melt it in a waterbath at 60°C.*

#### ***Time***

*60 minutes to record temperatures*

#### ***Cost***

*Salol £12 for 250g*



***Cooling in a liquid***