

## **Freezing Point of Phenyl Salicylate**

# **INSTRUCTOR RESOURCES**

### **The CCLI Initiative**

#### **Learning Objectives**

- demonstrate the general features of a cooling curve.
- measure the freezing point of a compound.

#### **Procedure Overview**

- guided writing of an experiment program.
- temperature probe calibration at a minimum of three points between 0°C and 55°C.
- apparatus assembly and warming of phenyl salicylate sample.
- data collection for cooling curve with supercooling and spreadsheet treatment of data.

## FREEZING POINT OF PHENYL SALICYLATE

### Report Sheet

1. In the space below, record the freezing point temperature for phenyl salicylate obtained in this experiment. For comparison, the *Handbook of Chemistry and Physics, 65<sup>th</sup> Edition*, lists the melting point as 43°C.

Observed freezing point: \_\_\_\_\_

2. Include the following item as part of your report for this experiment:
  - (a) printout of your scaled cooling curve graph with the grid shown.



## FREEZING POINT OF PHENYL SALICYLATE

### Suggested Answers to Questions

1. Your instructor will provide the structure of phenyl salicylate. Explain the meaning of the term "supercooling," and on the basis of the structure, suggest a reason why phenyl salicylate supercools so dramatically.

*Supercooling is the process of cooling a liquid below its freezing point without its changing to a solid.*

*Supercooling occurs because, as it is cooled, the liquid may not achieve the degree of organization necessary to form solid at the freezing point temperature, and thus it continues to exist as the liquid. At some point the correct ordering occurs and solid rapidly forms, releasing energy in the exothermic process and bringing the temperature back up to the freezing point, where the remainder of the liquid freezes.*

2. Explain how you would modify the experiment program to achieve the following:

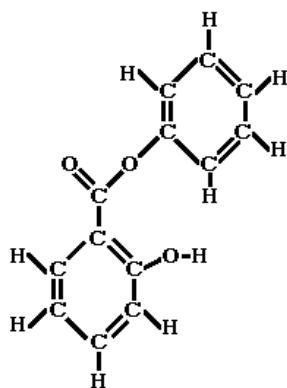
(a) space the temperature readings at 20 second intervals.

*Change the "Repeat every . . ." line by double clicking on the line and changing the time to read 20 sec.*

## FREEZING POINT OF PHENYL SALICYLATE

### Tips and Traps

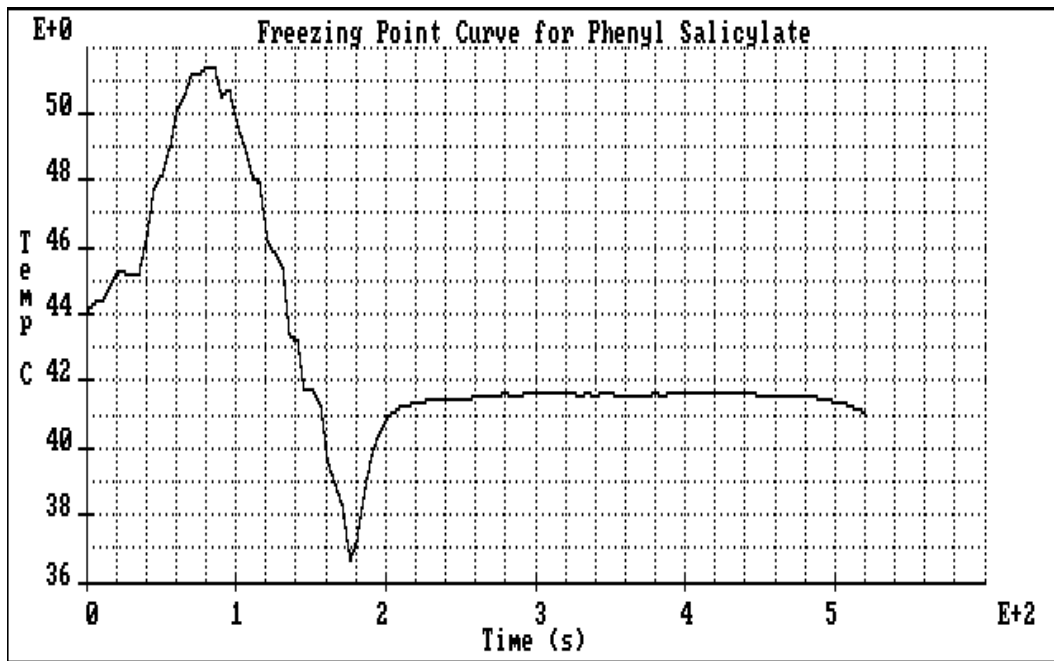
1. Make sure the interface is turned on by pushing the power switch on the upper right corner of the interface.
2. In the calibration of the temperature probe, students should be cautioned to immerse the thermometer and temperature probe in the ice water or warm water for at least one minute before entering the temperature.
3. After the calibration, the temperature probe should be thoroughly dried before being placed in the melted phenyl salicylate.
6. As indicated in the experiment, the most satisfactory cooling curves are obtained if the initial temperature of the sample is above 50°C.
7. Never push the temperature probe through the #2 two hole stopper. Slit one side of the stopper. Open the slitted side and insert the temperature probe into the stopper hole to the proper depth.
8. Be sure to keep and reuse the phenyl salicylate. The original 20 x 50 mm test tube serves as a good storage site. Cap the tube with a rubber stopper.
9. The structure of phenyl salicylate,  $\text{HOC}_6\text{H}_4\text{COOC}_6\text{H}_5$ , is



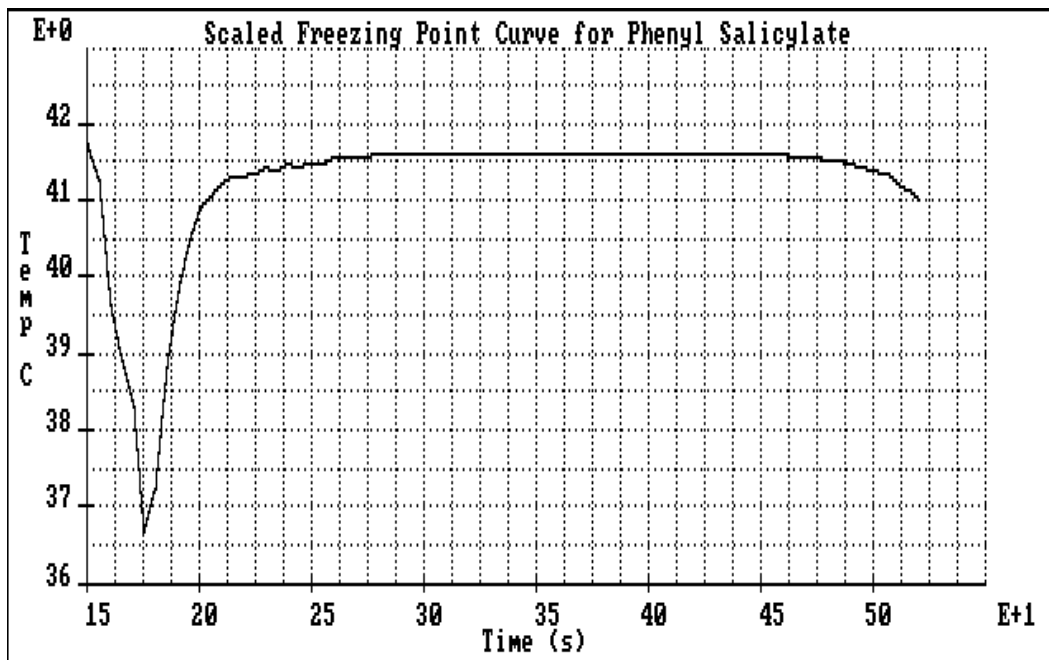
10. Butyl alcohol can be used in place of phenyl salicylate, but supercooling is far less and traces of moisture spoil cooling curves.

# FREEZING POINT OF PHENYL SALICYLATE

## Sample Data



Typical Cooling Curve Showing Initial Warming to Attain ~ 50°C.



Scaled Cooling Curve Showing Freezing Point of 41.6°C.

## **FREEZING POINT OF PHENYL SALICYLATE**

### **Laboratory Preparation (per student station)**

#### **Equipment**

- each freezing point determination apparatus (see figure on page 5 of the experiment) consists of an inner test tube (20 x 50 mm) fitted with a rubber stopper (number 2, two hole) to accommodate the temperature probe and stirrer. The outside of the test tube should be fitted with a rubber ring to allow it to fit snugly into a 40 ml conical centrifuge tube (29 x 118 mm, Corning No. 8320-40, or equivalent).
- temperature probe
- stirring wire, approximately 7.5 inches long (see figure on page 5)
- 250 ml beaker (2)
- 400 ml beaker
- 600 ml beaker
- universal clamp
- ring stand

#### **Supplies**

- 150 - 200 g ice for calibration of the temperature probe

#### **Chemicals**

- 12 g phenyl salicylate

#### **Safety and Disposal**

- there are no known safety problems associated with the experiment, and there should be no waste for disposal.