# Lab 1 Melting Point

Reading: Zubrick, pages 86-92.

**Pre-Lab:** Look up the structures and melting points for urea and cinnamic acid, and look up the definition of "eutectic point".

**Introduction:** One of the most common methods for determining the purity (and preliminary identification) of organic compounds is melting point determination. The melting point of a substance is the temperature at which the solid phase is in equilibrium with the liquid phase. In other words, both phases can exist at the melting point. For water, this corresponds to 0°C. Similarly, organic compounds have melting points. For most organic compounds, this melting point is actually not one temperature, but a 1-3°C range of temperatures. The start of the melting point range is the first temperature at which liquid begins to form and the end is the temperature at which all of the solid has disappeared.

The melting point and range of a given compound is related to the purity of the compound. If the substance is contaminated with other compounds, the melting point range will be lower and the range broader than if the substance were perfectly pure. This phenomenon is called melting-point depression. For example, pure cinnamic acid has a melting point range of 132 - 133°C. But if it is significantly contaminated, it will have a lower melting point with a broader range (say, 125 - 130°C, for example).

In this lab, you will determine the contaminant effect on the melting point of cinnamic acid by the systematic addition of a contaminant (urea). You will make a plot that shows the relationship between melting point temperature (range) and the amount (as a mole percentage) of urea mixed with cinnamic acid. Using that plot, you will determine the % composition of cinnamic acid and urea in an unknown solid mixture.

#### **Experimental:**

Make several melting point determinations of pure cinnamic acid and urea. Make several melting point determinations of each mixture: 80/20, 60/40, 40/60, and 20/80 (% cinnamic acid/ % urea). Get a sample of the unknown mixture and make several melting point determinations.

#### **Results:**

You have recorded a lot of data. In your lab report, put your data in an easy-to-read table. Make a plot of your data: on the y-axis, plot the melting points (ranges) you measured, and on the x-axis, plot the mixture percentages (100/0, 80/20, etc.). Draw the smoothest line or curve (NOT DOT-to-DOT), through the data points. You should use a spreadsheet or graphics program (like Excel) for this if possible. Using your plot, determine the composition of the unknown.

In this lab, you were given the mixtures. Calculate how much of each compound you would need to make 0.5g of an 80%/20% mixture of cinnamic acid and urea.

## **Discussion:**

Discuss how impurities affect melting points.

### Waste Disposal:

Any left over cinnamic acid or urea should go in solid waste. Used melting point tubes should go in the box for glass waste.