8 Calorimetry: Heat of Crystallization of Wax

Introduction
The process of crystallization (solidification) is the exact opposite of the process of fusion (melting). When a substance changes form liquid to solid, heat is released. This is an exothermic change.

When crystallization takes place in a calorimeter, the water will absorb energy. The same relationships that you applied in Lab 7 will be used to calculate the heat of crystallization in this lab.

Introductory questions
1. When does crystallization begin?

2. What is the mass of 1 mL of water?

3. Will the temperature of the water in the calorimeter increase or decrease? Explain.

4. What is the specific heat of water?

Problem
How can you determine the heat of crystallization of wax?

Equipment
Graduated cylinder, 100-mL   ring stand
Beaker, 250-mL   lab burner
Styrofoam cup   wire gauze
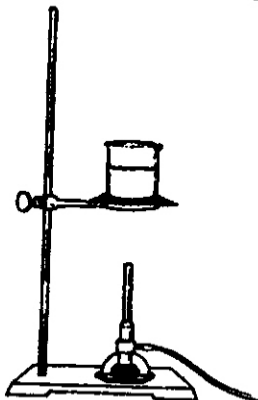Thermometer   safety glasses
Test tube holder

Materials
Test tube containing 10.0g of wax

Procedure 🎽 🥽 🔥 Fire

1. In a 250-mL beaker heat about 200 mL of water to boiling.

2. Place the test tube containing the 10.0 g sample of wax, into the beaker of boiling water.
3. Gently rotate the tube (be careful of steam) until all of the wax is melted.
4. Measure 100 ml of cold tap water and pour it into the Styrofoam cup.
5. Using a test tube holder remove the test tube containing the wax from the beaker of boiling water. Turn your burner off.
6. Hold the test tube up to the window or light and look for the first sign of cloudiness. This indicates that crystallization has started.
7. Immediately take the temperature of the water in the Styrofoam cup and then place the test tube in the cup with the cold water. Record the temperature. (T_1)
8. Rotate the test tube while the wax is solidifying. Constantly watch the temperature of the water.

9. When the temperature of the water has stopped increasing, Record this temperature. (T_2)

Observations and data

Mass of water in calorimeter (m_1)	g
Mass of wax sample (m_2)	10.0g
T_1	°C
T_2	°C

Calculations

1. Find the change in temperature of the water. ($\Delta T = T_2 - T_1$)

2. Find the heat gained by the water. ($\Delta Q = m_1 \times \Delta T \times C_p$)

3. Find the heat of crystallization of wax. ($\Delta Q \div m_2$)

Conclusions and Questions

1. Define the term of heat of crystallization. What unit is used to express this property?

2. Explain why this experiment could not be conducted using a mixture.

3. How does the heat of fusion compare to the heat of crystallization of the same substance?