

8C Pure Substance or Mixture?

How can observing the melting point identify a pure substance or a mixture?

Matter can be divided into two main categories: mixtures and pure substances. Pure substances are homogeneous throughout. They have the same chemical properties no matter where the sample is obtained or how large the sample is. Mixtures are combinations of two or more substances, with each substance retaining its chemical identity.

In this lab, you will obtain four test tubes containing unknown solids. The melting point, or the temperature at which the matter changes from a solid to a liquid, will be measured to determine if the matter is a mixture or a pure substance. Any given pure substance will always have the same melting point. Pure substances usually melt over a small temperature range while mixtures often melt over a very wide temperature range.

Materials

- 4 test tubes with unknowns
- Hot plate
- Stirring rod
- 1 250 mL beaker
- Water
- Safety goggles
- Lab apron
- Data Collector
- Temperature probe



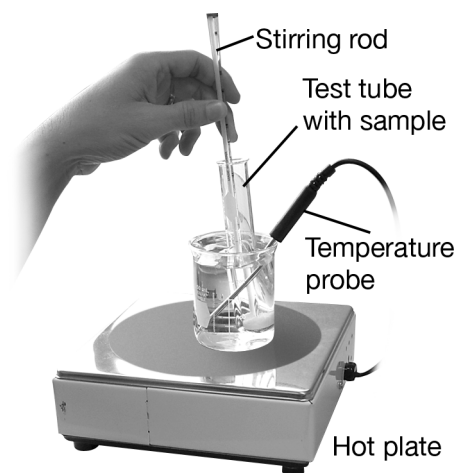
WARNING — This lab contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

1 Thinking about what you will do

Why do you think a pure substance will melt over a smaller range of temperatures than a mixture?

2 Doing the experiment

1. Attach the temperature probe to the Data Collector and set it to meter mode for the entire experiment. Record your sample label (A–D) in Table 1.
2. Add approximately 200 mL of cold water to a 250 mL beaker. Place the beaker on the hot plate, and turn the hot plate on to medium.
3. Place the first sample into the water bath and have one group member hold the temperature probe about halfway in the water.
4. Another group member should stir the contents of the test tube with a stirring rod as it heats.



5. Watch the contents of the test tube carefully. At the moment the contents begin to melt, measure and record the temperature in Table 1.
6. Continue stirring the contents of the test tube and watching the contents until the entire sample is liquefied. Once the last solid particle melts, measure and record the temperature in Table 1.
7. Return your sample to your instructor.
8. Pour out the hot water in the beaker.
9. Repeat steps 2-8 for each of the remaining samples. Be sure to start with a fresh sample of cold water for the water bath.

Table 1: Melting data

Sample label	Temperature melting starts (°C)	Temperature melting ends (°C)
A		
B		
C		
D		

3 Analyzing the data

- a. How would you know which test tubes contain pure substances and which contain mixtures?

- b. If a sample contained 1 gram of pure substance A and another test tube contained 4 g of pure substance A, how would the melting points differ? How would the experiment differ?

- c. Name two possible sources of error for this experiment. How would they affect your data?

4 Applying your knowledge

A white, waxy substance is heated in a test tube. Part of the substance melts almost immediately, and is poured off into a separate test tube after a minute of further heating, leaving a little more than half of the original sample behind.

- a. Explain why you think the original sample was a pure substance or a mixture.

- b. Is the melted portion that was poured off a pure substance or a mixture? What evidence do you base your answer on?

- c. Can you be sure that the remaining portion left behind in the test tube is a pure substance or a mixture? How could you know for sure?
