CHEMISTRY MATTERS
gpb.org/chemistry-matters

Unit 2D Demonstrating Intermolecular Forces

Name:

Date:

## Guided Inquiry: Intermolecular Forces and Heating Curves

You will be making a heating curve and cooling curve for paraffin wax. Recall that substances with strong intermolecular forces require more heat to melt than substances with weaker intermolecular forces. A higher melting point and freezing point indicates that a substance has strong intermolecular forces.

Your task is to design an experiment to determine the heating curve and the cooling curve of paraffin wax (commonly found in candles). In other words, you will need to construct a graph showing the ***change in Temperature vs. Time*** for this substance.

In most classes, one team will measure the heating curve while a partner team will measure the cooling curve.

## Safety:

Keep all materials clear of the hot surfaces. If you are using electronic probes, make sure that the probe cords (AND YOUR SKIN) do not come in contact with the heated surfaces.

You must wear safety goggles, an apron and closed-toe shoes. Long hair must be tied back. Remember that HOT GLASS looks the same as cold glass, so be careful.

## Designing a procedure:

The requirements are as follows:

### Cooling Curve

- You may use any of the materials provided to you.
- Your measurements should begin while the wax is in the liquid phase and continue until the wax solidifies (freezes) into a solid.
- Before you begin your experiment, you need to write a step-by-step procedure and construct a data table in which you will record your collected data.
- Your teacher needs to “ok” your procedure and data table before you begin.
- You must record data (take temperature measurements) for 30 minutes.

### Heating Curve of paraffin wax

- You may use any of the materials provided to you.
- You will begin while the wax is in the solid phase and continue until the wax liquefies (melts) into a liquid.
- Before you begin your experiment, you need to write a step-by-step procedure and construct a data table in which you will record your collected data.
- Your teacher needs to “ok” your procedure and data table before you begin.
- You must record data (take temperature measurements) for 30 minutes.

continued on next page

CHEMISTRY MATTERS
gpb.org/chemistry-matters

# Unit 2D Demonstrating Intermolecular Forces

Name:

Date:

## I. Procedure (write neatly):

Write a step-by-step procedure for determining the cooling curve of candle wax.

**Available Materials:**

- 600mL beaker
- Test tube with candle wax
- Thermometer or Electronic temperature probe
- Hot plate
- Water
- Ice Bath
- Test tube clamps
- Graph paper

## II. Data Table:

Construct a data table that you can use to record the data you collect in your experiment. Remember, you need to collect data for 30 minutes. Be neat, label correctly, and don't forget units.

## III. Argumentation from Evidence:

Predict what the cooling curve (***graph of temperature vs time***) will look like for candle wax as it cools from a hot liquid to a cool solid (draw a blue line to indicate the cooling curve). Collect the data from a group that was collecting data for candle wax as the solid is heated to a hot liquid and predict what the heating curve will look like (use red to indicate the heating curve). Don't forget to provide a title, label axes, and include units on your evidence graph.

**Data Analysis**

Construct a graph to show how ***temperature*** depends on ***time***. ***Make sure to follow the guidelines and include the following items:***

- Put the independent variable on the x-axis and the dependent variable on the y-axis.
- Use the bulk of the graphing area.
- Include a title.
- Label axes with label & unit.
- Plot the points.
- Sketch a smooth curve that represents the trend of the data.

continued on next page

## IV. Conclusion Questions:

***Remember: Temperature is a measure of the average kinetic energy of the particles in a sample of matter.***

1. Using your graph, determine the freezing point of candle wax in degrees Celsius.

2. Describe the shape of your graph during the actual changes of state (while the substance is actually solidifying).

3. Consider the diagonal region of the cooling curve. What is happening to the kinetic energy of the particles as the temperature is decreasing?

4. During the cooling process, heat is continually being removed from the sample, yet the temperature remains constant during the actual freezing process. If the constant temperature indicates no change in kinetic energy, then what form of energy is changing?

5. During the freezing process, what is happening to the candle wax particles?