Activity 1: Calorimetry

Equipment	Quantity
Xplorer GLX	1
Fast-response Temperature Probes	2
20 g Brass Masses	3
Styrofoam Cups	3
String	1 m
Hot Water (50 to 70 °C)	500 ml
Room-temperature Water	500 ml

Background

In this experiment, you will add a hot piece of metal to room-temperature water and measure the temperature change of the water. How does doubling the mass of the added metal affect the temperature change?

Before You Begin

Start a new experiment on the GLX.

1. Press (⌂) to go to the Home Screen.
2. Use the arrow keys to highlight the Data Files icon and press (✓) to open the Data Files screen.
3. Press (F4) to open the Files menu and press (1 pqrs) to select New File.
4. When the GLX asks if you would like to save the previous file, press (F1) to save or (F2) not to save.

Procedure

Equipment Set-Up

1. Fill a Styrofoam cup with hot water.

2. Tie a string to each mass, and lower all three masses into the hot water. Let the masses warm up for about 10 minutes.

3. Label two other cups “Cup 1” and “Cup 2.” Put 250 ml of room-temperature water into each cup.

4. Put one temperature probe in each cup of room-temperature water. Use a paperclip to secure each probe to the rim of the cup so that the end of the probe is about midway between the bottom and the surface of the water.

GLX Set-Up

1. Connect the temperature probes.*

*Optional: after connecting the probes, perform the alignment calibration described on page 89.

a) Connect the probe in Cup 1 to one of the temperature ports on the left side of the GLX.

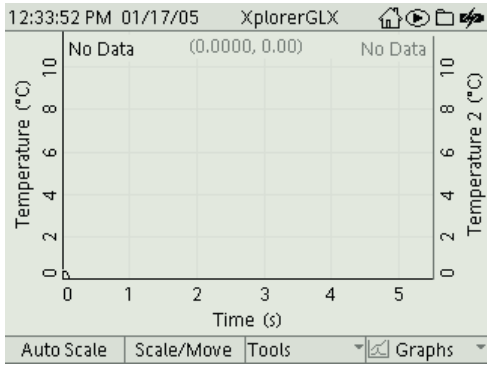
b) Connect the probe in Cup 2 to the other temperature port.

c) If there are other sensors connected to the GLX, remove them.

2. Set up the Graph to display both temperatures versus time.

a) Press (⌂) to return to the Home Screen; press (F1) to open the Graph.

b) The Graph will automatically be set up for the first temperature probe. Press (F4) to open the Graphs menu, press (3wxyz) to select Two Measurements mode. The second temperature probe will be added to the Graph.



Graph in Two Measurements mode

Data Collection

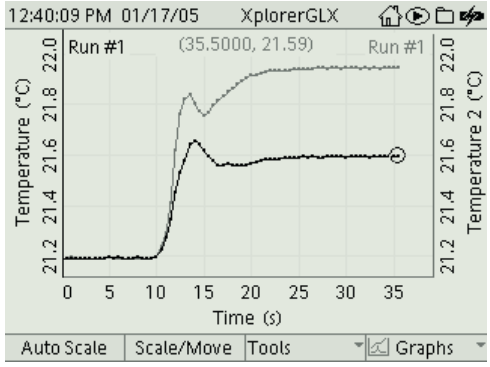
1. Press (▶) to start data collection.

2. Remove the masses from the hot water. Lower one mass into Cup 1; lower two masses into Cup 2.

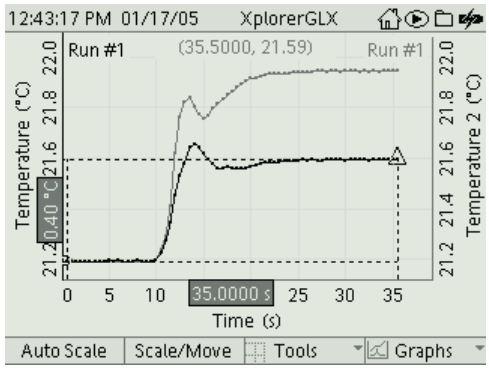
3. Gently stir the water in both cups.

4. Press (F1) to automatically scale the Graph.

5. After both temperature measurements have stabilized, press (▶) to stop data collection.



Analysis



1. **Use the Delta Tool to find the temperature change in Cup 1.**

   a) Press F3 to open the Tools menu; press 2tuv to turn on the Delta Tool.

   b) Press the up arrow to move one of the cursors to the first data point.

   c) Press F3 then press 8abc to swap control to the other cursor; press the down arrow key to move that cursor to the last data point.

   The Delta Tool should now show the changes in temperature and time from the first to the last data point.

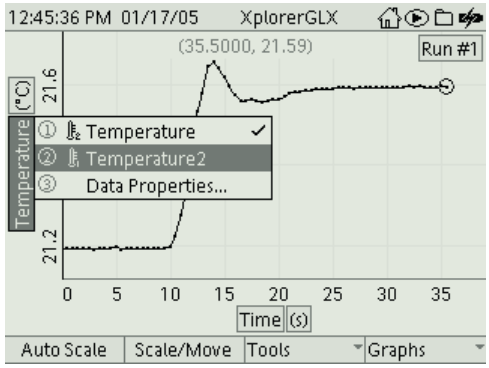
   Cup 1 temperature change = _____

2. **Create a new graph page showing only the temperature in Cup 2 versus time.**

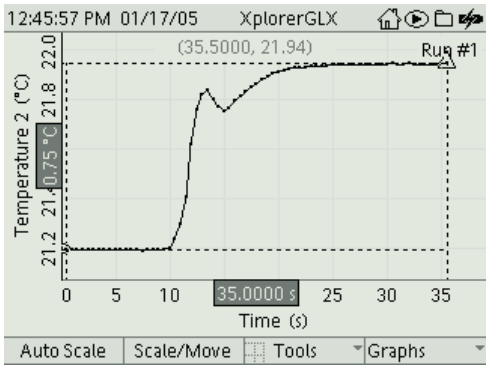
   a) Press F4 to open the Graphs menu; press 6mno to select New Graph Page.

   b) On the new graph page, press ✓ *twice* to open the data source menu.

   c) Press the down arrow key to highlight Temperature2 and press ✓.



3. Use the Delta Tool to find the temperature change in Cup 2.



a) Press F3 to open the Tools menu; press 2 to turn on the Delta Tool.

b) Press the up arrow to move one of the cursors to the first data point.

c) Press F3 then press 8 to swap control to the other cursor; press the down arrow key to move that cursor to the last data point.

The Delta Tool should now show the changes in temperature and time from the first to the last data point.

Cup 2 temperature change = _____

4. How does the temperature change in Cup 2 compare to the temperature change in Cup 1?

_____

_____

_____

5. If you repeated this experiment with *three* masses in Cup 2, what do you think the temperature change of Cup 2 compared to Cup 1 would be?

_____

_____

_____

6. Why did this experiment call for Styrofoam rather than glass containers?

_____

_____

_____