

Activity 3: Heat Transfer by Radiation

Equipment	Quantity
Xplorer GLX	1
Fast-response Temperature Probes	2
Aluminum Can, Painted Black	1
Aluminum Can, Unpainted*	1
Hot Water (50 to 70 °C)	500 mL
Tongs or Mitt (for handling hot cans)	1







*Use empty beverage containers or PASCO part TD-8570A, which includes one black can and one unpainted can.

Background

You may have observed that dark objects heat up faster than light-colored objects when exposed to sunlight, but how does the color of an object affect its rate of cooling? In this experiment you will record the temperature of two water-filled cans as they cool. One can is painted black, the other can is unpainted. Which can do you think will cool faster?

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  to open the Files menu and press  to select New File.
4. When the GLX asks if you would like to save the previous file, press  to save or  not to save.

Procedure

Equipment Set-Up





1. Place a fast-response temperature sensor in each can. Secure the probes with tape.
2. Prepare hot water (50 to 70 °C), but don't fill the cans yet.

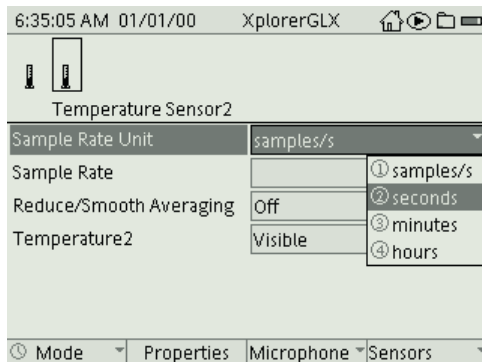
GLX Set-Up

1. Connect the temperature probes.

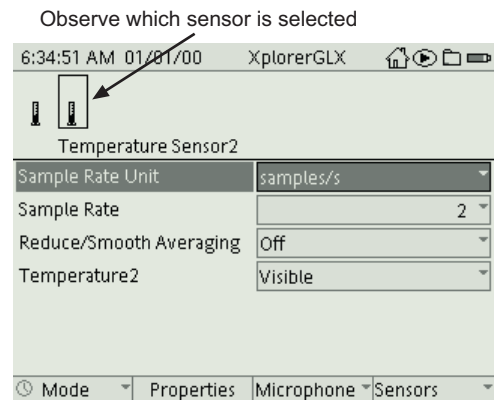
- a) Connect the probe measuring the black can to Temperature Port 1 on the left side of the GLX.
- b) Connect the probe measuring the unpainted can to Temperature Port 2.

2. Set the sampling periods of both probes to 10 seconds.

- a) Press  to return to the Home Screen; press  to open the Sensors screen.
- b) Observe the top part of the screen and note which sensor ("Temperature Sensor" or "Temperature Sensor 2") is selected.
- c) With Sample Rate Unit highlighted, press  to open the menu; press  to select seconds.

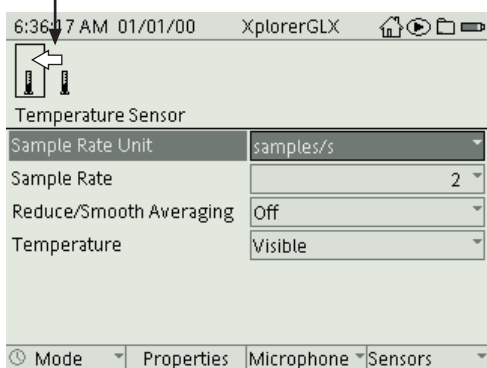


Select seconds from the Sample Rate Unit menu



- d) Press the down arrow to highlight Sample Rate; press \oplus until the value is set to 10 seconds.
- e) Press the left or right arrow to select the other sensor.

Press \leftarrow or \rightarrow to select the other sensor



- f) Repeat steps c and d to set the sampling rate for the newly selected sensor to 10 seconds.

3. Set up the Graph to display both temperatures.

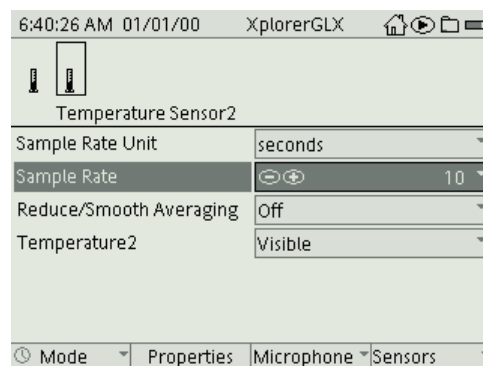
- a) Press Home to return to the Home Screen; press $F1$ to open the Graph. The Graph is automatically set up to display data from the first temperature probe.
- b) Press $F4$ to open the Graphs menu; press 3_{ways} to select Two Measurements mode. The second temperature measurement will be added to the Graph.

Data Collection

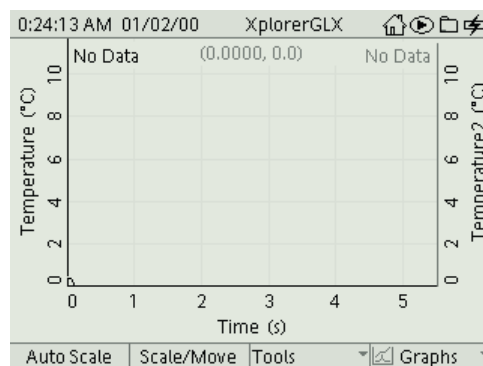
1. Fill both cans with equal amounts of hot water.
2. Press Start to start data collection.
3. Press $F1$ to automatically scale the Graph.
4. Gently swirl the cans as data will be collected for about 15 minutes.
5. Press Stop to stop data collection.

Analysis

Which can cooled faster? Why?



Set the Sample Rate to 10 seconds



Graph prepared to display both temperature measurements