To compare the hardness in different water samples

Hardness in water is caused by the presence of Mg^{++} and Ca^{++} ions. The amounts of these ions present determine how hard the water is.
In this experiment, you will use two methods to compare the hardness of water samples. First you will test their ability to form lather with soap flakes. Hard water does not form lather, soft water does.

Next you will measure the ability of the water samples to conduct electricity. If there are ions present in a solution, it will conduct electricity; if there are no ions present it will not. We can measure the ability of a solution to conduct electricity by using a conductivity probe. The greater the conductivity, the harder the water.

In the second part of this activity, you will compare the conductivity between boiled and unboiled water.

Apparatus:

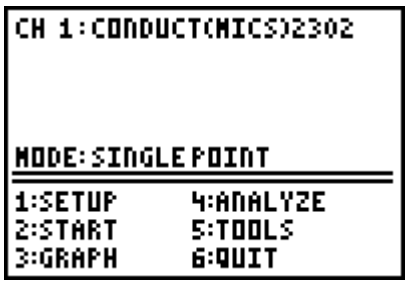
4 Test tubes
Soap flakes
Water samples
Conductivity probe
Data logging apparatus

Procedure:

Label four test tubes 1-4. Label each sample of water 1-4. Half fill each test tube with the corresponding number water sample.
Add three or four soap flakes to each test tube and shake vigorously.
Record the height of the lather.

Throw out the soapy water, and wash the test tubes. Half fill the test tubes again with fresh water samples.
Set up the conductivity probe to collect data
Switch the selector switch on the side of the conductivity probe to the 0-2000

Turn on the CBL and calculator. Select the **DATAMATE** programme from the **APPS** menu.
Press [CLEAR] to reset the programme.
Press [ENTER] at the welcome screen. The CBL will check for probes. Screen 1 will be shown.

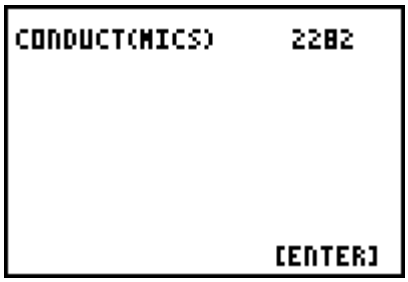


Screen 1

If the calculator does not display the conductivity probe in Channel 1 you will need to set up the sensor manually. To do this:
Select `SET UP` from the main screen
Press [ENTER] to select `CH 1`
Chose `CONDUCTIVITY` from the select sensors menu
Select `CONDUCT 2000 (MICS)` from the `CONDUCTIVITY` menu
Select `O.K.` to return to the main screen.

To set up the sensor for data collection
Press `1 :SETUP`
Use the [▲] arrow to select MODE on the calculator screen. Press [ENTER]
Select `4:SINGLE POINT` from the select mode menu Select `OK` to return to the main menu

Place the probe into the sample, ensuring that the tip of the probe is well under the surface of the water.
Press `2:START` the calculator will collect data for 10 seconds.
When Data collection is done the conductivity in microsiemens will be displayed



Record this value and press [ENTER] to return to the main screen
Repeat for each of the water samples

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Results:

Test tube number	Height of lather	Conductivity

Processing the data:

Enter these results into graphic analysis on the computer. (Conductivity can be entered automatically via the calculator, enter the height of the lather manually)

Produce two different bar charts, one with height of lather on the vertical axis, and one with Conductivity on the vertical axis axis. Use the number of the water sample as the horizontal axis in each case.

Alternatively enter the height of the lather as L3 in the calculator, and examine the graphs of L1:L2 and L1:L3 (in the Bar chart option in STAT PLOT

PART TWO

Obtain a sample of the hardest water sample. Measure the conductivity again. Record this value. Boil the sample for a few minutes, and leave it to cool. Record the conductivity again and compare it to the unboiled sample.

	CONDUCTIVITY (μS)
UNBOILED	
BOILED	

1. What was present in the water that caused it to be hard?
2. Why did their presence increase the conductivity of the water?
3. How would the height of lather produced by soapflakes compare in the boiled and unboiled water samples?
4. Which water sample was harder, the unboiled sample or the boiled sample?
5. Was this hardness due to temporary or permanent hardness?