

For Students

Water I use in Daily Life

A grade 8 – 9 chemistry module on water hardness

The Scenario

Lesson 1

For approximately 2,500 years people are trying to iron their clothes. It is known that ancient Aztecs laid their clothes on a level surface, pressed it with a rock and left under such press for some time. In the 4th century BC ancient Greeks used hot metal bars for ironing their linen wraps. First irons appeared only in the 14th century.



Nowadays only steam irons are used. Such irons contain a special tank for water. Usually the user manuals of such steam irons state that it is advised to use distilled water. The water inside the iron comes to a boil, creating steam which discharges from special gaps on the base of the iron made either from metal, ceramics or covered with polymer.

Such an iron can be used to easily iron very dry cloth. But the problem appears when not following the instructions sometime the interior of the iron and the gaps on its base rather quickly covers with sediment causing the equipment to stop functional on full volume, as well as leaving greyish-brownish stains on the cloth.

In groups of 3-4:

1. Brainstorm on possible causes why the gaps on the base of the iron can become covered in sediment and sometimes greyish-brownish stains appear on the cloth. Make a list of the reasons that seem feasible. Discuss this issue with the next group and agree on one assumption, which seems the most suitable.
2. Discuss how such a situation could be studied in a laboratory. Develop a step-by-step plan for the research to verify your assumption. Indicate the laboratory accessories and equipment that are necessary to carry out the research.

3. When the teacher has approved your plans, carry out experiments to investigate the effects of (a) distilled water, (b) tap water.
4. Draw conclusions based on results of your experiment:
 - On the difference in a composition of distilled and tap water;
 - Why do sediment forms on the gaps of the base of the iron and stains sometimes appear on the cloth while ironing;
 - On validation of the assumption.
5. What would you suggest the user of a steam iron to avoid the problems described in abovementioned situation?
6. Discuss and evaluate by ticking the boxes on the success of your group in the performance of the experiment.

Student group's self-evaluation sheet on performance of an experiment

Experimental/cooperation skills	Fully accomplished	Partially accomplished
Experiment performed without assistance		
Experiment performed following the planned order		
Matter was heated correctly by using a spirit-lamp		
Each water sample taken using a different dropper		
Safety regulations were followed		
Results of the experiment could be obtained/ observations were made		
Workplace was put in order after the experiment		
During the experiment the group members divided the tasks		
The division of tasks among the group members was successful		
Group members assisted each other		
What and how should be done differently performing a similar experiment next time:		

7. Present to your classmates on how well did your group do on performing the experiment and cooperating, what and how should be done differently performing a similar experiment next time.

Lesson 2

In groups of 3-4:

1. Work with the text

- 1.1. *Individually.* Read the text and highlight no less than 5 keywords!
- 1.2. Discuss them with the teammates!

Text

Naturally found water contains dissolved calcium and magnesium salts. The higher the content of such salts, the harder the water.

Due to heightened hardness the use of water in daily life creates many problems.

It is rather difficult to wash your hair well in water of heightened hardness. Because of that, a number of shampoos must be used when washing your hair, and a number of



detergent – when washing your clothes. The laundry loses its brightness due to the greyish sediment that appears as a result of a chemical reaction between the washing detergent and calcium salts. However, these are the lesser of all evils.

A truly huge problem is limescale which appears when the hard water is

boiled. The main components of limescale are the water-insoluble calcium and magnesium carbonates in – CaCO_3 , MgCO_3 – which appear when heating the water-soluble calcium and magnesium hydrogen carbonates – $\text{Ca}(\text{HCO}_3)_2$, $\text{Mg}(\text{HCO}_3)_2$.

The limescale can cause harm to household appliances produced by the latest technologies. If, for instance, the boiling time of water in a teapot is 3 to 4 minutes, after half a year it will hardly boil in 6 minutes. For example, a clogged radiator will be hardly warm, even though the heating works and it must be hot. After some time the shower head gets covered in sediment and the water flow is not as heavy and even as before. Just recently bought washing machine does not function to a full scale, toilet gets covered in sediment, but hot water from the tap flows very slowly.

Some products, for instance, meat and beans poorly boil in hard water and lose their nutritional value. The use of hard or soft water is not usually harmful to health, however, there is information that water of heightened hardness stimulate the formation and inspissations of kidney stones. However, regular use of soft water in nutrition is harmful it lack mineral substances causing bones to gradually become fragile, reducing the body's resistivity and increasing the possibility of teeth caries, increases the risk of heart and vascular diseases.

- 1.3. Formulate three most essential questions that can be answered by the text!

- 1.4. Formulate questions that arise after reading the text!
- 1.5. Formulate the main idea of the text. Offer your title for the text!
- 1.6. Present the text title, main idea and ask you three questions to other groups!
- 1.7. Debate with another group! The topic of the debate: Do you agree with the statement that distilled water is *alive* but hard water is *lifeless*? Justify you opinion by using the information given in the text or based on your personal experience!

In groups of 3-4:

2. Study on water hardness.

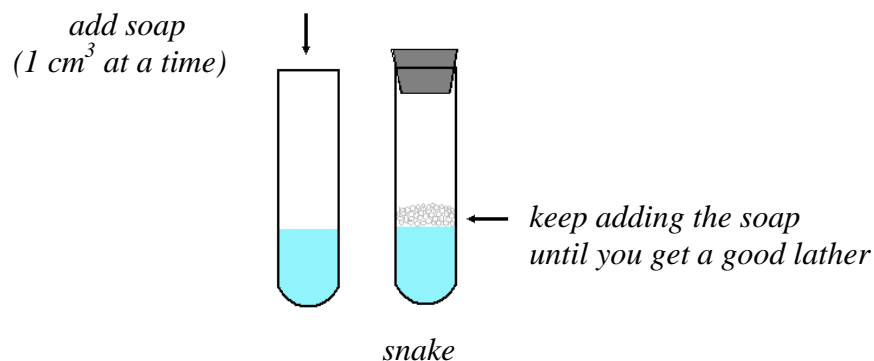
Determining the water harness at home is not difficult: take notice of how it causes soup to foam. The lack of soap foam and small white scum indicate the heightened hardness of water, but if it foams well, it shows that water is soft.

- 2.1. Read the description of the experiment *How hard?* and name the value to be measured in order to determine the hardness of the water to be tested!

Description of an experiment

How hard?

Add 1 cm³ of soap solution to 10 cm³ of the water being tested. Stopper the test-tube and snake. Repeat this until you get a good lather (one that lasts at least 30 seconds). Test different numbered samples: distilled water, mineral water, tap water or other kind of natural water you have brought from your location.



- 2.2. Create a table for data registration!

- 2.3. Perform the experiment and register your data in the table!
- 2.4. Graphically demonstrate your findings!
- 2.5. Name the examples of hard water! Explain the results of the experiment with mineral water!
- 2.6. Name the examples of soft water! Explain the results of the experiment with distilled water!
- 2.7. *Work in pairs.* Give recommendations on the usage of water of your location and present them to your class mates.