



HOW CAN WE COLLECT
WATER SAMPLES AND
MEASURE
TEMPERATURE
AND pH?

Geography | Physics | Biology | Chemistry | Computer Science | Mother Language
| Mathematics |



SEA WATER QUALITY

PEDAGOGIC CONTENT:

- Physicochemical parameters,
- Temperature and pH measurements
- Pollution
- Water monitoring,
- Human health

PRE-REQUISITES:

- Physico-chemical magnitudes,
- Computer skills,
- Knowledge about pH magnitude in water solutions.

NEW COMPETENCIES TARGETED/LEARNING OUTCOMES:

This activity is an introduction to the use of collecting water samples in an industrial area and how they can perform temperature and pH measurements. The results will provide key information about the seawater conditions, and will generate questions about the reasons of a potential pollution

STUDENTS WILL BE ABLE TO:

- Identify the different water pollution sources
- Understand the impact of water pollution to humans.
- Understand the need for supporting a water monitoring programme to estimate the factors that affect human health.

- Learn important concepts related to cost-effective sensing devices for monitoring the water temperature and pH, including their principle of operation

- Understand in a simplified way the key specification of such devices like sensitivity and accuracy.
- Develop basic data bases using software packages and save their data for further analysis.
- Get familiar with scientific procedures



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DESCRIPTION:

IMPLEMENTATION

First sampling should take place in controlled system (e.g. river, stream, lagoon or lake) since freshwater is not saline and the experiment is similar with seawater analysis.

Second sampling should take place in coastal zone taking into account seawater turbidity. Students should understand the motivation of the measurements since the indicators of water quality (e.g. turbidity) will provide initial information of state of the water, that is if it is affected from industry and natural processes (e.g. climate change, natural disasters).

Students are divided in pairs/ groups and follow the protocol below:

#1: Water collection

Students should prepare with the educator a preliminary study to identify the areas of sampling. Students should also ensure that they collect the samples from exactly the same location and in the same way each time they test the water. One example is to perform sampling before and after a rainfall event in any of the proposed aquatic systems. Typical protocol indicates that the water sample should be collected from an area close to the centre of the water body. So, a two-times visit in the area is the minimum. The first visit will be in controlled system to get the relevant experience and know-how. The second will take place in the coast before and after rainfall.

Students follow the instructions below:

- I. To remove potential contamination and in case you use a typical bottle for collection, rinse it out four times with the water.
- II. In case of a sampling procedure in a river take your sample upstream from where you are standing but do not disturb the bottom since this may affect temperature, turbidity and salinity results.
- III. In case that you collect the sample beneath water surface submerge your container and try not to collect surface water.

#2: Temperature measurement

The student who will take the measurement should place the thermometer a few centimeters into the water source in-situ or immediately into the water sample after the collection.

Then he/she should measure the temperature directly in the water. Then the student should wait one minute, until the recording becomes stable. The temperature is recorded to the nearest 0.5°C while the temperature sensor is still immersed in the water. Students repeat steps of the previous procedure at least **once**. In case that the results deviate, the students should get up to **5 measurements** and provide an average value. The students should record the results on a datasheet and will see the trends in temperature and comment unusual data (high or low) compared with literature information.

DESCRIPTION:

#3: pH measurements

pH is a difficult concept to explain to younger students.


As a general information they should know that plants and animals live in a good quality if the pH values are between 6 and 8. pH test strips are not reusable. If the students touch the strips with salty, oily hands or they put food on their skin, pH reading will be changed. So the students should always handle the strips by the white end and don't use pH strips that have been dropped.


The following steps should be followed:


Students should pick one pH strip from the container making sure they will not touch the colored end. Then they should dip the colored part of the strip into the water to be tested and swirl for 2 minutes. The students should compare the 3 colors on the pH strip with the colors on the chart and then they should match the closest result on the data sheet


#4: (in the classroom /science laboratory)


The teacher will explain and describe what is being measured and he will explain the data for both magnitudes (temperature and pH)


 #5: Students have to describe patterns in water temperature and/or pH based on in-situ observations.

 #6: Students have to communicate for providing an explanation and possible interpretation for the observed patterns getting appropriate support from the teacher.


 #7: Students have to discuss about the two quality indices and to compare with literature data at other sites in correlation with the contamination status.


 #8: The students should repeat the whole procedure in a seasonal basis (e.g. 3-4 months).


 #9: Students have to discuss data comparisons in different aquatic areas.


 #10: Students should define their conclusion according to the type of the aquatic system (static for a lake, dynamic for a stream or river), to the comparison of the measured values with baseline data, and to the type of the area of study (affected or not from anthropogenic activities).

 # 11: Students present their conclusions to the rest of the class


Type of activity  information research,
experimental activities


Target audience  From 15 years old


Place  Field, chemistry lab, classroom

Material needed  Temperature probe/sensors
pH test strips
Bottles or buckets
Other general consumables, pencils,
notebooks, work sheets, sun cream,

Duration of activity  Implementation : 3-4 hours

Authorship  HCMR (Education Unit)
No authorization required

Links  <https://www.watercorporation.com.au>
<https://ecosystems.psu.edu/youth/sftrc/lesson-plans/water/6-8/quality>
<https://betterlesson.com/lesson/645226/water-quality-what-is-ph>
<https://www.michiganseagrant.org/lessons/lessons/by-broad-concept/earth-science/water-quality/314-2/>
<https://www.otffeo.on.ca/en/resources/lesson-plans/testing-water-quality/>

Notes by author  This activity should take place in an aquatic system such as pond, lake, streams or at the coastal zone. This exercise could be also implemented in collected rainwater or after rainfall.



Departament de Sostenibilitat i Medi Ambient i Consell de Mallorca



MedORO





How can we collect water samples and measure temperature and pH?

Worksheet

Collecting a water sample

Why we test/monitor the water?

How to collect a water sample ?

photo

photo

Temperature

What I know about temperature ?

How to test the water temperature ?

photo

photo

pH

What I know about pH?

How to test the pH of water ?

photo

photo