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| Activity plan | | | | |
| ACTIVITY PLAN | | | | |
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| **Theme** | **Subtopic** | **Activity Title** |
| 1. Environmental Awareness and Conservation | * 1. Biodiversity and Ecosystems | Eco-Explorers: Testing the water quality - Determination of the presence of chlorides by Mohr's procedure |

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| Introduction part (or activity overview) |
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| **Introduction part (or activity overview)** | Experimental research is aimed at connecting theoretical activity with experimental demonstration, discovering new methods and concepts by examining the purity of water, as well as confirming the fact that it is one of the most important substances and resources in nature and without it there is no life. |
| **SETTING** | А chemistry cabinet to demonstrate the experiment, a local sampling area, a natural water source, water mains and bottled water |

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| Materials Needed |
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| **Materials Needed** | **Laboratory equipment:**  300cm3 Erlenmeyer flask, 20cm3 mixing pipette, 50cm3 burette, funnel, beaker and stand pH meter  **Reagents:**  solution AgNO3  C=0.05 mol/dm3 , K2CrO4  5% solution  Cameras or smartphones |

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| **Learning Outcomes** | * Expanding and deepening knowledge about eco systems, gaining new experiences and expanding one's conceptual understanding through experimental activities * Enhancing a sense of teamwork through research activity with environmental content and cooperation between group members * Developing critical expression by presenting experimentally obtained results on water pollutants and illegal amount of chloride salts |  |
| **Activity Contents**  **Notes** | **Activity 1 (Duration: 45 minutes): Taking a water sample for analysis**  **Theoretical part** (Duration: 10 minutes): Discussion about the method of taking a water sample that depends on the place of sampling. A sample of the water supply network is taken from the starting and ending points of the network, but previously it is allowed to flow from the tap for 5-10 minutes.    Video: <https://www.youtube.com/watch?v=jz63HqVerUM>  Overview: The video covers physical, chemical and biological tests in chemical laboratories, showing how samples are stored and prepared for testing.  Physical examination procedures include temperature measurement, determination of color, transparency, density, odor and taste.  Chemical procedures serve to determine the pH value, the presence of salts in the water (nitrates, chlorides, carbonates, sulfates, etc.).  Microbiological tests are aimed at identifying the microorganisms present in the water.  Duration: Approx. 5 minutes  **Task (Duration: 20 minutes):** Students take sample from a natural water source in the local community and a sample from bottled water and prepare three samples for analysis.  **Activity 2: Demonstrating the experiment and determination of chloride content** **in water samples**  **Theoretical part ( 20 minutes ):**  Consideration of possible ways to reduce water pollution, highlighting the importance and role of water as a natural resource, which is increasingly polluted and in short supply ( 10 minutes).  Discussion about the experimentally obtained results of water pollution, proving the hypothesis that the drinking water in our place of residence is safe and has the presence of a permissible concentration of chlorides (10 minutes).  Video: <https://www.youtube.com/watch?v=xEAIjx5BcSY> (5 minutes)  **Еxperimental Part (Duration: 60 minutes):** The students get a work obligation to demonstrate the experiment, by analyzing three water samples:  Pipette 20 cm3 of the solution into an Erlenmeyer flask with a mixing pipette.  Add 3 - 4 drops of indicator K2CrO4 (the sample turns yellow).  It is titrated with a standard AgNO3 solution with C= 0.05 mol/dm3. Chlorides are deposited as a white precipitate (yellow coloration is due to the indicator).  Titration is continued until a pale brown color appears. The titration is repeated 3 times and the mean value is calculated.  Аn overview of the aims and methods of experimental research  - Students apply their knowledge, skills and abilities to be able to determine the presence of chlorides of chlorides in water samples experimentally with methods for experimental analysis.  - Researches and performs laboratory analyzes with the specified chemicals and laboratory equipment  - Students apply their knowledge to gain new experiences and expand their conceptual understanding through experimental activities.  **Task (Duration: 2 hours):** Students work in groups, conduct an experimental analysis of three water samples, at the end of the experimental research they present and compare the obtained results. They make a conclusion which of the sampled water is of higher purity and with what concentration of chloride salts.  \*Step 1: analysis a sample from a natural water source in the local community and a sample from bottled water and prepare three samples for analysis  \*Step 2: analysis a sample from a natural water source in the local community  \*Step 3: analysis a sample from a natural water source in the local community and a sample from bottled water  Forms Techniques for Research and Data Entry : Group learning, teamwork through the method of observation and experimental demonstration.   * Handle silver nitrate with care * Direct students to develop critical thinking about all pollutants of ecosystems |  |
| **Assessments** | Monitoring of exploratory analyzes and synthesized group activities related to water purity.  Evaluation of presentation the experimentally obtained results for the presence of chlorides in water according to Mohr's procedure, which has a significant role in eco systems.  Each student self-asceses his contribution to the work. |  |
| **Key Competences** | * Cognitive competence * Experimental competence * Social, emotional and healthy living competence * Cultural competence |  |
| **Connections with Eco STEAM** | **Eco** - **S**cience - ecological science (examination of the quality of eco system – water )  **T**echnology - use of digital tools for research  **E**ngineering - argentometric volumetric procedure that is used in chemical engineering  **A**rts - drawing tables, graphs of experimental results  **M**ath - mathematical calculations for volume during titration |  |
| **References** | * Analitical chemistry-Argentometry - Volumetric method in Quantitative analysis * Article ["Adaptation of the Mohr Volumetric Method to General Determinations of Chlorine"](https://zenodo.org/record/1428738) * Ionic Equilibria in Analytical Chemistry – Jean Louis Burgot |  |

# Research Guide for Activities

# Results obtained from the water analysis and comparison with the limit values from activity 1

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| Water temperature | 12˙C |  |
| Dullness | / |  |
| Transparency (clarity) |  |  |
| Smell | Odorless |  |
| Taste | No taste |  |
| Colour | Colorless |  |
| pH value of the water | 7 |  |
| Location where the sample was taken | Chemical laboratory |  |

# Results obtained from the water analysis and comparison with the limit values from activity 2

**Table for permissible values of chlorides in water**

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|  | Obtained values | Allowed values |
| Chlorides | 17,725 mg/L | 200 mg/L |

**Assessment Table :**

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| Assessment Criteria | Points | Comments |
| Handling laboratory equipment and reagents | \_\_/5 |  |
| Experimental Research | \_\_/5 |  |
| Describing experimental results | \_\_/5 |  |
| Accuracy of calculations | \_\_/5 |  |
| Quality of Presentation | \_\_/5 |  |