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| ACTIVITY PLAN | | |
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| **Theme** | **Subtopic** | **Activity Title** |
| 3. Creative and Critical Thinking in Eco - STEAM Education | 3.2. Design Thinking for Eco-friendly Solutions | Eco soap - Limonene Soap |

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| Introduction part (or activity overview) |
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| **Introduction part (or activity overview)** | Students will collect waste from oranges, isolate a lemon substance from the peel of oranges, which they will use to obtain soap with a characteristic smell and aroma, learn soap-making procedures, develop creative and critical thinking, design eco-friendly solutions.  This activity will contribute to raising environmental awareness by using organic waste that can lead to pollution of nature if not used properly. |
| **SETTING** | А chemical cabinet with appropriate equipment for conducting physical - chemical processes or a classroom with the necessary equipment and materials.  Еducational context: teamwork and learning. |

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| Materials Needed |
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| **Materials Needed** | Fat (5 grams), 6 cm3 sodium hydroxide solution (NaOH), 6 cm3 96% alcohol – ethanol, table salt (NaCl), oranges, beakers, laboratory beaker, Erlenmeyer flask, cork, bent tube, glass rod, teaspoon, alcohol lamp or Bunzen burner, asbestos netting, tripod, funnel, filter paper, watch glass, red and blue litmus paper, computer or telephone.  Precautions: Be careful with sodium hydroxide! |

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| **Learning Outcomes** | - Develop skills for experimental work;  - Collaborate and develop skills for creative and critical thinking about all polluters of eco systems;  - Learn to prepare materials needed to make soap, calculate the profitability of the production itself;  - Draw conclusions based on experimental results;  - Create thinking about eco friendly solutions; |  |
| **Activity Contents** | **Activity 1: Preparation of the necessary equipment and substances for experimentation**  **Theoretical part (Duration: 15 minutes):** Discussion of organic waste and ways to reduce it, consideration of the concept of production, costs and formation of the price of the obtained product <https://www.youtube.com/watch?v=FqVNU9eN9DU>  Discussion around creative ideas for reducing waste and solutions for environmental protection, as well as raising environmental awareness to a higher level, as well as the production of ecological products.  **Task 1 (Duration: 10 minutes):** Students observe and collect data on the phenomena and processes that surround us and which they will apply during production, according to the conditions. All team members participate with individual ideas and thoughts. They discuss and think about ecological content and solutions for environmental preservation.  **Task 2 (Duration: 20 minutes):** Students research on the internet about the properties of the substances they will use in experiments, consider the necessary equipment, videos that give an explanation of the process of obtaining soap.  **Videos:**  <https://www.youtube.com/watch?v=VmQV3Qs9Qzk>  <https://www.youtube.com/watch?v=Tu_sWoHULtY>  Overview: Videos show the necessary laboratory equipment and chemicals, describe the method of obtaining soap.  Duration: Approx. 10 minutes  <https://www.youtube.com/watch?v=KtPbwXolNag>  Overview: The video will help to demonstrate the saponification reaction, in the reaction of higher fatty acids with a strong base.  Duration: Approx. 3min 07sec  **Task 3 (Duration: several days):** Collection of orange waste and other materials.  The students collect oranges from shops, which instead of being thrown away will be used to flavor the soap, with procedures of crushing, crushing and filtering the peel and isolating the limonene substance.  Students set up the laboratory equipment and reagents needed for the experimentation process.  **Activity 2: A laboratory procedure based on a chemical reaction and obtaining a final product.**  **Task 1 (Duration: 1 hour):**  Step 1: Soap making. Put 5 grams of fat, 6 cm3 96% alcohol and 6 cm3 20% sodium hydroxide solution into erlenmayer. The Erlenmayer is well shaken, closed with a cork through which a bent glass tube passes, and is dumped into a glass of hot water (15 min).  Step 2: Heat for about 20 minutes.  Step 3: Add some of the liquid to an Erlenmeyer flask filled with slightly boiling water. If no fat droplets appear, the reaction is complete (5 min).  Step 4: The mixture from the first Erlenmeyer flask is poured into a laboratory beaker with a saturated salt solution and stirred. The soap is separated, after filtering with filter paper, and the glycerol and other soluble ingredients remain in the solution (10 min.).  Step 5: Calculate the yield of the soap (10 min.).  This can be determined by comparing the actual mass of soap obtained with the theoretical yield based on the amount of fat or oil used in the reaction. A high percentage yield indicates that the reaction is efficient and that most of the starting material has been converted to soap.  Another key parameter is the quality of the soap produced. This can be assessed through various physical and chemical tests, such as measuring pH, determining the amount of base remaining, assessing the lather and lather properties of the soap. High-quality soap will usually have a pH close to neutral and will be foamy.  **Task 2 (Duration: 30 minutes):** Final Work. Reflection.  Students prepare audio-visual material from the laboratory procedures and present the final product, explain the profitability of the process and its environmental significance. |  |
| **Assessments** | The final product will be evaluated through the self-evaluation method.  The evaluation segments are contained in the evaluation table, which includes: Proper handling of laboratory equipment and reagents, the quality of the resulting product – soap, skills in presenting eco-friendly solutions and presenting conclusions, description.  All students in the class can be included in the evaluation. |  |
| **Key Competences** | * Experimental competence * Cognitive competence * Creativity competence * Socual, emotional and healthy competence * Digital competence |  |
| **Connections with Eco STEAM** | **Eco** – application of organic materials and reduction of organic waste  **S**cience: implementation of chemical processes in production  **T**echnology: using a computers during research and cameras during recording of audio visual material  **E**ngineering: methods and procedures applicable in production  **A**rt: creating interesting shapes and forms of soap in molds  **M**ath: calculating the cost and price of the resulting product - soap |  |
| **References** | <https://www.youtube.com/watch?v=FqVNU9eN9DU>  <https://www.youtube.com/watch?v=VmQV3Qs9Qzk>  <https://www.youtube.com/watch?v=Tu_sWoHULtY>  <https://www.youtube.com/watch?v=KtPbwXolNag>   * + Cavitch, Susan Miller. The Natural Soap Book. Storey Publishing, 1994.   + p. 632, chapter 11, Anionic and Related Lime Soap Dispersants, Raymond G. Bistline, Jr. in Anionic surfactants: organic chemistry, Helmut Stache, ed. Volume 56 of Surfactant science series, CRC Press, 1996, ISBN 0-8247-9394-3. |  |
| **Notes** | |  |  |  |  | | --- | --- | --- | --- | | C:\Users\Viktor Georgievski\Downloads\337482701_1574104543064976_5508819409000065064_n.jpg | C:\Users\Viktor Georgievski\Downloads\337555193_1702337430201926_70819636377171620_n.jpg | C:\Users\Viktor Georgievski\Downloads\337487732_697193238823618_3939618224773532940_n.jpg |  |   Picture 1 Picture 2 Picture 3  The soap production project in our school The final product - soap made in our school  Chemistry cabinet |  |

Evaluation Table

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| Evaluation Criteria | Points | Comments |
| Proper handling of laboratory equipment and reagents | \_\_/5 |  |
| The quality of the resulting product - soap | \_\_/5 |  |
| Skills in presenting eco-friendly solutions and presenting conclusions | \_\_/5 |  |
| Еxpressing a critical opinion about environmental pollutants | \_\_/5 |  |
| Description |  |  |