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| ACTIVITY PLAN | | |
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| **Theme** | **Subtopic** | **Activity Title** |
| 1. Environmental Awareness and Conservation | * 1. Sustainable Living and Green Technologies | Design plastic for the future - Bioplastic bag |

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| Introduction part (or activity overview) |
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| **Introduction part (or activity overview)** | Students will demonstrate experimental work, implementing the Environmental Awareness and Conservation teaching model in chemistry learning. Students analyze the problem related to polymer topics and use their knowledge to develop biodegradable plastics that are environmentally degradable. |
| **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** | Gelatin, glycerol, beaker, chopsticks, mixing bowl, measuring equipment, scale, thermometer, glue, scissors, food coloring, computer or telephone. |

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| **Learning Outcomes** | - Raising students' environmental awareness, obtaining a final product that does not pollute the  environment  - Develop skills for experimental work  - Collaborate and develop skills for team work  - Learn to prepare materials needed and design biodegradable plastic  - Draw conclusions based on experimental results  - Create thinking about sustainable living and green technologies |  |
| **Activity Contents** | **Activity 1:**  **Preparation of laboratory equipment and necessary chemicals**  **Theoretical part (Duration: 15 minutes):** Discussion on the pollution of nature with toxic waste from traditional plastics, greenhouse gas emissions, dependence on fossil fuels and the amount of waste in landfills.  <https://www.youtube.com/watch?v=qiXRTA0tYoI>  Approx. 2 min 35sec  <https://www.youtube.com/watch?v=_6xlNyWPpB8>  Approx. 4min 06sec  Discussion around creative ideas for recycling of traditional plastics, producing high-quality secondary polymer raw materials that are then converted into new plastic products.  <https://www.youtube.com/watch?v=zO3jFKiqmHo>  Approx. 3min 50sec  **Task 1 (Duration: 10 minutes):** Searching for ecological alternatives for synthesizing biodegradable plastic "Green Plastic", which is mostly produced from plant-based polymers, unlike traditional plastics, which are made from non-renewable petroleum products  <https://www.youtube.com/watch?v=6ky9opWGc-c>  Approx.4min 38sec  **Task 2 (Duration: 20 minutes):** Students research online about composition and properties of biobased polymer, review necessary equipment, videos that provide an explanation of the process during experimentation.  **Videos:**  <https://www.youtube.com/watch?v=SNaLBaAiAGU>  Overview: Video shows biodegradable plastic  Duration: Approx. 4min 25sec  <https://www.youtube.com/watch?v=fDStwxetx7Q>  Overview: The video will help to demonstrate the process of making bioplastic sheets and design a bioplastic bag  Duration: Approx. 7min 23sec  **Task 3 (Duration: 1 hour):** Students are divided into groups and distribute their work responsibilities, set up the laboratory equipment and reagents needed for the experimental process.  **Activity 2: Demonstration an experimental work**  **Theoretical part (Duration: 10 min) :** An introductory discussion about the way to demonstrate the experiment.  **Task 1 (Duration: several days):** Making bioplastic  Step 1 (25 min): Measure ingredients  Make a solution of 6.75 grams of gelatin with 4 ml of glycerol in 1000 ml of water (to make a solution, we will mix water and glycerol together). Whisk the solution. These are the basic components of our bioplastics.  Step 2 (1 h 15 min): Combining the ingredients  Measure out 360 ml of solution, heat to 90 degrees Celsius or 194 degrees Fahrenheit.  Gradually add gelatin to the solution as it heats.  At first we see that the gelatin does not dissolve in the water. Overtime after heating the gelatin, the hydrogen bonds break and allow a reaction with water.  Step 3 (3 days): Pouring and drying  Use food coloring such as beet juice, henna, saffron, spirulina to change the color of your plastic. You can put spirulina (biomass of cyanobacteria-green algae) in the glass and naturally change the color to green. Pour the coloring plastic into a baking pan, mix it with the cutlets. Before you let your plastic dry, add spinach seeds. After the mixture has cooled, let the plastic dry until it is completely dry and the edges start to peel (3 days later). To create a complete bag, you need to make two more plastic sheets.  Step 4: (10 min): Comparing the strength of the final product, obtained by chemical means, compared to the natural one.  **Task 2 (Duration: 30 minutes):** Final Work. Reflection.  Students present experimentally obtained results and conclusions, prepare a description for designing biodegradable plastic, as a suitable way to preserve the environment. |  |
| **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 - bioplastic bag, skills in presenting about sustainable living and green technologies, description.  All students in the class can be included in the evaluation. |  |
| **Key Competences** | * Experimental competence * Cognitive competence * Creativity competence * Digital competence |  |
| **Connections with Eco STEAM** | **Eco** – design bioplastic that can be decomposed in nature through biological processes.  **S**cience: experimental research with practical objectives.  **T**echnology: production of biodegradable bags.  **E**ngineering: developing a model to reduce environmental pollution and applicable in production.  **A**rt: drawing charts to show the strength and flexibility of the final product, obtained by chemical means, compared to the natural one.  **M**ath: mathematical calculations for making solutions of glycerol with water. |  |
| **References** | <https://www.youtube.com/watch?v=qiXRTA0tYoI>  <https://www.youtube.com/watch?v=_6xlNyWPpB8>  <https://www.youtube.com/watch?v=zO3jFKiqmHo>  <https://www.youtube.com/watch?v=6ky9opWGc-c>  <https://www.youtube.com/watch?v=SNaLBaAiAGU>  <https://www.youtube.com/watch?v=fDStwxetx7Q> |  |
| **Notes** | C:\Users\Viktor Georgievski\OneDrive\Desktop\proekt\biolastic\Bioplastics.png  The final product - Bioplastic    Тhe following activities 4.5 will be the students' homework. They will have to make several sheets, assemble them and design a biodegradable bag. |  |
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Evaluation Table

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| Evaluation Criteria | Points | Comments |
| Proper handling of laboratory equipment and reagents | \_\_/5 |  |
| The quality of the resulting product - bioplastic bag | \_\_/5 |  |
| Skills in presenting sustainable living and green technologies | \_\_/5 |  |
| Team work and collaboration | \_\_/5 |  |
| Description |  |  |