



GREEN-EDU Learning Activity

Title: The sun

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Summary

Lesson plan summary

In this lesson plan students will learn about green Chemistry and how important the sun is for our earth. They will learn about the benefits of the sun along with the measures that need to be taken to protect ourselves against its negative effects. They will also learn about the solar system.

Then, students will be given instructions for an easy DIY construction so as to construct a solar oven made of cardboard that uses energy from the sun to cook the food inside.

Finally, they will apply the Green Chemistry principles to make and test sunscreen.

Subject	Green Chemistry
Topic	The sun
Age of students	Elementary 6-12
Preparation time	Minutes
Teaching time	Minutes
Online teaching material (links for online material)	<p><i>Introducing Green Chemistry: The Science of Solutions</i> https://blossoms.mit.edu/videos/lessons/introducing_green_chemistry_science_solutions</p> <p><i>The sun</i> https://www.youtube.com/watch?v=vQSECrMlygg</p>
Offline teaching material	<p>https://www.beyondbenign.org/bbdocs/pdfs/Lactic_Acid_Titration_Extension.pdf</p> <ul style="list-style-type: none"> ▪ "12 Principles of Green Chemistry" from Figure 4.1: (p.30). 12 Principles of Green Chemistry from <i>Green Chemistry: Theory and Practice</i> (1998) by Anastas P and Warner J. By Permission of Oxford University Press. ▪ American Chemical Society Green Chemistry Institute ▪ EPA Green Chemistry ▪ Beyond Benign ▪ https://www.youtube.com/watch?v=PqxMzKLYrZ4 ▪ https://www.youtube.com/watch?v=RzkJkEKV8Yk ▪ https://www.youtube.com/watch?v=F2prtmPEjOc



- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5129901/>
- <https://www.youtube.com/watch?v=riMAITbLqZI>
- <https://www.kids-world-travel-guide.com/solar-system.html>

Aim of the lesson

By the end of this lesson students will:

- 1) Understand what green Chemistry is
- 2) Learn about the sun and the solar system
- 3) Construct their oven
- 4) Make and test their sunscreen

Trends

STE(A)M Learning , Project based learning



Activities

Name of activity	Procedure	Time
Introduction to Green Chemistry	<ol style="list-style-type: none"> 1. Start the lesson with introductory questions: What does a chemist do? What are some chemical products? What do you think about when you hear the words "Green Chemistry"? What is environmental science? 2. Students can watch the introductory video ... (MAKE VIDEO) 3. Students will be introduced to the 12 Principles of Green Chemistry. Activity: Think about what Green Chemistry means to you. Present the 12 principles in your own words. Students will be divided in groups. Each group will be assigned with a green Chemistry principle and will be asked to present it with a skit, a drawing or even a song to their classmates. 	45 min
The sun and the DIY solar oven	<ol style="list-style-type: none"> 1. Start the lesson with an introduction to the sun: what it is, how far it is from the earth (solar system), how it transfers heat to earth and space (atomic reactions, 8min and 300.000km/sec for light to travel to earth), how the earth's movement around the sun is connected with the four seasons and how the sun is directly connected with life on earth. Continue with giving them information about the gas the sun uses as fuel to burn bright (hydrogen) and the sunlight which allows us to see as well as provide energy to earth either used for photosynthesis (how plants make plant food and produce oxygen) or for solar panels. 2. A connection could be made among photosynthesis, the water cycle and the weather. Let the students hear a few things around photosynthesis that has to do with life on earth and then talk to them about the water cycle which is responsible for the clouds that bring the rain, along with the physics hidden behind evaporation and condensation. 3. Finally, highlight the precautions we should be taking against the sun, because no matter how many benefits it offers, there still is a need for some measures. 4. Give them instructions to construct at home their personal oven so as to melt some chocolate with the sun's help: <ul style="list-style-type: none"> • Start by cutting a hole in the top of an empty pizza box • Lift that up and cover with a piece of aluminum foil • Place a piece of black paper inside the pizza box • Put inside the box your ingredients on top (biscuits and chocolate pieces) and cover that with plastic wrap • Take it out to the sun (you can check its temperature with a thermometer) and let it melt 	90 min



	<ul style="list-style-type: none"> Once the sun has melted it, enjoy 	
The solar system	<ol style="list-style-type: none"> Talk about the snack they were able to make simply by putting their construction under the sun and help them realize how powerful the sun is and think of ways we could take advantage of this energy for a good cause. Remind them that because the sun is in the middle of the planet's system, it is called the solar system. The solar system was formed about 4.7 billion years ago. It probably started as a loose cloud of gas and dust. Scientists think that a force called gravity pulled parts of the cloud together into clumps. The largest clump was squeezed together so tightly that it got very hot. This clump eventually became the sun. Over millions of years the other clumps became the planets. The sun's strong gravity eventually pulled the planets into their orbits. Over time some of the leftover clumps became asteroids, comets, and other small, icy objects. Then, talk to the students about its 8 planets (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune) and provide them with information about each one. Give them a list with the top 10 facts about our solar system: <ul style="list-style-type: none"> Everything in the Solar System revolves around the Sun. The Sun is a star – a massive ball of hot gas that gives off light and heat. There are eight planets that orbit around the Sun. The closest planet to the Sun is Mercury, and the farthest away is Neptune. The biggest planet is Jupiter, and the smallest planet is Mercury. The Earth is the only planet that we know has creatures living on it. The Earth rotates as it orbits the Sun. It takes one day to complete a rotation. It takes 365 days for the Earth to complete one circuit around the Sun. We call this a year. The Sun is just one of hundreds of billions of stars in the galaxy that we live in, which is called the Milky Way. The whole Universe has at least 100 billion galaxies in it. You are held onto the surface of the Earth by a force called gravity. This is the same force that keeps the Earth and the other planets orbiting around the Sun. Not everything in the Solar system orbits directly around the Sun. The Moon orbits around the Earth. 	45 min
Sunscreen	<ol style="list-style-type: none"> Recap their knowledge on the sun and the solar system, so as to pinpoint the most important information and then proceed with the reminder of the measures that need to be taken to protect ourselves from the sun's negative effects. One of these measures is the sunscreen. Sunscreen is a topical health and wellness product that protects your skin from the sun's ultraviolet (UV) rays. SPF stands for "sun protection factor." It's a numerical estimate of how well a product protects your skin from ultraviolet B (UVB) rays, 	90 min



which is why a number is used to represent the SPF. Therefore, effective sunscreens reflect or scatter both harmful UVA and UVB rays so that they can't penetrate your skin. After the rays are scattered, organic material — the creamy components of sunscreen formulas — absorb the energy from the rays and distribute the energy over your skin in the form of heat.

2. Once the students have learned about the use of sunscreen, a good idea would be to give them an easy recipe to make their own sunscreen. Many of the ingredients in this recipe have a natural SPF:

Ingredients

- ½ cup almond or olive oil (can infuse with herbs first if desired)
- ¼ cup coconut oil
- ¼ cup beeswax
- 2 TBSP zinc oxide
- 1 tsp red raspberry seed oil (or less, optional)
- 1 tsp carrot seed oil (or less, optional)
- 2 TBSP shea butter (optional)
- Optional Ingredients: essential oils, vanilla extract, other natural extracts (not citrus)

Instructions

- Combine all the ingredients except zinc oxide in a pint-sized or larger glass jar.
- Fill a medium saucepan with a couple inches of water and place on the stove over medium heat.
- Put a lid loosely on the jar and place it in the pan with the water.
- Shake or stir the jar occasionally to mix the ingredients as they melt.
- When all the ingredients are completely melted, stir in the zinc oxide, and pour into whatever jar or tin you will use for storage.
- Stir a few times as it cools to make sure zinc oxide is incorporated.
- Store at room temperature or in the refrigerator to increase shelf life.

3. Once the sunscreen is ready, it is time to test its effectiveness. The Sun Sensitive Paper is a great tool for this experiment because it reacts to light waves and particles when exposed to ultraviolet (UV) light, due to the light-sensitive chemicals on its surface. When UV Rays are blocked from the paper, the paper turns white. However, when the paper is exposed to the UV light, it turns blue. The darker shades of blue indicate more exposure to UV light. Placing the paper in water stops the process of reacting to UV light and preserves the colors on the paper as they are. So, tell the students to start out inside and take out a piece of paper. Label the back of the paper with which sunscreen they are using and then place the paper inside one of the zipper-lock bags and seal it. Smear the sunscreen on the outside of the bag. It is important not to forget a blank sheet of paper in a bag without any sunscreen to have it as a control sheet. Then head outside.



- Set the papers out in the sun and wait for about 5 minutes. Bring the papers back inside and submerge it in the tub of water to stop the process and fix the images on the paper. The more blue the paper is, the more the UV rays came through. The more white the paper is the more UV rays were blocked by the sunscreen.
4. Ask them how they imagine the future of our planet and ask them "Can you imagine other simple ways to save the environment?"

Assessment

Describe here the assessment method of the lesson, if any. For example, if you plan on assessing your students with a quiz, include here questions and answer options with color-coding the correct answers.