Learning Tool Code	Title
SDG6-SDGfP	**WATER IS A PRICELESS GIFT FROM NATURE**

Objectives

1. Summary of students' knowledge of water as the most common substance on Earth, water as a living environment and living conditions obtained in lessons in various natural sciences.
2. Improving the skills for independent work with additional literature.
3. Development of the ecological education of the students in the lessons on man and nature
4. Increasing the role of man in solving modern environmental problems.

Activity details

- **Materials** - globe, table "Water consumption in different enterprises", chemical bulletin "All about water", a selection of literature on water, posters on "Save water", pre-made by students.
- **Duration** – 72 min.
- **Number of groups** - several groups of students - (5 grade, ages 11-12)

Instructions

The lesson is held in the form of a game conference, which brings together representatives of expert groups who study the following issues:
1. Sources of water pollution.
2. Operation of a treatment plant.
3. Drinking water quality.
Students take on the role of experts.

The teacher starts the lesson by formulating the topic of the lesson, its objectives and presenting the expert groups. / 7 minutes /

1 expert. Water is the most unique substance in the world. Water is an invaluable natural gift needed for life on planet Earth. For thousands of years, man has admired and enjoyed the water. The globe clearly shows that 3/4 of our planet is water and the rest is earth. Astronauts, who first saw Earth from space, said it did not look like a globe at all, but like a water polo ball. The problems with the depletion of water resources are especially

relevant today. Water must be protected for future generations. Imagine that water will disappear from our planet. The gloomy, gaping "eye sockets" will appear in the trenches of the sea ocean, covered with a thick layer of salt. The riverbeds will dry up, the springs and streams will be silenced. The rocks will crumble as they contain chemically bound water. There will be no bush, no flower, no living thing on the dead Earth.
The teacher has a conversation with the class: "Students, what do you know about the importance of water?" / 7 minutes /

2 expert. Water is the most unique substance on Earth. The paradox is that there is a lot of water, but there is little fresh water. In some areas it rains often and there are heavy floods, and in others it does not rain for months, there is a drought.
The main reserves of fresh water are concentrated in the glaciers of Antarctica and Greenland. Fresh water represents only 2% of its total mass.
It is believed that man uses water mainly in everyday life. In fact, most of the fresh water is consumed in industrial production and agriculture. Water is needed in all sectors of the national economy. The largest consumer of water in our country is agriculture, in second place are industry and energy, in third place are the municipal services of the city.
Water consumption in the production of certain substances and materials./ 10 minutes /

Substances and materials	Quantity	Water consumption
Wheat	**one**	1500
Rice	**one**	7000
Cotton	**one**	10000
Sugar	**one**	3
Aluminum	**one**	1200
Synthetic fibers	**one**	2000-5000
Paper	**one**	250-400
Textile	100 m	25

3 experts. In Bulgaria, one of the places where a very large amount of water is consumed is the pulp mill in the town of Svishtov, which does not release enough purified water into the Danube River. The town of Svishtov is one of the biggest polluters of the Danube. In the area of the city, pollutants from many enterprises enter the river - woodworking, pulp mill, as well as from urban wastewater. The discharged waters contain sulfur compounds, nitrates, phosphates, ammonium salts, heavy metals, phenols, petroleum products and others. These pollutants are not harmless when they enter the water, they cause the death of plankton and mollusks that are involved in water self-purification. Caviar is particularly sensitive to water pollution. High concentrations of pollutants affect the metabolism of warm-blooded animals and humans, leading to the failure of all functional systems of living organisms. What should we do? How to avoid pollution of water bodies? / 7 minutes /

4 experts. In every city and in every large enterprise there is a treatment plant where all wastewater is treated. Wastewater treatment methods are divided into mechanical, biological and chemical. Hundreds of thousands of cubic meters of water pass through the treatment plant every day. First, the water is cleaned mechanically. Large water-

insoluble contaminants, including household waste (paper, plastic bags, etc.), are retained by means of gratings. The separation of smaller particles, insoluble in water, is carried out in three primary clarifications with radial type, each with a diameter of 28-30 m. For biological treatment special structures are used - aeration tanks. They feed on a special biological sediment containing microorganisms - bacteria, protozoa: amoebae, cilia and algae. I l, which contains all these microorganisms is called active. The precipitate is mixed with water saturated with oxygen. The simplest organisms, visible only through a microscope, bring life back to water: they oxidize harmful impurities, destroy everything that cannot be removed from water by mechanical cleaning. Biological cleaning takes about 7 hours. The water then enters the contact tanks, where it is chemically treated. Only then does the water flow into the river.

In the event of a volley discharge of a large amount of toxic substances into the sewage system, the microorganisms in the water may die completely, and the biological treatment plant will not work for several months. To prevent this, special standards for hazardous wastewater have been developed for industrial plants. Their observance is controlled by a chemical laboratory of the treatment facilities. / 10 minutes /

Teacher. But all these structures cannot completely solve the problem of protecting water bodies from pollution. To keep water clean, we need to stop thinking of water basins as waste tanks. In large enterprises, this problem can be solved only by switching to a closed water supply system or closed-loop technology, in which the used and then purified water is taken in the enterprises
and only replenishes its losses from external sources. Nowadays, they not only design but also build plants where wastewater disposal is completely eliminated. This is especially important for the chemical, pulp and paper and metallurgical industries. / 3 minutes /

5 expert. There are special requirements for the quality of drinking water. Therefore, the path to its purification is longer: mechanical purification - biological purification - clarification - disinfection - stabilization - softening - return to the user. Unfortunately, the water in our country does not always meet the requirements. For example, in our water the iron content is much higher than normal. Doctors associate this fact with a high incidence of diseases of the digestive system and coronary heart disease among the people of the country. The question arises, what to do? It is necessary to settle the water for a day or to boil it or to pass it through a household filter. In this case, the soluble iron salts are converted into insoluble compounds. In addition, our water is very hard. And the greater the stiffness, the greater the likelihood of developing urolithiasis and cholelithiasis and even cancer. At home, the water is boiled or passed through a filter. In addition to harm to the body, hard water creates many problems in everyday life - detergents foam

poorly, scale forms in the kettle, central heating systems become clogged. Therefore, it is necessary to add special softeners to the water. / 7 minutes /

Teacher. The problems with water protection and purification are becoming more acute every year. It is possible that in the near future one of the current students will have to take responsibility for solving certain problems that are directly related to the condition of the treatment facilities. So today you have to learn to make the right decisions yourself. To do this, I offer you several tasks:

1. Sea water contains salt, sand, sawdust, gasoline. How to purify this water from all impurities? Suggest a step-by-step method for water purification. / 4 minutes/
2. Calculate the volume of water that has leaked uselessly due to a poorly closed tap per hour and per day if a glass (250 ml) is filled in 1 minute. / 4 minutes /
3. After completing the lab work, your classmate poured the used reagents into the sink, not into a specially prepared container. What would you do:

a) you will also pour your reagents there;
b) explain to him why this should not be done;
c) tell the teacher about his actions. / 4 minutes /

4. What will you do if you see a rusty bucket on the shore:

a) clean the shore by throwing the bucket into the water;
b) you do not pay any attention;
c) take the bucket to the nearest depot. / 4 minutes /

5. Explain the fact that people have been poisoned by edible mussels caught in the sea area, contaminated with petroleum products. / 4 minutes /

Summary and Conclusions: The Environmental Protection Act, adopted in 2002 and amended several times over the years, prohibits the dumping of polluted water in water bodies, deforestation around water bodies, and littering of shores.

In addition, if we take a lot of water from nature, then our reservoirs will become shallow and may disappear completely. Therefore, it is necessary not only to protect water from pollution, but also to use it economically.

1. Water is a priceless natural gift necessary for life on Earth.
2. There is very little fresh water on Earth - about 2% of the total mass.
3. Undertakings must introduce low-waste technologies and closed water use cycles, provide for the reduction of harmful emissions in water bodies, as well as the construction of treatment facilities.
4. Do not discharge untreated wastewater into closed reservoirs.
5. Do not use wastewater for watering plants.
6. Every citizen of the country must be held responsible for violating the Environmental Protection Act. / 5 minutes /

Tips for the facilitator

The Environmental Protection Act, adopted in 2002 and amended several times over the years, prohibits the dumping of polluted water in water bodies, the felling of forests around water bodies, and the dumping of rubbish on shores.
In addition, if we take a lot of water from nature, then our reservoirs will become shallow and may disappear completely. Therefore, it is necessary not only to protect water from pollution, but also to use it economically. Give your suggestions.

Debriefing

Students to create an interactive quiz that summarizes what they have learned.

Follow-up/Inspiration for the future

Information on social media, school website.

References/Further reading

https://www.novatx.com/drinking-water/top-6-causes-water-pollution-reduce-risks/

Annex

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