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INTEGRATION OF NATURAL SCIENCES - AS A MEANS OF REFLECTING THE COMPLETE PICTURE OF THE UNIVERSE

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Abstract
This article describes the unique aspects and effective ways of teaching chemistry based on the integration of natural sciences. The system of teaching natural sciences, the structure of the universe in the minds of students, the formation of holistic ideas about natural phenomena require greater interdisciplinary integration. The organization of the educational process on the basis of interdisciplinary integration requires a systematic analysis, re-systematization of the educational material and the choice of appropriate teaching methods, as well as the organization of a complex creative process in the classroom.

Key words: Integration, cognitive, Venn diagram, systematic analysis.

Introduction

The implementation of interdisciplinary integration enables successful realization of methodological, educational, developmental, instructional, and constructive functions of the lesson. It ensures diversity in classroom activities, homework assignments, and independent work of students.

Materials are selected to establish interdisciplinary connections, specifically identifying chemistry topics that are closely linked with subjects from other disciplines.

Implementing interdisciplinary connections in studying chemistry represents a form of logical revision that deepens and improves acquired knowledge.

Since using interdisciplinary integration ensures that students incorporate knowledge from other subjects into lessons, it's important to identify common, stable, and long-term interdisciplinary concepts while considering curriculum requirements. Examples of such information can include concepts like substance composition, structure, chemical properties, and biological functions. Special attention must be paid to selecting and using interdisciplinary information without disrupting the logical structure of academic subjects and avoiding excessive complexity in their content.

Using fundamental concepts from other subjects while studying specific topics in chemistry is a crucial means of developing students' dialectical-materialist worldview and their understanding of the unity of natural phenomena and their interrelationships.

To prepare materials for an interdisciplinary integrated lesson, first, information from supporting subjects is systematically analyzed. The selected information is arranged according to the topic plan and aligned with the content. Topics requiring an approach based on the integration of natural sciences can be represented through a Venn diagram as follows (Figure 1).

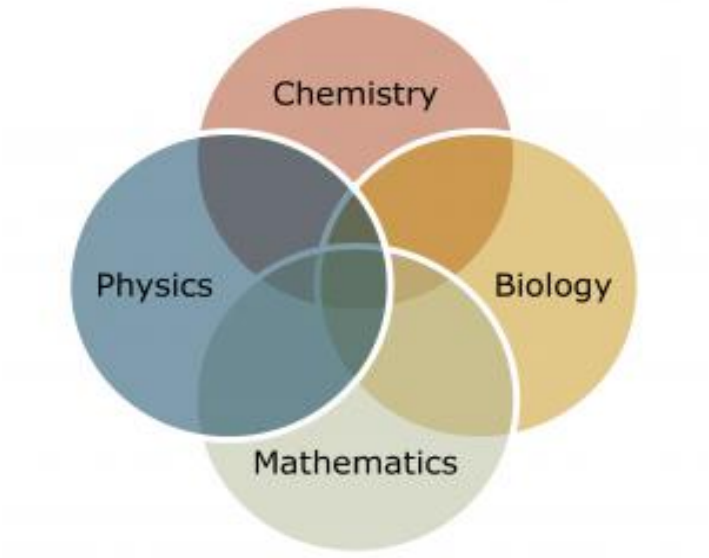
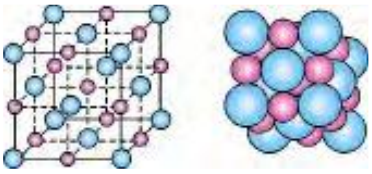


Figure 1. Venn diagram showing the interconnections between natural sciences.

1-Chemistry+Geography: Natural reserves of substances, deposits, manufacturing enterprises.
2-Chemistry+Physics: Substance structure, substance properties, solutions, electrolysis, nuclear reactions, semiconductors, chemical kinetics, catalysis, thermochemistry.
3-Chemistry+Biology: Occurrence and importance of substances in plant and animal organisms, cell composition, chemical structure of tissues (blood, bone, muscle), metabolism in organisms, protein biosynthesis.
4-Biology+Physics: Organ functions, bionics.
5-Physics+Geography: Geodesy, topography, working with maps, globes, and compasses.
6-Biology+Geography: Centers of origin for cultivated plants, zoogeographic regions, adaptive types, physical geography.
7-Chemistry+Biology+Geography: Biotechnology-based manufacturing enterprises, discovery of natural compounds, artificial product manufacturing industry and exports (for example, Japan leads globally in iodine extraction from seaweed).
8-Chemistry+Geography+Physics: Weather, climate changes, factors related to water, air, soil analysis, information about countries and enterprises developing new technology-based (nanotechnology, hydroelectric power stations, nuclear power plants) manufacturing directions.
9-Chemistry+Biology+Physics: Functions of substances in plant and animal organisms, nerve impulses, synapses, photosynthesis, respiration-diffusion and digestion-dissociation processes, energy metabolism in organisms.
10-Biology+Physics+Geography: Cooling mechanisms in organisms, transpiration, sweating, structure and function of sensory organs (vision, hearing, smell).
11-Chemistry+Biology+Physics+Geography: Information about formation and location of natural substance reserves (limestone, marble, coal, oil). Substance cycles in nature, ecological factors, biosphere structure, diseases related to environmental factors such as hypoxia and caisson disease, information about substance discoveries.

Therefore, organizing an interdisciplinary integrative lesson is carried out in 3 stages: 1) systematic analysis 2) reorganization 3) information synthesis. The first two stages depend on teacher activities during lesson preparation, while the third stage is a creative process involving both student and teacher participation during the session.

Table 1. Technological map fragment for developing interdisciplinary integrative study methods for the topic "Chlorine and its compounds"

<table>
<tr><td colspan="2">Topic "Chlorine and its Compounds"</td></tr>
<tr><td colspan="2">Stages of formulating and solving educational problems in the lesson:
1. Activate core knowledge, skills, abilities using interdisciplinary information
2. Create interdisciplinary integrative situations
3. Present educational problems
4. Solve educational problems
5. Prove and apply found solutions</td></tr>
<tr><td>Educational Problems of the Lesson:
Problem Situation Questions</td><td>Related Information Used in Solving Educational Problems</td></tr>
<tr><td>Structure of Chlorine Molecule:
1. We know that relative atomic mass equals the sum of protons and neutrons. Why then is chlorine's relative atomic mass 35.5? How many neutrons does it have? Why is it expressed as a fraction?</td><td>The chlorine molecule consists of 2 atoms. Each atom has 17 protons, 17 electrons, and 18-19 neutrons. Relative atomic mass is calculated as an average based on the natural distribution of isotopes. Protons and neutrons are made up of even smaller particles called quarks.</td></tr>
<tr><td>Natural Occurrence of Chlorine (and other halogens):
2) What causes the freezing point of sea and ocean water to be low?</td><td>Table salt (NaCl) consists of Na - sodium and Cl - chlorine atoms.
When atoms are connected by straight lines, they form a lattice structure.
 
Hot mineral waters containing various minerals (carbonic acid, hydrogen sulfide, iodine, bromine, lithium, barium, etc.) are located at depths of 1500-3000m between Paleozoic and Mesozoic deposits. These waters reach temperatures of +40 to +70°C. Living matter contains higher proportions of hydrogen, carbon, nitrogen, oxygen, sodium, magnesium, silicon, sulfur, chlorine, potassium, and calcium compared to inorganic nature. Brown algae accumulate high amounts of iodine.</td></tr>
<tr><td>Physical Properties of Chlorine:
3) The speed of sound in chlorine atmosphere is lower than in air - how can you explain this?</td><td>Sound speed in chlorine atmosphere is 206 m/s (slower than in air, nitrogen has 333.6 m/s). At room temperature, chlorine is a gas, bromine is liquid, and iodine is solid.</td></tr>
<tr><td>Chemical Properties of Chlorine and its Compounds
4) Silver halides have easy decomposition properties (even under light and other radiation). How can these properties be used practically?</td><td>In 1801, it was observed that silver chloride decomposes faster when exposed to the ultraviolet portion of the spectrum. Based on this, Ritter and other scientists concluded that light consists of three distinct components: infrared, visible, and ultraviolet. Silver halides also decompose under radioactive radiation, forming darkened silver. While most salts are sufficient in food, table salt is lacking, so NaCl is added to food. Table salt is necessary for water retention in tissues.</td></tr>
</table>

Chlorine and Other Halogen Compounds 5) Why is table salt used to address iodine deficiency? What compound is added for iodization, and who first proposed this method? 6) Why is specifically table salt added to human food?	The Chirchiq Electrochemical Plant produces magnesium chloride (used for cotton defoliation). Recent increases in fluorochlorine compounds (freons) in the atmosphere are causing the Earth's protective ozone layer to thin. Food contains sufficient amounts of most salts, but table salt needs to be added as NaCl is necessary for tissue water retention. For iodization, 20-40g of potassium iodate is added per 1kg of salt.
Importance of Chlorine and Other Halogens 7) Which halogens are macroelements and which are microelements? 8) Why do most heartburn tablets contain sodium bicarbonate? Explain this. 9) As we know, Japan has almost no mineral resources. However, Japan leads the world in production and export of one substance - identify this substance and explain why.	Hot mineral waters containing various minerals (carbonic acid, hydrogen sulfide, iodine, bromine, lithium, barium, etc.) are located at depths of 1500-3000m between Paleozoic and Mesozoic deposits. These waters reach temperatures of +40 to +70°C. The Chirchiq Electrochemical Plant produces magnesium chloride (used for cotton defoliation). Academician Y.Kh. Turaqulov developed a method of preventing goiter by adding iodine to table salt. Bromine and iodine are extracted from seaweed. Laminaria contains high amounts of iodine. Macroelements (S, O, H, N, P, C, K, Na, Ca, Mg, Cl, Fe) and microelements (Zn, Cu, I, F, Co, Mo, Sr, Mn, B). Na, K, and Cl facilitate transport of various substances across cell membranes. The thyroid hormone thyroxine contains iodine. Chlorine (Cl) is present in pancreas (HCl). Iodine (I) is present in thyroid hormone (thyroxine). Fluorine (F) is present in tooth enamel. Mineral salt cations K+, Na+, Ca2+, Mg2+ and anions Cl-, HCO3-, HPO42-, H2PO4- create potential differences between internal and external cellular environments, enabling nerve impulse transmission and muscle fiber contraction. In Central Asia, environmental iodine deficiency in food leads to thyroid dysfunction. Living matter contains higher proportions of hydrogen, carbon, nitrogen, oxygen, sodium, magnesium, silicon, sulfur, chlorine, potassium, and calcium compared to inorganic nature. Brown algae accumulate high amounts of iodine.
Environmental Impact of Chlorine and Other Halogen Compounds 10) What do you know about the gas called "fox tail," and why does it have this appearance and name? 11) How is aluminum plant operation related to fluorine gas pollution? 12) What is the composition of freons and why are they particularly dangerous for the ozone layer?	Cities like Olmaliq, Angren, Navoiy, Andijan, Fergana, and Tashkent have air pollution from sulfur, nitrogen oxides, ammonia, hydrogen fluoride, and other gases. The air in Sariosiyo and Uzun districts of Surkhandarya region is contaminated with toxic fluorine gas from the aluminum plant in Tursunzoda, Tajikistan. In recent years, increased emission of fluorochlorine compounds (freons) into the atmosphere has led to the thinning of Earth's protective ozone layer.

Using the distinctive aspects of interdisciplinary connections in teaching natural sciences, particularly chemistry, effectively helps develop students' critical and creative thinking abilities and reflects a holistic scientific picture of the world in their consciousness.

In organizing integrated lessons, systematic analysis of textbooks, generalizing and analyzing information based on Venn diagrams, systematizing collected information in tables, and enriching

lesson content, serves as a systematic database that helps increase students' interests and preparation levels, and develops cognitive skills.

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