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CLASSIFICATION AND METHODOLOGY OF DESIGNING ECOLOGICALLY ORIENTED PROBLEMS IN PHYSICS COURSE SECTIONS

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Abstract
The article discusses the methodology of using, classifying, and constructing problems with ecological content in various sections of the physics course. Methods for forming the ecological culture of students by analyzing environmental problems in the process of studying physical laws are proposed.

Keywords: Physics, ecology, methodology, problem solving, classification, energy saving, environment, integration.

Introduction

In the context of today's global environmental crisis, providing ecological education to the younger generation has become an urgent task. Since physics teaches the fundamental principles of natural phenomena, it serves as a key tool in explaining processes occurring in the environment. Solving ecological problems in physics classes helps students develop not only theoretical knowledge but also a responsible attitude toward nature.

As a science that studies the fundamental laws of nature, physics forms the basis of environmental education. Indeed, any ecological problem (such as the greenhouse effect or radioactive pollution) is rooted in specific physical processes. Therefore, systematically classifying ecological problems across physics course sections and improving their teaching methodology is one of the most pressing pedagogical issues today. This approach helps students understand the importance of physical laws not only in laboratory conditions but also on a global scale—particularly in maintaining the balance of the biosphere and technosphere. Knowledge acquired through problem-solving remains in memory longer and is reflected in everyday behavior, such as energy conservation.

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1. Classification of Ecological Problems by Physics Course Sections

Ecological problems can be divided into the following groups based on their content:

Mechanics Section

This section deals with issues related to the movement of vehicles, noise pollution, and atmospheric pressure.

Topics: Inertia, friction force, kinetic energy

Ecological aspects: Vehicle emissions, soil erosion, impact of noise on living organisms.

Molecular Physics and Thermodynamics

Thermal machines and energy exchange processes are directly related to ecology.

Topics: Heat quantity, efficiency (η), diffusion

Ecological aspects: Greenhouse effect, global warming, air pollution by harmful gases.

Electrodynamics and Optics

Topics: Electrical energy, electromagnetic fields, light interference

Ecological aspects: Harm of electromagnetic radiation, use of solar energy, light pollution.

2. Methodology for Constructing Ecological Problems

When designing a problem, the teacher should follow this sequence:

1. **Situation:** "A factory discharges 1000 m^3 of wastewater per day..."
2. **Physical process:** "The temperature of the water increases from 20°C to 60°C..."
3. **Question:** "How much fuel combustion does this amount of heat correspond to, and how does it affect the river ecosystem?"
4. **Ecological conclusion:** After solving, the student should conclude that "a water filtration and cooling system is necessary."

The following steps are recommended in constructing problems:

Selection of a physical object: For example, a thermal power plant or a car engine

Identification of an ecological issue: CO_2 emissions from fuel combustion or heat loss.

Mathematical modeling: Creating a calculation model using physical formulas.

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Example problem (Thermodynamics):
A car consumes 8 liters of gasoline to travel 100 km. If the heat of combustion of gasoline is $q = 4.6 \times 10^7$ J/kg and the engine efficiency is 25%, how much excess heat is released into the atmosphere? How does this heat affect the ambient temperature?

3. The Role of Ecological Problems in the Educational Process

There are several ways to incorporate ecological problems into lessons:
Short illustrations during lessons: Providing real-life examples when explaining theory.
Independent work: Assigning students tasks to evaluate the ecological condition of their local area from a physical perspective.
Project work: For example, "School energy audit" or "Efficiency of a solar oven".

Physics Section	Ecological Concept	Physical Quantites
Mechanics	Noise level	Frequency, amplitude (dB)
Thermodynamics	Greenhouse effect	Temperature (T), Heat (Q)
Optics	Ozone layer	Wavelength (λ)
Atomic Physics	Radiation	Dose, half-life ($T\frac{1}{2}$)

Practical Recommendations and Methodological Innovations

Digital technologies: Using programs such as PhET Simulations or Algodoo to model ecological processes (e.g., greenhouse effect).
Case study method: Students are given a specific environmental issue (e.g., oil spill in the ocean) and calculate the impact by analyzing surface tension and light transmission properties of the oil film**.**

Conclusion

The systematic use of ecological problems in physics course sections broadens students' worldview. Through this methodology, physics is shown not merely as a collection of formulas but as a tool for protecting nature. Using local environmental problems in problem design further increases educational effectiveness. Strengthening the ecological component in physics education prepares students not only for exams but also for life as responsible individuals committed to a sustainable

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future. The classification system presented in the article can serve as a ready methodological guide for teachers in enriching their lesson plans.

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