INTERNATIONAL MULTIDISCIPLINARY JOURNAL FOR RESEARCH & DEVELOPMENT
SJIF 2019: 5.222 2020: 5.552 2021: 5.637 2022:5.479 2023:6.563 2024: 7,805
eISSN :2394-6334 https://www.ijmrd.in/index.php/imjrd Volume 12, issue 02 (2025)

COMPARATIVE SYSTEMATIC ANALYSIS OF TEACHING SUBJECTS OF MOLECULAR PHYSICS TO BIOLOGY AND CHEMISTRY STUDENTS

M.A. Zahidova-prof.v.b., D.A.Begmatova-dots
National University of Uzbekistan

Annotation: Systematic analysis is an important object of methodical research work and is considered one of the most rapidly developing scientific directions. The need for systematic analysis in physics is caused by the developing level of technology and science, socio-economic changes taking place in society. Ensuring adaptation of subjects to non-specialists in the teaching of subjects, improvement of textbooks and training manuals, reflection of innovations in the field of science in them, coverage of today's and future tasks, independent education, adaptation to specialties in the teaching process, systematic analysis based on the demand of the times to convey general physics to students in a short time. This article presents a comparative systematic analysis of teaching molecular physics topics to biology and chemistry students.
Key words: systematic analysis, molecular physics, chemistry, biology, optimization, physical phenomena.

Enter. Teaching molecular physics to chemistry and biology students is an important part of their professional education, because physical laws and regularities at the molecular level are directly related to chemical and biological processes, reactions, and properties of substances [1]. The use of systematic analysis method is a very convenient approach for students to study these physical processes in depth and comprehensively. Such an approach makes it possible to show not only individual physical phenomena, but also their relationship with chemical and biological processes, which is especially important in interdisciplinary fields such as chemical physics and biophysics.

Analysis of literature on the topic. R. Akoff, O. Lange, R. Merton, M. Mesarovich, T. Parsons, U. Ross, I. Ashby, L. Von Bertalanfi, V. G. Afanasev, V. M. Glushkov, V. P. Kuzmin, Yu. G. Markov, I. B. Novik, L. A. Petrushenko, V. N. Sadovsky, M. I. Setrov, V.S. Tyukhtin, A.I. Uyemov, Ye.G. Yudinlar, F.I. Peregudov, F.P. Tarasenko, V.N. Sagatovsky, A. Poincaré, A.A. Bagdanov, A. Kolmogorov, V.N. Romanov, A.V. Antonov, M.A. Gaydes, I. Prigozhin, G. Kissindjer, Z. Brzezinski, M. Albright, D. Imboden. P.Ye. Wellstead, Giorgio Parisi, V.Arnold, E.Lasloni, Esenfur, Franz, Weber, Martin, Langer, R.E. Wellstead, T.Alimardonov, F.Ravshanov, N.Berdiyev, A.Khudaynazarov, R.Samarov, S.Juraev, A.Radjabov, M.G.Davletshin, E.G‘.G‘iyev, V.M.Karimova, B.R.Kodirov, G‘.B.Shoumarov and others conducted scientific research.

They created a scientific and theoretical basis for applying the theoretical and methodological principles of the foundations of systematic analysis to education, solving complex problems in science, developing systematic projects, applying systematic analysis in physics, implementing technical and scientific requirements, and applying socio-economic changes taking place in society in the educational process.

Research methodology.
Systematic analysis allows any physical process or phenomenon to be considered as part of a larger system consisting of many interrelated elements. This method is aimed at studying complex objects or processes as integrated systems consisting of interconnected components [2].
The main stages of systematic analysis include:
1. Defining the goal: the goal of studying the system is clearly formulated.

2. Identification of components: the main elements affecting the operation of the system are identified.
3. Determining connections: relationships between system elements are analyzed.
4. Study of system dynamics: studies how the system changes over time and what factors influence these changes.
5. Optimization or problem solving: based on the analysis of relationships and dynamics, ways to improve the performance of the system are sought.

The use of systems analysis allows not only to consider each element or component separately, but also to understand how the parts of the system interact to achieve a common goal. The method of systematic analysis allows the teacher not only to structure the material related to the subject, but also to allow the student to master it more deeply, to adapt the training course to a specific specialization. While biology students learn molecular physics by studying biomolecules and the processes involved in living systems, chemists focus on learning the basic physical laws needed to describe chemical processes and reactions. Such an approach not only helps students of various specialties to master the course of molecular physics in a practical and theoretical way, but also ensures that they consciously apply the knowledge they have acquired in their future professional activities.

Molecular physics is a branch of general physics that focuses on studying the properties of matter at the molecular level, viewing molecules as the basic building blocks of matter. Since many chemical processes, biological systems and reactions are based on intermolecular interaction forces and the structure of molecules, this approach to studying physics is a very convenient way for chemistry and biology specialists [3].

Based on the above considerations, let's consider examples of the use of structural analysis in teaching molecular physics to chemists.

1. Defining the goal

The goal of teaching molecular physics to chemistry students is to provide them with the fundamental knowledge of the structure, behavior, and interactions of molecules that are necessary to understand chemical reactions and the properties of substances. At the same time, it is important to teach students to see physical processes in terms of chemical systems.

2. Identification of components

As part of systematic analysis, in molecular physics, it is necessary to identify the main elements that make up the studied system. These may include:

• Molecules and atoms: elements that make up the basic structure of matter.
• Types of interactions between molecules: covalent, ionic, hydrogen bonds, van der Waals forces, polarization, induction, etc.
• Energy characteristics of the system: internal energy, thermal energy, entropy, etc.
• Physical parameters: temperature, pressure, volume, concentration and their effect on molecular movement.

3. Identifying connections

The next step is to study how these components interact with each other:

• Temperature and molecular motion: An increase in temperature increases the kinetic energy of molecules, which changes their motion and interactions.
• Pressure and Volume: Changes in pressure or volume directly affect the state of a gas and molecular forces.
• Energy and intermolecular forces: thermal energy affects the intensity of intermolecular interactions, changes the phase states of matter.
• Phase transitions: An important aspect of molecular physics is how changes in temperature and pressure cause matter to change from one state of matter to another.

4. Study of system dynamics

Molecular physics studies how molecular systems behave in response to external conditions. For example, as the temperature increases, the molecules begin to move faster, which changes the properties of the substance, such as the pressure of a gas or the viscosity of a liquid. To explain this situation, the teacher can use the following examples:

• Phase transitions: consider how a liquid turns into a gas when it boils or, conversely, a gas condenses when it cools. This situation is connected with the change of kinetic energy of molecules and weakening of intermolecular forces.

•Gas Laws: Consider the relationship between pressure, volume, and temperature in terms of the molecular structure of substances using the ideal gas equation of state PV=nRT.

5. **Optimization or problem solving.**

After analyzing all the relationships, you can give students tasks that require a comprehensive approach and take into account several factors at the same time.

For example:

• Problem: How to change the parameters (temperature, pressure) to minimize the energy of the system and increase the efficiency of the chemical reaction?

• Solution: Students examine various molecular interactions and apply their knowledge to optimize a chemical process. It helps to gain a deep understanding of physico-chemical principles.

Analysis and results:

Let's give an example of a problem that requires solving using systematic analysis.

Task: Determine the conditions for sublimation based on the molecular properties of a substance.

1. Purpose of the problem: Determine the temperature and pressure at which a substance passes from a solid to a gaseous state, bypassing the liquid phase (sublimation).

2. Components: molecules of the substance, intermolecular forces, temperature, pressure.

3. Interactions: changes in temperature cause changes in the energy of molecules, which affects intermolecular interactions. An increase in pressure increases the interaction between molecules, which makes it difficult for them to go into a gas state.

4. Dynamics of the system: as the temperature increases, the molecules begin to move faster and the intermolecular forces weaken. When a certain energy level is reached, molecules can enter the gas phase.

5. Problem Solving: Using experimental data on the heat of sublimation and the Clapeyron-Clausius equation, students will be able to calculate the temperature and pressure parameters required for the sublimation of a substance.

Teaching these topics to chemistry students through systematic analysis not only helps them understand the basic principles of molecular physics, but also helps them see the practical application of knowledge of molecular interactions in chemical and physical processes.

Below is a table compiled on the basis of a comparative systematic analysis of the teaching of molecular physics topics for biology and chemistry students, which shows the approach to passing molecular physics topics.

Topic	**For Biologists**	**For Chemists**
Molecular interactions	Hydrogen bonds, hydrophobic effects	Debye, London, Kizim forces, covalent and ionic bonds
Phase transitions	Transitions of lipid membranes, stability of proteins	Description of physical phase changes, phase diagrams

Thermodynamics	Free energy, entropy in cellular processes	Calculation of enthalpy and entropy for chemical reactions
Molecular-kinetic theory	Diffusion and osmosis, the role of the movement of molecules in biological systems	General molecular-kinetic theory for the movement of molecules, movement in ideal and real gases
Energy of molecules	The role of internal energy in biological processes	Chemical stability, calculation of energy for reaction processes
Formation of molecules	Synthesis of biomolecules, polymerization	Formation mechanisms of complex compounds, kinetics of chemical reactions.

Conclusions and suggestions. Thus, the use of systematic analysis in teaching molecular physics to chemistry and biology students helps them to form a holistic and interdisciplinary understanding of physico-chemical and biological processes. This approach allows not only to explain the theoretical basis of the subject, but also to see how various parameters and factors affect systems at the molecular level. This view is especially important for students of chemistry, because chemical processes are always the result of the interaction of molecules in dynamic systems.

References:

1. Кузнецов, И. П., Лебедева, Н. А. *Интеграция знаний по физике и биологии: системный анализ в преподавании.* Вестник высшего образования, 2019, № 5, с. 67–75.
2. Жданов, С. Л. *Системный анализ в физическом образовании.* Москва: Наука, 2019.
3. Симонов, П. В., и Петров, К. В. *Системный подход в преподавании точных наук.* Вестник высшего образования, 2021, № 4, с. 34–42.
4. Abdullayev N.Q., Begmatova D.A. Fizika ta'limida tizimli tahlilni amalga oshirishning metodik asoslari. Monografiya// O'zMU. – T.: 2023. – 130 b.
5. Abdullayev N.Q. Method of system analysis in solving physical problems // Journal of Critical Reviews JCR. Vol 7, 2020. p. 3344-3351 doi:10.31838.07.14.613. (scopus IF 0.67).