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TEACHING MOLECULAR PHYSICS TO 7TH GRADE STUDENTS BASED ON NON-STANDARD TASKS

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ABSTRACT

This article examines the methodological foundations of teaching the molecular physics section to 7th grade students through non-standard tasks. A comparative analysis of standard and non-standard tasks based on Bloom's taxonomy is presented. Practical examples of non-standard tasks on the topics of diffusion, intermolecular forces, and states of matter have been developed. The proposed approach fosters analytical thinking, the ability to connect real-life phenomena with physical laws, and independent inquiry skills in students.

Keywords: non-standard tasks, molecular physics, diffusion, Bloom's taxonomy, intermolecular forces, problem-based learning, analytical thinking, states of matter, structure of matter.

INTRODUCTION

The modern education system requires students not only to acquire ready-made knowledge but also to develop skills in independent thinking, analysis, and solving real-life problems. Physics — particularly the molecular physics section — offers great opportunities to meet this demand, as it explains natural phenomena at the particle level, encouraging students to observe and draw their own conclusions.

7th grade students encounter molecular physics for the first time. Topics such as the structure of matter, diffusion, and intermolecular forces are entirely new and fascinating for them. However, in traditional teaching, these topics are often covered solely through definitions and formula memorization, which diminishes students' interest in the subject.

Non-standard tasks offer an effective solution to this problem. Such tasks move students beyond rote memorization, encouraging them to explain real-life situations through physical laws and to think critically and creatively. This article examines the nature of non-standard tasks in the molecular physics section, their differences from standard tasks, and practical examples.

1. The Nature of Non-Standard Tasks and Their Place in Bloom's Taxonomy

A non-standard task is a type of task that does not have a single correct answer and

requires the student to perform logical analysis, apply a creative approach, and provide a reasoned response. Such tasks correspond to the higher cognitive levels of Bloom's taxonomy — analysis, evaluation, and creation.

The table below shows the key differences between standard and non-standard tasks:

Table 1. Comparative analysis of standard and non-standard tasks

Criterion	Standard task	Non-standard task
Solution method	Ready-made formula or algorithm	Analysis, creativity, various approaches
Type of answer	Exact, single number / word	Open-ended, debatable, reasoned
Cognitive level	Recall, understanding (levels 1–2)	Analysis, evaluation, creation (levels 4–6)
Student's role	Passive executor	Active researcher
Goal	Consolidating skills	Developing critical thinking
Assessment	Easy, objective	Process and result are both assessed
Motivation	Compulsory exercise	Through curiosity and wonder

2. Non-Standard Tasks in Molecular Physics: Examples and Analysis

Below we examine standard and non-standard tasks on the topics of "Structure of Matter," "Diffusion," and "Intermolecular Forces." Non-standard tasks for 7th grade students are designed based on real-life situations, encouraging students to connect physical phenomena with their own experience.

Table 2. Examples of standard and non-standard tasks (7th grade, Molecular Physics)

No.	Standard task	Non-standard task
1	Why do substances exist in gaseous, liquid, and solid states? How are molecules arranged in each state?	Why does a sugar cube dissolve in tea even if you do not stir it? Would it dissolve faster or slower in cold

	✓ *Answer: In gases — molecules move freely and are far apart; in liquids — they are close but can slide; in solids — they are ordered and fixed.*	water? Explain using diffusion and molecular motion. 💡 *In hot water, molecules move faster → diffusion is faster → the sugar dissolves more quickly.*
2	Copper powder was placed on glass, a weight was put on top, and after several days copper molecules had transferred into the glass. What phenomenon is this? ✓ *Answer: This is diffusion — the spontaneous spreading of molecules.*	If two plastic bottles are pressed firmly together, will they fuse? Why not? What conditions would be needed for them to fuse? 💡 *Intermolecular attraction only acts at distances of ~10^{-10} m. The plastic surface is microscopically uneven — so the molecules cannot get close enough to bond.*
3	Why is it impossible to break an iron nail, yet water droplets merge together? What force explains this? ✓ *Answer: In iron, repulsion and attraction forces are balanced, resisting breaking. Water droplets merge due to attractive forces.*	Ice cream melts in your mouth and also in your hand. Does it melt at the same speed in both cases? What is the difference? Explain from the perspective of diffusion and temperature. 💡 *Mouth temperature ≈37°C → faster. Hand temperature ≈32°C → slightly slower. Diffusion depends on temperature.*
4	If you add hot tea to cold tea — what is the result? Explain using molecular motion. ✓ *Answer: The speeds of molecules equalize — this is heat exchange.*	If you are standing in water and someone drops paint next to you — would you sense the paint? Is it different from sensing it through air? Think about the speed of diffusion in different media. 💡 *Diffusion in water is slower than in air — molecules are more densely packed. However, diffusion occurs*

		in both media.
5	What happens when a copper wire is stretched? Why does it require more force? ✓ *Answer: The distance between molecules increases — the attractive force decreases, and force is needed to pull them further apart.*	In a newly built house, the smell of paint lingers for a long time. It disappears faster when you open a window, and slower in winter. Why? What should you do to ventilate the room quickly? 💡 *Diffusion is faster in warm air. In winter, cold air slows diffusion — so the smell stays longer. Opening a window adds convection, which accelerates diffusion.*

3. Methods for Implementing Non-Standard Tasks in the Teaching Process

The following methodological approaches are recommended for effectively using non-standard tasks in 7th grade lessons:

1. Starting the lesson with a problematic question: a real-life question is posed at the very beginning of the lesson to engage students in thinking from the outset.
2. Pair and group discussion: solving a non-standard task together ensures communication and exchange of ideas among students.
3. Observation and experiment: non-standard tasks are introduced visually through simple experiments (for example, dissolving sugar in cold and hot water).
4. Creative assignments: students are given tasks such as "give an example of diffusion from your own life" or "show intermolecular forces from everyday life."
5. Assessment process: in non-standard tasks, both the answer process and the reasoning path are assessed — this teaches students not to fear questions.

CONCLUSION

The analysis and examples presented in this article demonstrate that using non-standard tasks in the molecular physics section for 7th grade students increases their interest in the subject and raises their cognitive activity to a higher level. The comparative table based on Bloom's taxonomy proved that standard tasks cover only the lower cognitive levels, while non-standard tasks encompass the levels of analysis, evaluation, and

creation.

Non-standard tasks on diffusion, intermolecular forces, and states of matter allow students to explain real-life situations — such as the melting of ice cream, the dispersal of paint smell, and the failure of plastic bottles to fuse — through physical laws. This ensures deep and long-lasting understanding, as opposed to mechanical memorization. Thus, the systematic use of non-standard tasks in 7th grade physics lessons meets the requirements of modern educational standards and shapes students into independent, creative, and analytical thinkers.

REFERENCES

1. Khujanov E.B. Molecular Physics and Thermodynamics. Textbook. – Tashkent: "ZUXRO BARAKA BIZNES", 2025. – 328 p.
2. Khujanov E.B. Methodology of Teaching Specialized Subjects. Textbook. – Tashkent: "ZUXRO BARAKA BIZNES", 2025. – 331 p.
3. Bloom B.S. Taxonomy of Educational Objectives. – New York: Longman, 1956.
4. O'lmasova M.Kh. Physics (Book 3). Textbook for academic lyceums and vocational colleges. – Tashkent: "Cho'lpon", 2010.
5. www.bilimdon.uz – Official website of the Ministry of Higher and Secondary Specialized Education of the Republic of Uzbekistan.