TAJIK NATIONAL UNIVERSITY
Department of Nuclear Physics

SYLLABUS (PROGRAM)
MECHANICS
FOR FIRST YEAR STUDENTS
SPECIALTY 31040103-PHYSICS, FACULTY OF PHYSICS

Educational subject: molecular physics

Specialization: physics

Number of hours of training – 9.5 credits (228 hours)

2 lecture credits, 2 practical credits, 2 physical practical credits, 3.5 credits

1 course

First December

Dushanbe – 2023

SYLLABUS

(Extensive work program) compiled by senior lecturer of the Department of Nuclear Physics Latipova Sarvinoz. in the subject of mechanics for 1st year full-time physics students - 1-31 04 01 03.

<table>
<tr><th>Full name</th><th>course</th><th>1</th><th rowspan="3">Timetable of classes</th></tr>
<tr><td rowspan="2">senior lecturer
Latipova S.</td><td>semester</td><td>1</td></tr>
<tr><td>Number of credits</td><td>6</td></tr>
<tr><td rowspan="5">Teacher's address:
Department of Nuclear Physics, educational building No. 16 TNU</td><td>Lectures</td><td>48 s</td><td></td></tr>
<tr><td>SSWT</td><td>48 s</td><td></td></tr>
<tr><td>SSW</td><td>48 s</td><td></td></tr>
<tr><td>CONSULTATION</td><td>-</td><td></td></tr>
<tr><td>Summary control form</td><td>exam</td><td></td></tr>
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The syllabus (extensive work program) is compiled on the basis of the educational program of general physics courses, approved by the Methodological Council of the DMT on December 27, 2022 (Prot. No. 4/6), and corresponds to the State educational standard of higher education. Professional education of the Republic of Tajikistan, direction 3301- “Physical Sciences”, specialty 1-31040103- “Physics”, approved by order of the Ministry of Education and Science of the Republic of Tajikistan dated September 16, 2022, prepared for physics students.

The syllabus (extensive work program) was compiled by senior lecturer of Department of Nuclear Physics Latipova S.

The syllabus (extensive work program) was reviewed and approved at a meeting of the Department of Nuclear Physics on _____

Head of the department Makhsudov B.I.

The Scientific and Methodological Council of the Faculty of Physics December 1, 2023, protocol No.____ recommends for publication.

Chairman of the scientific and methodological council Istamov F.Kh.

SECTION I: ORGANIZATIONAL AND METHODOLOGICAL PART
II. DETERMINING THE PLACE OF A SUBJECT IN THE EDUCATIONAL PROCESS

The subject of molecular physics has a mandatory status in the curriculum for the physics specialty of the Faculty of Physics and plays a key role in the development of students as highly qualified specialists. In the field of mechanics, students are introduced to methods for studying the motion of macroscopic objects, which is the basis for the study of theoretical mechanics.

III. PURPOSE OF STUDYING THE SUBJECT

The purpose of studying the subject "General Physics" is to demonstrate the theory of physics as a result of observations and experiments. Physical theory expresses the relationship between physical phenomena and physical quantities from a mathematical point of view. A general physics course should introduce students to the basic techniques of observation, measurement, and experiment through lectures and practical exercises. This course should teach students to apply theoretical knowledge to solve practical problems. General physics is the basis of fundamental natural sciences and plays an important role in the development and promotion of modern engineering and technology. The second part of general physics is molecular physics.

IV. OBJECTIVES OF TEACHING THE SUBJECT

In terms of mechanics, the teacher must, through lectures, practical and experimental classes, familiarize students with:
with the laws of mechanics and their mathematical expressions; -
teach students to solve practical problems based on theoretical knowledge; -
familiarize with physical phenomena, methods of their observation and research, methods of operation of physical instruments, measurement of physical quantities with their help, methods of processing test results.

IV. OBJECTIVES OF TEACHING THE SUBJECT

Physics is the basis of fundamental natural sciences and plays an important role in the development of engineering and technology. The first part of general physics is mechanics. In this section, the teacher must introduce students to the basics of mechanics through lectures and practical exercises:

- to create among students a sufficiently broad theoretical training in the field of physics, allowing future specialists to navigate the flow of scientific and technical information and providing them with the opportunity to use knowledge in physics in technology;
- provide certain methodological training that allows one to master the process of cognition and the structure of scientific knowledge, use various physical concepts, determine the limits of applicability of principles, laws and theories;
- systematize and generalize knowledge from the point of view of general ideas corresponding to the modern level of development of science;
- familiarize yourself with modern scientific equipment, develop skills in conduct-

ing physical experiments;
- master the methodology for solving specific problems from individual branches of physics;
- to develop the ability to assess the degree of reliability of the results obtained in experimental or theoretical studies.

V. FINAL LEARNING RESULTS SUBJECT

Along with mastering the subject of study, the student must:

- master the content of basic concepts, equations and molecular physics and mathematical relationships;
- correctly express the laws of physics, quantify and solve physical problems;
- using stylistic indicators and physical tools, conduct experiments in the laboratory, calculate and analyze the results of experiments;
- learn to build mathematical models of physical phenomena and learn to use them;
- know the basic concepts, laws and physical models of molecular physics, mechanics, thermodynamics, statistical physics and be able to use them to solve scientific and practical problems;
- know and be able to apply methods for measuring the physical characteristics of substances and fields;
- know and have the skills to use the principles of experimental and theoretical study of physical phenomena and processes;
- be able to implement an integrated systematic approach to solving problems based on comparative analysis;
- understand the need to study the latest achievements in the field of physics and be able to assess the possibilities and prospects of their use to create technical devices;
- have skills in organizing research;
- know and be able to use methods for numerical estimation of the order of magnitude characteristic of various applied branches of physics;
- be able to work in a team.
- use textbooks independently.
- use educational books independently.

Based on mastering the subject, the student must:

- master basic concepts, equations and molecular physics proportions;
- be able to correctly express the laws of physics, quantify and solve physical problems;
- be able to conduct experiments in the laboratory, using stylistic indicators and physical instruments, as well as calculate, analyze and draw conclusions from the results of experiments;
- be able to build mathematical models of physical phenomena;
- be able to use textbooks independently.

Prerequisites (connection of the subject with the subjects mastered by the student): subjects studied by the student during his studies in secondary school: chemistry, physics, mathematics, fundamentals of computer science, mathematical analysis.

Postrequisites: (connection of the subject with the subjects that the student studies, mastering the subject of general physics, and then mastering it during his studies): specialties, theoretical mechanics

Sh. Standard requirements for the level of subject proficiency.

Know

- content of basic concepts, equations and proportions of molecular physics;
- correctly express the laws of physics, quantitatively explain and solve physical problems;
- learn the basic laws of dynamics, methods of kinematic and dynamic description of mechanical systems in molecular physics;
- using stylistic indicators and physical means, conduct an experiment in the laboratory, calculate and analyze the results of the experiment;
- learn to build mathematical models of physical phenomena and learn to use them;
- to master the operating principles and structure of modern experimental research on the study of mechanical phenomena.
- use educational books independently.

Be able to

- master the content of basic concepts, equations and proportions of mechanics;
- be able to correctly express the laws of physics, quantitatively explain and solve physical problems;
- use stylistic indicators and physical tools to conduct experiments in the laboratory and calculate, analyze and draw conclusions from the results of the experiment;
- be able to create mathematical models of physical phenomena;
- be able to independently use educational books.
- be able to quantitatively explain and evaluate scientific concepts;
- understand pressing modern technical problems and ways to solve them.

To get skills

- calculation and description skills in the field of dynamic and kinematic methods;
- ability to work with measuring instruments;
- ability to work with educational and scientific literature;
- ability to solve problems related to the mechanical movement of material bodies;
- ability to manage modern physical equipment and instruments;
- skills of modern educational and information technologies;
- skills in theoretical and practical research

Forms - lectures, practical classes, preparing reports for conferences, independent ongoing work, performing conditional tasks on each topic, performing independent work, writing notes.

Methods - solving tasks, preparing reports, doing independent work, discussions, work games, passing exams, tests, etc.

When conducting practical classes, it is recommended to use the available set of electronic equipment: an electronic board. Basic explanatory materials (posters, graphics) should be prepared in advance for appropriate use (displays, CDs). When conducting a survey during practical classes, it is advisable to use a set of tests.

Schedule - subject of the academic subject " Molecular physics"

Total number of credits 6 (144 hours)

Auditory lecture-theoretical classes - 2 (48 hours)

Practical classroom training - 2 (48 hours)

Independent work of students – 2 (48 hours)

2.2. General schedule of the subject matter being read

Subject content

No.	a week	Title of sections and topics	Auditory lessons		SRS	Total	Literature
			Lexia	SRSP			
1.	I	Topic 1. Methods of studying molecular systems (statistical and thermodynamic methods).	3	3	3	9	Literature: 1(pp.9-18) Literature: 2 (pp. 11-18)
2.	II	Topic 2. The study of molecular processes by statistical method and the laws of distribution of random variables.	3	3	3	9	Literature: 1(pp.55-60) Literature: 2 (pp. 18-30)
3.	III	Topic 3. Elements of the statistical theory of an ideal gas.	3	3	3	9	Literature: 1 (pp. 18-25) Literature: 2 (pp. 33-35)
4.	IV	Topic 4. Kinematic parameters of the motion of molecules.	3	3	3	9	Literature: 1 (pp. 25-35) Literature: 2 (pp. 87-95)
5.	V	Topic 5. Fundamentals of the molecular kinetic theory of gases.	3	3	3	9	Literature: 1 (pp. 35-39) Literature: 2 (pp. 33-35)
6.	VI	Topic 6. Topic 6. Distribution laws in molecular physics.	3	3	3	9	Literature: 1 (pp. 48-81) Literature: 2 (pp. 60-87)
7.	VII	Topic 7. The first law of thermodynamics.	3	3	3	9	Literature: 1 (pp. 95-102) Literature: 2 (pp. 119-125)
8.	VIII	Topic 8. Classical theory of heat capacity.	3	3	3	9	Literature: 1 (pp. 103-117) Literature: 2 (pp. 132-140)

9.	IX	Topic 9. Periodic processes in gases.	3	3	3	9	Literature: 1 (pp. 241-254) Literature: 2 (pp. 152-165)
10.	X	Topic 10. The second and third laws of thermodynam-ics.	3	3	3	9	Literature: 1 (pp. 255-271) Literature: 2 (pp. 171-185)
11.	XI	Topic 11. Thermodynamic potentials.	3	3	3	9	Literature: 1 (pp. 276-280) Literature: 2 (pp. 186-195)
12.	XII	Topic 12. Real gases.	3	3	3	9	Literature: 1 (pp. 208-238) Literature: 2 (pp. 172-175)
13.	XIII	Topic 13. Liquefaction of gases.	3	3	3	9	Literature: 1 (pp. 369-378) Literature: 2 (pp. 253-260)
14.	XIV	Topic 14. Transference phenomena.	3	3	3	9	Literature: 1 (pp. 143-179) Literature: 2 (pp. 256-288)
15.	XV	Topic 15. Molecular prop-erties of liquids.	3	3	3	9	Literature: 1 (pp. 307-360) Literature: 2 (pp. 278-292)
16.	XV I	Topic 16. Solids.	3	3	3	9	Literature: 1 (pp. 399-470) Literature: 2 (pp. 301-334)
Total sum:			48	48	48	144	

2.3. Contents of sections and topics readable subject

Topic 1. Methods of studying molecular systems (statistical and thermodynamic methods). Methods of investigation of a system of a large number of particles. Aggregate states of matter.

Topic 2. The study of molecular processes by statistical methods and the laws of distribution of random variables. Basic concepts of probability theory. Gaussian distribution ..... Distribution.

Topic 3. Elements of the statistical theory of ideal gases. Macro-sconic and microscopic state of the system. The ideal gas model. The probability of macrostates Fluctuation .

Topic 4. Kinematic parameters of the motion of molecules. The number of stresses and the length of the free space of the molecules. Pressure measurement of pressure. Levelling of the ideal gas state. Experimental laws of the ideal gas.

Topic 5. Fundamentals of the molecular kinetic theory of gases. Tempera tour. The thermometer body and the thermometer value. Thermometers. Atmo-sphere

of planets and barometric formula. The distribution of energy by degrees of freedom. Brownian motion.

Topic 6. Distribution laws in molecular physics. Boltzmann distribution. Maxwell's distribution. Determination of velocities in the Maxwell distribution. Maxwell distribution for relative velocities. Experimental determination of the Maxwell distribution.

Topic 7. The first law of thermodynamics. Internal energy. Quantity of heat. Work in thermodynamics. The first law of thermodynamics. Application of the first law of thermodynamics. Adiabatic process. The polytropic process.

Topic 8. Classical theory of heat capacity. Heat capacity. Heat is the capacity of an ideal gas and its experimental measurement. The relationship between the heat capacities. The heat capacity of solids. The law of Dulong-Petit.

Topic 9. Periodic processes in gases. Equilibrium, unequal, reversible and irreversible processes. The Carnot cycle.

Topic 10. The second and third laws of thermodynamics. Absolute thermodynamic temperature scale. The second law of thermodynamics. Calculation of entropy changes in irreversible processes. The role of entropy in the performance of work.

Topic 11. Thermodynamic potentials. Thermodynamic potentials and the condition of thermodynamic equilibrium. The basic condition of thermodynamic equilibrium.

Topic 12. Real gases. Interaction forces in macroscopic bodies. Transition from a gaseous state to a liquid state. Experimental isothermal. Critical point. The Cla-Peyron-Clausius equation. The Van der Waals equation.

Topic 13. Liquefaction of gases. The internal energy of real gases. The Joule-Thomson effect. Inversion temperature. Liquefaction of gases. Methods of obtaining low temperatures.

Topic 14. Transference phenomena. Transfer phenomena in gases. Physical phenomena in rarefied gases. Transfer phenomena in solids. Phenomena in liquids.

Topic 15. Molecular properties of liquids. Surface tension. Pressure under the meniscus fluid. Wetting. Capillarity. Liquid crystals.

Topic 16. Solids. Amorphous and crystalline state of solids. Classification of crystals. The heat capacity of crystals. Phase transition.

2.3. Contents of student's independent work.

Independent work of a student is the student's activity in independently mastering the curriculum of a subject on certain topics and tasks, which is provided by the educational institution (department) with educational and methodological literature and manuals. Independent work of a student in the conditions of the credit education system is carried out in two types:

1. Independent student work under the guidance of a teacher (SISP)
2. Student independent work (SWS)

Contents of the SRS

Practical exercises are one of the forms of student educational activity that provides a logical connection with theory and prepares students as full-fledged specialists. In practical classes, students master the methods and rules for applying the acquired theoretical knowledge in general, and in solving various problems, in particular. The purpose of conducting SRS is to develop students' awareness of independent creative thinking. On the basis of this, knowledge obtained theoretically is consolidated and expanded, which should contribute to the formation of professional competence in students. Independent work of the student under the guidance of a teacher - in the form of test assignments, essays, homework essays, presentations of collected materials, defense of coursework (projects), practice reports, etc. assessed by the teacher.

Subject	a week	Contents of practical classes (SRSP)
Topic 1. Methods of studying molecular systems (statistical and thermodynamic methods).	I	Aggregate states of matter. Their main characteristics. Problem solving. References: 4 (pp. 58-59).
Topic 2. The study of molecular processes by statistical method and the laws of distribution of random variables.	II	Elements of combinatorics. Theorems of addition and multiplication of probabilities, conditional probabilities. Problem solving. Literature: 4 (pp. 60-61).
Topic 3. Elements of the statistical theory of an ideal gas.	III	Discrete random variables, the law of discrete random distribution. Mathematical expectation and variance. Problem solving. Literature: 4 (pp. 62-63).
Topic 4. Kinematic parameters of the motion of molecules.	IV	The free path length of the molecules. Pressure and its units. Pressure measurement. Problem solving. Literature: 4 (pp. 64-65).
Topic 5. Fundamentals of the molecular kinetic theory of gases.	V	Proof of the molecular kinetic theory of an ideal gas. Problem solving. Literature: 4 (pp. 66-67).
Topic 6. Topic 6. Distribution laws in molecular physics.	VI	Experimental verification of the Maxwell distribution. Problem solving. Literature: 6 (pp. 68-69).
Topic 7. The first law of thermodynamics.	VII	Polytropic process. Problem solving. Literature: 4 (pp. 70-71).
Topic 8. Classical theory of heat capacity.	VIII	Experimental methods for determining temperature. Problem solving. Literature: 4 (pp. 72-73).
Topic 9. Periodic processes in gases.	IX	The device and the principle of operation of the heat engine. Literature: 6 (p. 74).
Topic 10. The second and	X	The statistical meaning of entropy. Problem solv-

third laws of thermodynamics.		ing. Literature: 4 (p. 75).
Topic 11. Thermodynamic potentials.	XI	A method of interpreting thermodynamic potentials. Calculation of the stability condition of the system. Problem solving. Literature: 4 (pp. 76-77).
Topic 12. Real gases.	XII	Comparison of experimental isotherms with Van der Waals isotherms. Problem solving. Literature: 4 (p. 79).
Topic 13. Liquefaction of gases.	XIII	The integral Joule-Thomson effect. Literature: 4 (pp. 80-81).
Topic 14. Transference phenomena.	XIV	A method of interpreting the physical meaning of diffusion coefficients, viscosity and thermal conductivity. Literature: 4 (pp. 68-69).
Topic 15. Molecular properties of liquids.	XV	Physical properties of water. Liquid crystals. Problem solving. Literature: 4 (pp. 83-90).
Topic 16. Solids.	XVI	Mechanical properties of solids. Problem solving. Literature: 4 (pp. 101-105).
Total		**16**

2.5. Brief description of tasks for student independent work (SWS).

Student independent work (SWS) is an active, purposeful way of acquiring knowledge, as well as a way to develop the student's creative knowledge and skills without the participation of a teacher. All types of student independent work are mandatory and controlled. SRS ensures that the student is prepared for current classes. The results of the SRS implementation affect the active participation of students in classroom, lecture-theoretical and practical classes. The grades received by students for SRS are the basis for the final grades of the subject. Recording of results and grades for SRS is carried out continuously, over certain periods and in the presence of all students of the academic group. The obtained CDS results are taken into account at the final certification in this subject.

Methods for performing SRS based on the curriculum in the subject "Mechanics" and the curriculum of this specialty are established as follows:

Topic name classes	**Exercise**	**Deadline**	**Scope and procedure for completing the task**

Topic 1. Methods of studying molecular systems (statistical and thermodynamic methods).	Homework – Information about regular, irregular and constant linear motion.	a week 1	Submit a written report (4-5 pages) and answer questions on the topic
Topic 2. The study of molecular processes by statistical method and the laws of distribution of random variables.	Homework - analysis of thoughts associated with the jumping movement. Analysis of the relationship between linear and rotational motion.	a week 2	Submit - in writing and in the form of graphs
Topic 3. Elements of the statistical theory of an ideal gas.	Homework - examples of applying Newton's second law.	a week 3	Submit in writing. Homework presentation.
Topic 4. Kinematic parameters of the motion of molecules.	Homework – qualitative and quantitative analysis of work, energy and abilities.	a week 4	Submit in writing. Presentation of homework assignment.
Topic 5. Fundamentals of the molecular kinetic theory of gases.	Homework - examples of applying the law of conservation of energy, momentum and angular momentum.	a week 5	Submit in writing
Topic 6. Distribution laws in molecular physics.	Homework – Proof of the formula for relativistic motion	a week 6	Submit in writing
Topic 7. The first law of thermodynamics.	Homework - a deep understanding of the motion of planets around the Sun and the flight of artificial Earth satellites.	a week 7	Submit - in writing, presentation
Topic 8. Classical theory of heat capacity.	Homework – quantitative analysis of shock.	a week 8	Submit - in writing
Topic 9. Periodic processes in gases.	Homework – qualitative and quantitative analysis of forces in a rotating system.	a week 9	Submit in writing presentation
Topic 10. The second and third laws of thermodynamics.	Homework - examples of using the motion of bodies with changing mass.	a week 10	Submit - in writing, presentation
Topic 11. Thermodynamic potentials.	Homework – application of the Huygens-Steiner theorem for rigid bodies.	a week eleven	Submit - in writing, presentation

Topic 12. Real gases.	Homework – qualitative and quantitative analysis of the deformation of solids.	a week 12	Submit - in writing, presentation
Topic 13. Liquefaction of gases.	Homework - application of Bernoulli's equation.	a week 13	Submit - in writing, presentation
Topic 14. Transference phenomena.	Homework – qualitative and quantitative analysis of numbers.	a week 14	Submit - in writing
Topic 15. Molecular properties of liquids.	Homework – analysis of the properties of mechanical waves.	a week 15	Submit - in writing
Topic 16. Solids.	Homework – analysis of the properties of sound waves.	a week 16	Submit - in writing, presentation

SECTION III: STRATEGY AND ASSESSMENT PROCESS

The grade is given in accordance with the current Regulations on the credit education system. On a weekly basis, ongoing monitoring is carried out over students' participation in lectures and practical classes, activity in the SRSP, completion of written homework and assignments for the SRSP. At the end of the semester, a comprehensive examination is conducted in various forms (test, oral, written, etc.).

At the end of the semester, the student will receive an overall final grade, which is an indicator of the results of his efforts during the semester. The summary grade is assigned based on the evaluation table determined by the Academic Council of the university.

Student learning activity in each round (every week: 2.5 + 6 + 4 = 12.5 points).

Including: 4 points - for activity during lectures;

6 points - for completed work related to the SRSP (seminars, practicals, etc.);

2.5 points - for independent work (SRS).

Determination of a student's rating in a summary assessment or exam in an academic subject is also carried out on the basis of the requirements of the ECTS scoring system.

Summary certification and examination in the subject of education are accepted and conducted in test or oral form. The volume of test tasks for a comprehensive certification or exam in an academic subject is 25 questions. Less than this is allowed in academic subjects of the exact sciences.

For each correct answer, 4 points are awarded. If the test has less than 25 questions, the fixed score should be 100.

The points received by the student during the final certification or examination in the academic subject are taken into account as the sum of points for the test. Rating points received by a student at a comprehensive assessment or exam in an academic subject are added to the points scored during the semester.

The grade assigned to a subject is the sum of the marks obtained during the week and the result of the final examination. Points are awarded as follows:

No.	TYPE OF CONTROL	WEEKS AND MINIMUM NUMBER OF POINTS																IE	∑ points
		1	2	3	4	5	6	7	8	9	10	ele	12	13	14	15	16		
1	For activity at lectures	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4		**64**
2	For work performed related to the SRSP (seminars, practicals, etc.)	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		**96**
3	For work performed on SRS	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		**40**
4	**During the week**	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5		**200**
5	**Together**																	**100**	**300**

The overall score for the subject is calculated using the following formula:

$$Ич = \left[\frac{(ИФ_1 + ИФ_2)}{2}\right] \cdot 0{,}5 + Ич \cdot 0{,}5$$

Letter and numeric expression of student grade

literal expression assessments	Numeric evaluation expression	Points for right answers	Traditional expression of grades
A	*4.0*	*95 ≤ A ≤ 100*	Great
A -	*3.67*	*90 ≤ A < 95*	
B +	*3.33*	*85 ≤ V + < 90*	Fine
IN	*3.0*	*80 ≤ V < 85*	
IN -	*2.67*	*75 ≤ V - < 80*	
C +	*2.33*	*70 ≤ C + < 75*	Satisfactorily
WITH	*2.0*	*65 ≤ C < 70*	
WITH -	*1.67*	*60 ≤ C - < 65*	
D+	*1.33*	*55 ≤ D + < 60*	
D	*1.0*	*50 ≤ D < 55*	
F x	*0*	*45 ≤ F x < 50*	Unsatisfactory
F	*0*	*0 ≤ F < 45*	

Note: Fx- is an unsatisfactory grade, giving the student the right to take an exam in this subject in a trimester (additional session) without paying a fee.

Recommended clothing and student participation in all classes (lectures, seminars, laboratories, etc.) is required. Coming to classes in itself does not mean an increase in grades, that is, the student's active participation in classes is necessary. In case of absenteeism or failure to complete assignments set by the teacher on time, the student is fined certain points.

Activity in auditing and SRSP classes is mandatory and is one of the components of the student's overall grade. A mandatory requirement of the subject is preparation for each lesson, because... the result of the student's practical auditory training is the points obtained during the current training. As a result of mastering a subject in classrooms, participation and activity - 64 points, independent work of the student under the guidance of a teacher (seminar, practical, etc.) - 96 points and for self-help work 40 possible points for each academic period.

Written homework – complete independent work and write an independent work (IWP) on a given topic. Completing essays is mandatory for all students. Criteria for evaluating written work: completeness of content, volume, logic of presentation, presence of analysis and conclusions, delivery on time.

Step-by-step control includes all lecture topics, homework and reading materials that were reviewed during training, and is implemented in the form of tests and debates related to the topics studied.

An intermediate exam is a form of control that is conducted twice during each semester in order to determine the level of students' mastery of the educational subject program. Midterm exams are conducted by teachers.

The final exam is conducted orally or in writing and includes different types of tasks: open-ended questions, solving examples and problems. Criteria for assigning exam grades: completeness and correctness of answers, logic and manner of presentation.

SECTION IV: PROVIDING THE SUBJECT WITH EDUCATIONAL AND METHODOLOGICAL Aids

4.1. List of recommended literature

1. Kikoin I.K., Kikoin A.K. Molecular physics. M. Nauka. 1976, 559 p.
2. Matveev A.N. Molecular physics: Textbook for university students - M.: "Higher School", 1981.-400 p.
3. Telesnin R.V. Molecular physics. Study guide for universities. M.Higher School. 1973, 360 p. Nizamov Z. Physics of the molecule. Quito-bi darce baroi donisheni maktaboi oli. Dushanbe, PROM EXPO, 2017. 600 p.
4. Volkenstein V.S. Collection of problems on the general course of physics. M. "Science" Ed.9th, 1979.-351 p.
5. Trofimova T.I. Course of physics. M.: Higher School, 2010.-478 p.

4.2. List of educational and methodological materials prepared by teachers of the department:

6. Boboev T., Sadullosoda., D.M. General Physics, Table 1, Dushanbe 2019, DMT printing house, 320 p.
7. Saydulloeva M. Mechanics, molecular physics and thermodynamics - Dushanbe: obrazovanie, 1984.- 324 p.
8. Saadulloev H., Kholov M. Khadzhanov I. Mechanics, moleku-lari physics and fundamentals of thermodynamics - Dushanbe: 2000.- 174 P.
9. Nizamov Z. Collection of test tasks from "molecular physics" -Dushanbe: TSUP Typography, 2011.-55 p.