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Federal State Budget Educational Institution
of Higher Education
Pacific State Medical University
of the Ministry of Health of the Russian Federation

APPROVED BY

Director of the Institute of Fundamentals and
Information Technologies in Medicine
_____ / Bagryantsev V.N./
"4th" of April 2025

SUBJECT GUIDE FOR TEACHERS AND STUDENTS FOR

Б1.О.07 Chemistry

(Name of discipline)

Specialty	**31.05.01 General Medicine for international students (in English)** (code, name)
Degree	Specialist's degree
Profile	02 "Healthcare" (in the field of providing primary health care to the population in medical organizations: polyclinics, outpatient clinics, inpatient/outpatient facilities of the municipal health care system)
Mode of study	**Full-time**
Period of mastering the BEP	**6 years** (nominal length of study)
Institute	of Fundamentals and Information Technologies in Medicine

Vladivostok, 2025

Subject guide for teachers and students for **Б1.О.07 Chemistry** is based on:

1) Federal State Educational Standard of Higher Education for the specialty approved by the Order No. 988 of Ministry of Science and Higher Education of the Russian Federation
dated August 12, 2020.

2) Curriculum for the specialty 31.05.01 General Medicine for international students (in English), profile 02 "Healthcare" (in the field of providing primary health care to the population in medical organizations: polyclinics, outpatient clinics, inpatient/outpatient facilities of the municipal health care system),
approved by the Academic Council of FSBEI HE PSMU of the Ministry of Health of Russia Report No. 8/24-25 dated March 31, 2025.

Subject guide for teachers and students for the discipline were developed by the writing team of the Institute of Fundamentals and Information Technologies in Medicine of the FSBEI HE PSMU of the Ministry of Health of Russia, under the guidance of the director of the institute Candidate of Medical Sciences Bagryantsev V.N.

Developed by:

Assistant Professor	Candidate of Biological Sciences	Shevchenko O.V.
(position held)	(academic degree, academic title)	(full name)

1. GENERAL PROVISIONS

Subject guide for **Б1.О.07 Chemistry** is a set of recommendations and explanations that facilitate to optimal organization of mastering this discipline.

Regular analysis of lecture materials and work with end-of-the-text questions are necessary for better understanding of the material and systematization of knowledge of **Б1.О.07 Chemistry**. Particular attention should be paid to emerging questions, confusing terms, and conflicts of points of view during the independent review of the lecture material. If necessary, a student should contact the teacher for advice. Lecture material streamlines students' thinking, while practical classes provide deeper insight into the material of the discipline.

Special attention should be paid to the content of the main provisions and conclusions, explanation of phenomena and facts, and clarification of the practical application of theoretic aspects of topic when preparing for a practical class. During this process students should aim to understand and remember the main provisions of the material under consideration, examples provided, as well as understand the illustrative material.

Collections of assessment tools are used to organize independent study of topics (questions) of the discipline.

Independent work of students is facilitated by the following:

1. availability and accessibility of the necessary educational and reference material;
2. a system of regular quality control of completed independent work;
3. availability of teacher's advice.

Subject guides for self-study are presented as literary sources and subject guides for the students. Subject guides for independent work of students include a list of library resources of the educational institution and other materials accessible to students.

Independent work is a type of in-person extracurricular work of teachers and students of **Б1.О.07 Chemistry**. Control of independent work is conducted by the leading teacher. Evaluation of independent work results is taken into account when conducting interim examination of students throughout the **Б1.О.07 Chemistry** course.

Continuous assessment during the **Б1.О.07 Chemistry** course is implemented in order to check indicators of achieving competencies, to stimulate students' academic work, and improve methods of mastering new knowledge. Continuous assessment during the **Б1.О.07 Chemistry** course is conducted during the semester to assess all types and sections of the academic discipline that encompass the competencies developed by the discipline: classroom questioning, working with tests, writing library-research papers, and laboratory classes. Continuous assessment of students' knowledge and results of their preparation for practical classes is conducted during every class session.

Interim assessment aims to determine the level of mastery of competency indicators. It is conducted in the graded test format after the student has mastered all sections of **Б1.О.07 Chemistry** and takes into account learning outcomes for all types of student work over the entire period of mastering the **Б1.О.07 Chemistry** course.

Time allotted for interim assessment is indicated in the schedule.

Assignments given during practical classes, as well as assignments aimed to prepare students for continuous and interim assessment, are included in the collection of assessment tools for **Б1.О.07 Chemistry**. If necessary, students should contact the teacher for advice. It is necessary to thoroughly think over questions that need clarification before seeking teacher's advice.

2. SUBJECT GUIDES FOR LECTURE CLASSES

Table 1. Subject Guides for **Б1.О.07 Chemistry** Lectures

Topic No.1 Protolytic theory of acids and bases. Protolytic equilibrium. Buffer solutions	
Duration of the lecture (in academic hours):	2
Purpose of the lecture: 1. tell students about protolytic processes; 2. define relevant terminology: acid and base from the point of view of protolytic theory, buffer systems, buffer capacity; 3. examine the mechanism of action of buffer systems and the mechanisms of maintaining blood pH at a constant level.	
Lecture plan, order of presentation of its sections: 1. Protolytes, protolytic equilibrium. Protolytic theory of acids and bases. Conjugated protolytic pair; molecular and ionic acids and bases, ampholytes 2. Types of protolytic reactions 3. Ionization of acids and bases as a protolytic equilibrium. Constants of acidity and basicity. The relationship between constants in a conjugated protolytic pair 4. Definition of buffer systems from the point of view of the Brønsted–Lowry protolytic theory. Classification of buffer systems 5. The Henderson– Hasselbalch equation for calculating the pH of acidic and basic buffers 6. Basic properties of buffers and their mechanism of action 7. Buffer capacity and factors influencing it 8. Mechanisms for maintaining blood pH constant (physiological and physico-chemical). Blood buffer systems. Combined protolytic equilibria	
Recommended reading: 1. Kharitonov, Yu. Ya. Analytical Chemistry. Analytics 1. General Theoretical Foundations. Qualitative Analysis : textbook / Yu. Ya. Kharitonov ; ed. V. Yu. Grigorieva. - M. : GEOTAR-Media, 2021. - 602, [6] p.	
Topic No.9 Carbohydrates: mono-, di-, polysaccharides. Structure, properties, biological role	
Duration of the lecture (in academic hours):	2
Purpose of the lecture: 1. tell students about the role of carbohydrates in life processes; 2. define relevant terminology: tautomerism, reducing and non-reducing disaccharide; 3. examine the isomerism and chemical properties of mono- and disaccharides; the composition and structure of polysaccharides.	
Lecture plan, order of presentation of its sections: 1. Carbohydrates in the vital activity 2. Isomerism: structural, stereo, tautomerism 3. Chemical properties of monosaccharides 4. Individual representatives. Ascorbic acid 5. Characteristics of reducing and non-reducing disaccharides 6. Characteristics of homopolysaccharides. The role of starch and glycogen in the processes of vital activity 7. Characteristics of heteropolysaccharides. Participation in metabolic processes	

Recommended reading:
1. Kharitonov, Yu. Ya. Analytical Chemistry. Analytics 1. General Theoretical Foundations. Qualitative Analysis : textbook / Yu. Ya. Kharitonov ; ed. V. Yu. Grigorieva. - M. : GEOTAR-Media, 2021. - 602, [6] p.

3. SUBJECT GUIDES FOR PRACTICALAND LABORATORY CLASSES

Table 2. Subject Guides for Practical **Б1.О.07 Chemistry** Classes

Topic No.3 Properties of buffer solutions. Laboratory class "Determination of buffer capacity"	
Duration of the practical class (in academic hours):	4
Purpose of the practical class: 1. during the discussion, discuss the main types of protolytic equilibrium and its direction, the types of acids and bases of Brønsted–Lowry, the chemical nature and mechanism of action of buffer systems, the main characteristics of buffer systems, blood buffer systems and their role in the body; 2. study patterns and rules of preparing buffer solutions, calculating the pH of buffer systems, buffer capacity, determining the buffer zone, establishing the dominant process in combined protolytic equilibria, including blood buffer systems; 3. consolidate the knowledge gained by conducting an experiment and practicing skills of safe work in a chemical laboratory.	
Practical classes requirements: classrooms equipped with laboratory equipment and glassware, blackboards, subject guides for the discipline, and chemical reagents.	
Independent work of the student: writing a research paper, preparing a report on the studied topics, working with study materials, solving practice problems.	
Methods of evaluation of acquired knowledge and skills: discussion, classroom questioning, tests.	
Recommended reading: 1. Kharitonov, Yu. Ya. Analytical Chemistry. Analytics 1. General Theoretical Foundations. Qualitative Analysis : textbook / Yu. Ya. Kharitonov ; ed. V. Yu. Grigorieva. - M. : GEOTAR-Media, 2021. - 602, [6] p.	
Topic No. 5 Elements of chemical thermodynamics. Laboratory class "Determination of the enthalpy of salt dissolution"	
Duration of the practical class (in academic hours):	4
Purpose of the practical class: 1. consolidate acquired knowledge on definitions and concepts of thermodynamics, mathematical expressions of the first principle of thermodynamics, Hess's law and its consequences, methods of determining the enthalpy of reactions; 2. during the discussion, outline the main typical and situational practice problems based on theses of the theories; discuss the experimental data in the form of graphs and perform necessary calculations; draw conclusions taking into account the reliability of the result obtained; 3. consolidate the acquired knowledge using the skills of experimental determination of thermal effects: prepare the setup, use physical and chemical equipment, measure thermodynamic variables and functions; use the "Measure" educational software in a chemical experiment and practice the skills of safe work in a chemical laboratory	

Practical classes requirements: classrooms equipped with laboratory equipment and glassware, blackboards, subject guides for the discipline, and chemical reagents.
Independent work of the student: writing a research paper, preparing a report on the studied topics, working with study materials, solving practice problems.
Methods of evaluation of acquired knowledge and skills: discussion, classroom questioning, tests.
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4. GUIDELINES FOR CONTINUOUS AND INTERIM ASSESSMENT

Table 3. Guidelines for Conducting Continuous and Interim Assessment during the **Б1.О.07 Chemistry** Course

Type of assessment	Assessment format
Continuous assessment	- conducting and evaluating oral or written quizzes during lectures and practical classes; - assessment and evaluation of completion and results of assignments given during practical classes; - assess and evaluate completion and results of individual assignments and exam tasks given during practical classes; - assessment and evaluation of lecture notes quality.
Interim certification	is conducted in graded test format (oral and written); it allows to assess the development of students' competencies correlating with types of professional activity.

5 ASPECTS OF THE IMPLEMENTATION OF THE COURSE FOR STUDENTS WITH DISABILITIES AND SPECIAL NEEDS

5.1. Availability of accessible environment

For students with disabilities and special needs, if a written application is submitted, lectures and practical classes are carried out taking into account health limitations, individual capabilities and medical status (hereinafter referred to as individual characteristics) of the student. Compliance with the following general requirements is ensured: teaching aids for collective and individual use are provided, required technical assistance is provided by an assistant, buildings and premises where lectures and practical classes are taking place meet accessibility requirements, other arrangements lack of which makes it impossible or difficult to master the discipline are made.

5.2. Compliance with general requirements

When lectures and practical classes are carried out at the written application of the student, the following general requirements are met: lectures and practical classes for students with disabilities and special needs take place at the same location as for students who do not have disabilities, if this does not cause difficulties for students; an assistant (assistants), who provide(s) students with the necessary technical assistance taking into account individual characteristics of the student, is (are) provided; necessary teaching aids are provided, taking into account individual characteristics of the student.

5.3. Availability of the internal policies and procedures of FSBEI HE PSMU of the Ministry of Health of Russia to students with disabilities in a form accessible to them.

All internal policies and procedures of FSBEI HE PSMU of the Ministry of Health of Russia concerning the discipline are made available to students with disabilities in a form accessible to them.

5.4. Increase in the duration of interim assessment of students with disabilities and special needs in relation to the established duration

Format of the interim assessment of academic performance within the scope of the discipline for students with disabilities and special needs is selected taking into account individual characteristics (orally, by writing on paper, by typing on a computer, as a test, etc.). The duration of the interim assessment in relation to the established duration is increased at the written application of the student with disabilities. Time limit for the student's preparation for the test is increased by at least 0.5 hours

6. STAFFING REQUIREMENTS OF THE DISCIPLINE

Academic teaching personnel that ensure the implementation of the discipline education process meet the requirements of the Federal State Educational Standard of Higher Education for the 31.05.01 General Medicine for international students (in English) specialty; list of the aforementioned personnel is available on the website of the educational organization.