Al-Farabi Kazakh National University

Faculty of Chemistry and Chemical Technology

Approved at the meeting of the Scientific Council of the Faculty of Chemistry and Chemical Technology

METHODOLOGICAL RECOMMENDATIONS FOR FINAL CONTROL AT THE FACULTY OF CHEMISTRY AND CHEMICAL TECHNOLOGY

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The methodological recommendations of the final control were reviewed and approved at the meeting of the Scientific Council of the Faculty of Chemistry and Chemical Technology

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Chairman of the Scientific Council
of the Faculty of Chemical Technology Galeyeva A.K.

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1. General Provisions

1.1 These "Methodological recommendations for the final control at the Faculty of Chemistry and Chemical Technology" is a document of the quality management system and is aimed at providing mechanisms for ensuring quality training.

The methodological recommendations were developed in accordance with the instructions for conducting the final control of the autumn semester of the 2022-2023 academic year using DET, with the rules for conducting the final control (winter examination session) for the 2022-2023 academic year, approved by the protocol No. 8 of the meeting of the Scientific Council dated March 28, 2023.

The goal of the guidelines is to reflect the specifics of the final control at the faculty for planning, organizing and conducting the final control in the disciplines of the EPs of the faculty.

Tasks of methodical recommendations:

- to provide recommendations on the choice of forms (platforms) of the final control, taking into account the learning outcomes of the discipline in accordance with the learning outcomes of the educational program;
- to develop recommendations for the formation and evaluation of final control materials, taking into account the forms of exams (case tasks, essays, oral/written exams, test questions (tasks), project tasks), the specifics of the discipline and its place in the formation of learning outcomes of the educational program and levels preparation;
- to identify the specifics of the final control: the duration of the exam due to the need to write complex formulas, equations, etc.; as well as the use of additional resources;
- to determine the features of checking the examination papers of the final control.

2. Recommendation on the choice of forms (platforms) of examinations, taking into account the learning outcomes of the discipline in accordance with the learning outcomes of the educational program and the level of training

Form of final control	Platform	Recommended level of study	Mostly examined LOs	Note
Testing	Univer IS	undergraduate	cognitive	Suitable for disciplines of a theoretical nature. It is very difficult to assess the formation of functional and systemic learning outcomes
	Moodle LMS	undergraduate	cognitive and functional	With the successful construction and combination of various types of test tasks, it is possible to check the formation of not only cognitive learning outcomes, but also functional, in some cases, systemic LO.

Standard _ written	Univer IS	bachelor's , master's, PhD programs	Suitable for disciplines of a humanitarian nature. There is no way to write chemical formulas, etc.	When formulating an examination task, the lecturer needs to provide a response model. With the correct wording of the task, the answer will not include a 100% repetition of lecture and / or educational material. The correct (model) answer to the examination task to a large extent should be aimed at demonstrating the application of the theoretical knowledge gained.
Standard - oral	Microsoft Teams or BigBlueButton in Moodle LMS Alternative (Zoom, Skype)	bachelor's , master's, PhD programs	cognitive , functional and systemic	Examination materials are compiled in such a way that the student's answer reveals how much he/she has formed a specific expected learning outcome indicated in the syllabus; the degree of complexity of examination questions is recommended to vary depending on the level of education and the competence being formed. Examination questions for bachelor's , master's and PhD programs should vary significantly in complexity and content.
Written (creative)	Moodle LMS	bachelor's (3-4 courses), master's, PhD programs	functional and systemic	Can be successfully implemented for technological disciplines
Project				
Case tasks				Solving a professional situation
Essay		master’s, PhD programs	systemic, in some cases functional	Not suitable for assessing cognitive LO. The task should be problematic and aimed at identifying the ability to analyze, reasoning, prove and express own point of view.

Before conducting the final control, the lecturer, no later than one month after the start of the academic period, must select the form and platform for the exam. For any form of final control, the lecturer must upload the final control program to UNIVER IS.

The final control program for the discipline is drawn up in the form of a separate document with structural subsections: title page; introduction; topics on which assignments will be drawn up; recommended references for preparing for the exam:

✓ the title page indicates the name of the faculty, department, document - "The program of the final exam in the discipline ....." (code and name of the academic discipline according to the working curriculum), the code and name of the educational program within which the discipline is implemented, the year of development;

✓ on the reverse side of the title page: full name, position of the compiler of the program, protocol and date of consideration and approval by the department;

✓ in the "Introduction" section it is required to briefly indicate the format, form and platform for the final exam and the main requirements for it;

✓ in the "Topics on which assignments will be drawn up" section, a list of topics submitted for consideration in the final exam in accordance with the syllabus of the discipline is indicated. The list of topics should cover lectures, seminars, as well as assignments submitted to the IWS (IWM, IWS);

✓ in the "Recommended references for preparing for the exam" section, it is necessary to provide a general list of literature on the discipline, indicating in brackets the relevant topics and specific pages for study. It is obligatory to provide a basic textbook(s), teaching aids on the discipline;

It is not allowed to indicate in the exam program the formulated final exam questions included in the exam papers for the discipline.

In the final control program in the form of a project, essay, cases, the topics of projects, essays or cases are indicated: individual or for groups; – exam rules; – format for submitting responses; – methodological recommendations for the implementation of the project, essays, cases; – assessment policy; – schedule (deadlines for completing tasks); – the composition of the groups (be sure to appoint the organizer of the web conference in each group, who will record the video of the discussion and submit it together with the task in the system by posting a link to the video).

3. Requirements for the formation of examination materials, taking into account the forms of examinations, the specifics of disciplines and its place in the formation of learning outcomes of the educational program and the level of training

When creating control and measuring materials (questions, topics of creative tasks), it is necessary to take into account a number of factors:

- when evaluating the level of formation of students' competencies, conditions should be created for maximum approximation to future professional practice and specific activities in the profession and learning outcomes of the educational program;

- when designing assessment materials, it is necessary to provide an assessment of students' ability to engage in creative activities, without which it is impossible to solve new non-standard tasks in professional activities;

- the wording of the questions may contain a purely formed specific competence of the cognitive, functional or system level, or a combination of them.

To control the planned results of the formed competencies, evaluation tools should be developed that check not only and not so much the student's memory, but, first of all, student's ability to transform the material from one form of expression to another, interpret it, draw a conclusion, justify the applicability of the procedure and or method.

Exam questions during the final control are compiled in such a way that the student's answer reveals how well he/she has formed a specific expected learning outcome indicated in the syllabus.

Case assignment - professional situation

Cognitive type:

When formulating, it is recommended to use verbs: to recognize, to reproduce, to formulate, to explain, to interpret, to substantiate, to generalize, to evaluate, etc.

Functional type:

When formulating results, it is recommended to use verbs: to decide, to use, to build a system, to tabulate, to choose solution methods, to justify, to interpret, to calculate, to classify, etc.

Systemic type:

When formulating results, it is recommended to use verbs: to assess the quality of research; to justify the choice of methodology, to rank the results of your own research, to build the logic of research; to combine research methodology, to synthesize the results, to argue, etc.

3.1 Testing

Testing is one of the most effective modern methods for assessing the knowledge of graduates. The advantages of the method are:

- efficiency, speed of assessment;
- simplicity and accessibility;
- convenience for computer processing, the use of statistical methods and analysis results.

A test is a specific tool, consisting of a set of tasks, carried out under standard conditions, which allows to identify the level of possession of certain knowledge.

The goal of testing is determined by the task of high-quality training of graduates, so all test tasks should be related to the learning objectives.

The exam in a test form is conducted both on the Univer platform and in the Moodle LMS. The Univer system uses only one category of test - multiple choice, while Moodle LMS makes it possible to use different categories. Test tasks are best suited for testing cognitive competencies, it is recommended to use them in bachelor's programs on large groups of students (Univer system). Tests in Moodle LMS can be used both in undergraduate and under certain conditions in graduate and PhD studies.

The lecturer develops test questions in accordance with the requirements of the selected system.

FOR UNIVER IS

− **150-200 questions, excluding credits**;

- from 1 or more correct answers at the discretion of the lecturer.

FOR Moodle LMS

The lecturer creates the "Test" element in Moodle LMS and fills it with questions added by him manually to the bank of questions (Appendix 1).

When creating a test, at least **4 types of questions** must be used in equal proportion in 1 test set.

1. Requirements for the content of tests

1.1. The content of the tests must fully comply with the purpose of creation. Fulfillment of the requirement implies a clear statement of the goal and a detailed description of the content elements being tested, knowledge, skills, etc. in the test specification.

1.2 Correspondence of the number of test tasks with the volume of sections and topics of academic disciplines. The content of the tests should have the correct proportions. It should cover all important aspects of the subject area and in the right proportion, corresponding to the educational programs used, which determine the structure and proportions of the content of the academic discipline.

1.3. The test must be accompanied by a specification with information about the content, quality indicators and physical characteristics.

1.4. The content of the test task should reflect all the learning outcomes of the discipline that need to be checked. It should not be oversaturated with those sections for which it is easier to compose tasks.

1.5. The content of each task of each section of the test must satisfy the requirement of significance. It is necessary to include only the most important, key elements of the course content in the tests.

1.6. The content of each test task should cover only one semantic unit, that is, it should evaluate one thing.

1.7. The presence of test tasks of various test forms and categories of difficulty.

1.8. Orientation of the test task to obtain an unambiguous conclusion.

1.9. The content of each task must be logically correct. With the correct execution of each task, only the answers planned by the developer should be received.

1.10. Each item should have high content validity.

2. Recommendations for the formulation of the content of test.

2.1. The wording of the test task should be in narrative form (not in the form of a question). If possible, the text should not contain complex constructions, imperative mood ("choose", "calculate", "indicate", etc.). A specific attribute (keyword) is placed at the beginning of the test task. It is not recommended to start a test task with a preposition, conjunction, particle.

2.2. The main elements of the test task are instructions, assignment (content), answers to the assignment. Instructions for test tasks define a list of actions when passing the test. It should be adequate to the form and content of the task (“indicate the correct answer (answers)”, “match”, “determine the correct sequence”, “enter the correct answer”). The terminology used should not go beyond the main textbooks and normative documents.

2.3. The content of the task should not include instruction elements. The content of the task is formulated in the logical form of the statement, and not in the form of a question; it should not contain ambiguous and unclear formulations, introductory phrases, double negatives, value judgments that clarify the subjective opinion of the subject.

2.4. All repeated words should be excluded from the answers and placed in the content of the task. In the substantive part and in the answers, it is necessary to exclude the words “large, small, many, few, less, more, often, always, rarely, never ...”.

2.5. All answer options should be correctly coordinated with the content of the task, uniform in content and structure, and equally attractive. There must be clear distinctions between the answers. The correct answer is unambiguous and should not be based on clues.

2.6. Among the answers, there should be no answers arising from one another. The answer options cannot include “all of the above”, “all statements are true”, “the listed answers are not correct ”, since such answers violate the logical design of the test task or carry a hint. The number of negative test items should be minimal. At the same time, the particle **"Not"** highlighted in bold.

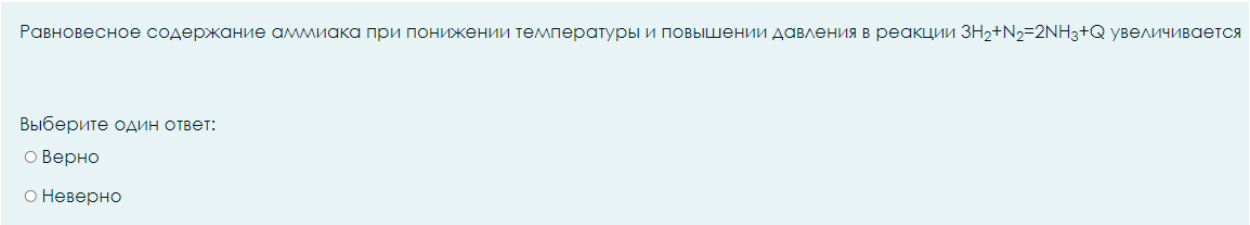
3. Types of test categories

3.1. A True/False test is an item in which a statement is offered and the student is given the option to agree or not. For this type, tasks with unambiguous answers should be used. This type of task consists of a base (text, illustrations, etc.) and two answer options. This is the least informative type of test items.

Examples:

1. The equilibrium content of ammonia with decreasing temperature and increasing pressure in the reaction $3H_2 + N_2 = 2NH_3 + Q$ increases **Answer: true**

2.



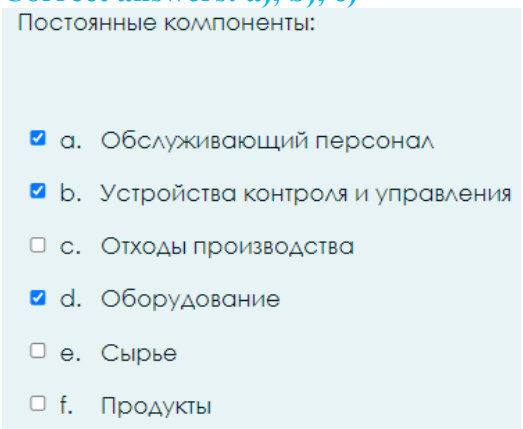
3.2. Test task "Multiple choice" - a task in which the student is asked to choose the correct statements from the list of answers. The task consists of a base (text, illustrations, etc.) and several answers, one (or several) of which is correct, transforming the main text of the task into a true statement. The remaining answers are incorrect because they transform the text of the task into a false statement. These response options are called distractors. The test designer can set the percentage of points (weight) that is awarded for a correct answer (or for each correct answer).

IMPORTANT! For incorrect answers, it is necessary to set not zero, but negative marks, so that if the student selects all the answer options, the resulting mark for the question is not the maximum, but zero. In particular, to make sure that when at least one wrong answer is selected, the final mark for the question is equal to zero, then the score for all wrong answers should be set -100% (minus one hundred percent)

Examples: ***With three correct answers***

Permanent components:
a) Equipment
b) Monitoring and control devices
c) Maintenance staff
d) Products
e) Production waste
f) Raw materials

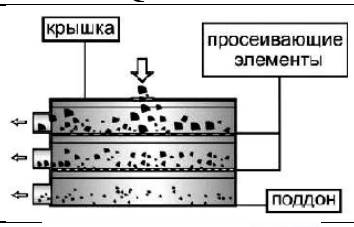
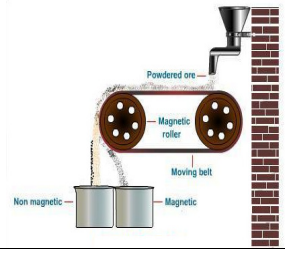
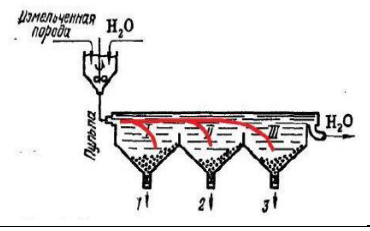
Correct answers: a), b), c)



3.3. Test task "Matching" - a task in which a group of terms is proposed and it is necessary to establish a correspondence. This type of task consists of a base (text, illustrations), several sub-questions and an appropriate number of answers. For each of the sub-questions, only one answer is correct. The student must choose the appropriate answer for each sub-question. Each sub-question automatically has the same weight.

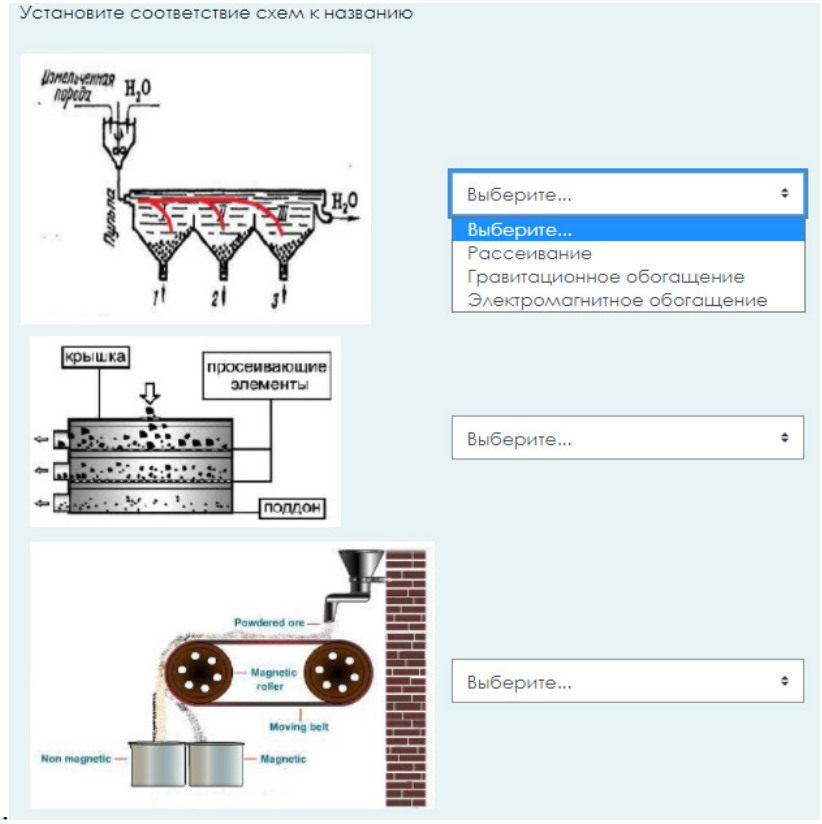
Task examples:

1. Match the schemes to the name

No.	Question	Answer
1		Diffusion
2		Electromagnetic enrichment
3		Gravity enrichment

2. Set the match

No.	Question	Answer *(more answers can be given)*
1	Selectivity of a catalyst	it is the ability of a catalyst to selectively accelerate one of the reactions, if several reactions are thermodynamically possible in the system
2	Porosity of a catalyst	is the ratio of the free pore volume to the total volume of the catalyst and is characterized by the surface area per unit mass or volume of the catalyst
3	Poisoning the catalyst	is a partial or complete loss of its activity under the influence of a small amount of certain substances
4	Stability of a catalyst	is the ability to remain active over time
5		is a measure of its accelerating effect with respect to a given chemical reaction

3. 

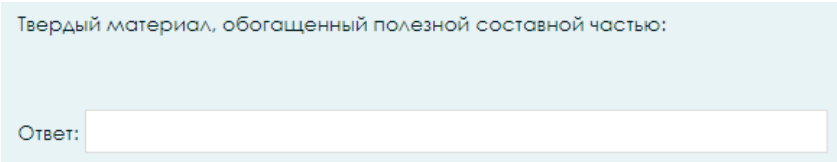
3.4. Test task "Short answer" - a task in which the student, when answering a question, enters a word or a short phrase. This type of task consists of a base (text, illustrations) and a field for entering an answer. Several correct answers can be specified, each with a different score. Responses may or may not be case sensitive. The answer must be one word or a phrase of several words, but they must correspond to one of the standards of answers established by the lecturer. When compiling this type of questions, it is necessary to provide for all options for the correct answers. If the answer is to fill in a gap in the text, underscores (5 or more) should be used to show where the gap is in the text. The asterisk character "*" can be used as a blank that substitutes for any set of characters in the question answer template. For example, the template "ju*p" will match a list of words that start with "ju" and end with "p". If the template symbol "*" is not used in the answer templates, then the student's answers must exactly match the templates, so the student must be careful when writing answers. When using the multi-word answer template, the template "*" must also be used so that the number of spaces between words does not matter.

3.5. Test task "Numeric question". From the student's point of view "Numeric question" looks similar to the task "Short question". The difference is that the numerical answer is necessarily a number and allows for an error in the answer. The lecturer indicates a continuous range of correct answers.

Examples: 1. Solid material enriched with a beneficial constituent:

Answer: concentrate

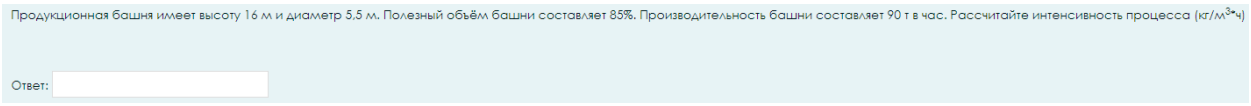
2.



3.5. Test task "Numerical" (the same as the short answer, only for performing computational operations, the numerical answer may have a specified interval of the maximum permissible error of deviation from the correct value).

Question text: The production tower has a height of 16 m and a diameter of 5.5 m. The useful volume of the tower is 85%. The capacity of the tower is 90 tons per hour. Calculate the intensity of the process (kg/m^3*h)

Answer: 279

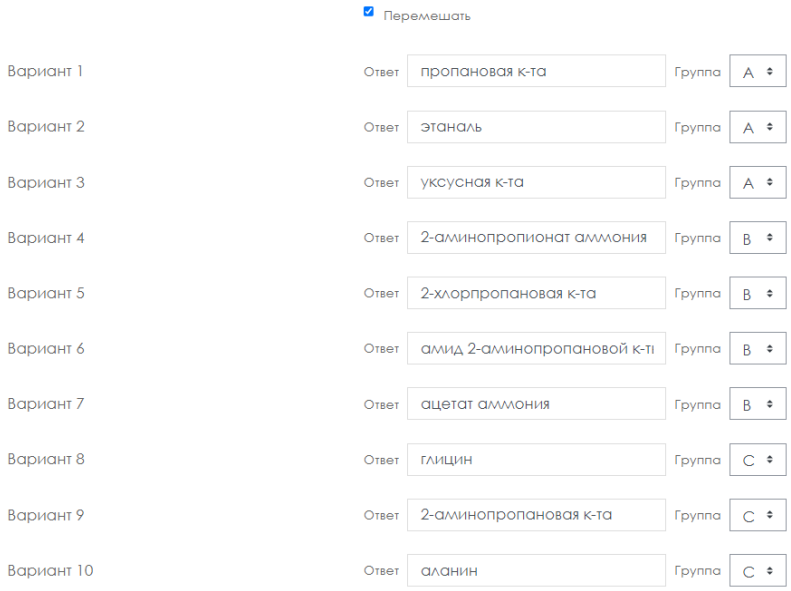


3.6. Test task "Calculating question". This type of task offers to calculate the value using a formula. The formula is a template into which random values from the specified ranges are substituted during each test. This type of tasks is most useful for testing knowledge of natural science disciplines. For the student, the task looks like a numerical question. The correct answer is calculated after substituting the values into the correct answer formula. Standard arithmetic operations are allowed in the formula, as well as some mathematical functions of the PHP language. As with Numeric Questions, the lecturer can specify the interval within which the answers will be considered correct. However, for this type of question, there are three different types of error: relative, nominal, and geometric.

3.7. Test task - "Choice of missing words"

Question text: Fill in the missing connections in the diagram below.

[[1]](Cl_2)→ [[5]] (NH_3)→ [[9]] (NaOH)→ H_2N-CH(CH_3)-COONa



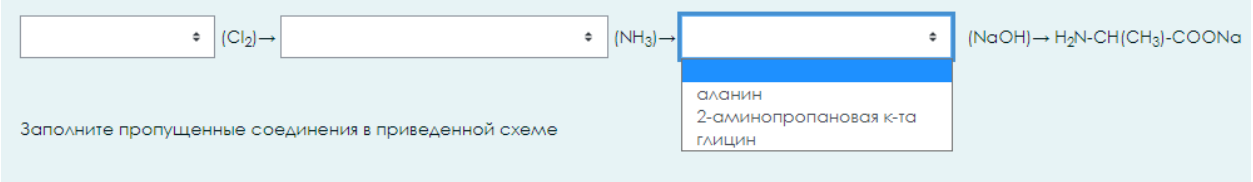
Answers:

propane acid / ethanal / acetic acid

chloropropane acid / 2-aminopropanoic acid amide / ammonium acetate

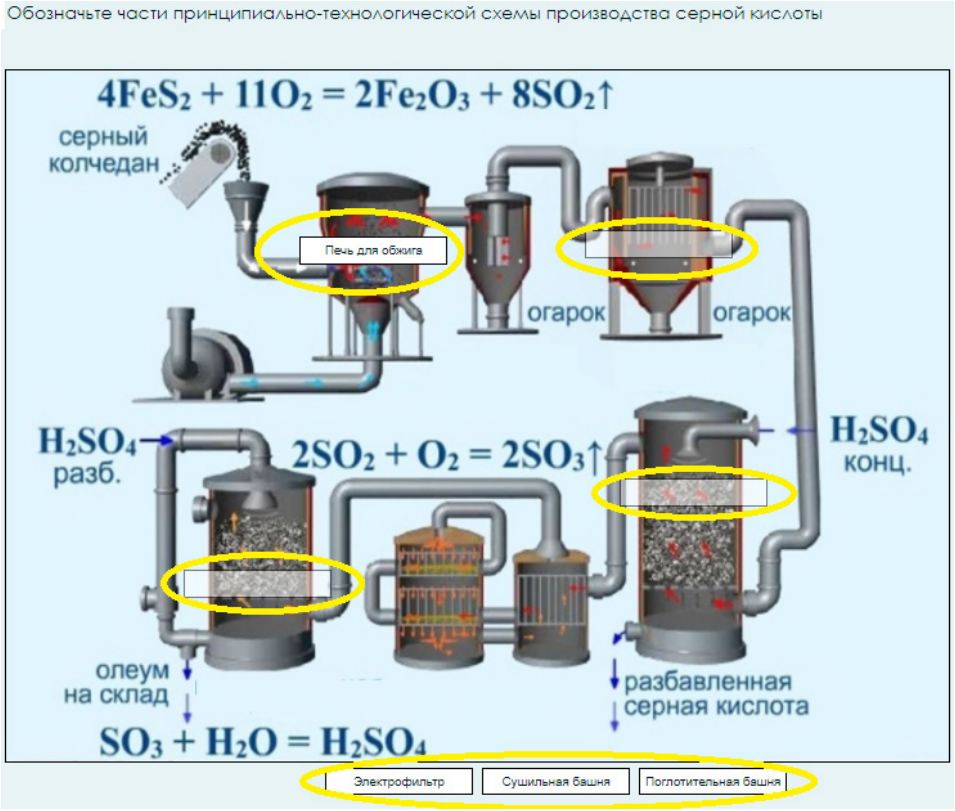
Z glycine / 2-aminopropane acid / alanine

Correct answers: propane acid, 2-chloropropane acid, 2-aminopropane acid



3.8. Test task - "Drag on the image"

Question text: Designate the parts of the process flow diagram for the production of sulfuric acid



4. Requirements for the forms of test tasks

4.1. Multiple choice tasks (for all types of tests). When choosing one correct answer:

4.1.1. In the text of the task, any ambiguity in the wording must be eliminated.

4.1.2. The main part of the task should be formulated as briefly as possible.

4.1.3. The task should have an extremely simple syntactic construction; no more than one subordinate clause is introduced into its main text.

4.1.4. In the main part of the task, it is necessary to include as many words as possible necessary for formulating the task, and for the answer to leave a smaller part of the most important, key words for this problem.

4.1.5. All answers to one task should be approximately the same length, or the correct answer may be shorter than others, but not in all tasks of the test.

4.1.6. From the text of the task, it is necessary to exclude all verbal associations that contribute to the choice of the correct answer with the help of a guess.

4.1.7. The frequency of choosing the same number for the correct answer in different tasks of the test should be approximately the same, or this number is selected randomly.

4.1.8. The main part of the task must be freed from any irrelevant material for this problem.

4.1.9. All repeated words must be excluded from the answers by entering them into the main text of the tasks.

4.1.10. Answers that follow one from the other are excluded from the number of incorrect answers.

4.1.11. All distractors for each task must be plausible and attractive to subjects who do not know the correct answer.

4.1.12. No distractor should be a partially correct answer, turning into a correct answer under certain additional conditions.

4.1.13. The answer to one item should not serve as a key to the correct answers to other items of the test.

4.1.14. All answers must be parallel in construction and grammatically consistent with the main part of the test item.

4.2. Open tasks (with short regulated and freely constructed answers) Open tasks with freely constructed answers are formulated in any form. Standardization is entirely aimed at the procedure for checking the results of their implementation.

4.2.1. Tasks with freely constructed answers are accompanied by a standardized system of their evaluation.

4.2.2. The assessment system should include: general approaches to assessment; a system for coding answers, including sample answers and examples of students' answers; scoring system; methods used in testing to identify typical responses of the subjects.

4.2.3. The grading system must be described and justified by the obtained statistical data.

4.2.4. The basis for determining the coding system or scoring for completing the task should be the analysis of the spectrum of students' answers (according to the testing sample) and the correlation of this spectrum of answers with expert evaluation criteria.

4.2.5. When performing free-response tasks that test academic achievement on the discipline, and not communication skills, students should not be required to write a long text.

4.2.6. The grading system should be supplemented by a document describing the organization of checking and rechecking tasks of this type. The development of open tasks with short regulated answers is subject to a number of generally accepted requirements.

4.2.7. Each task should target only one addition, the place for which is indicated by a dash or dots.

4.2.8. A dash is placed in place of the key element, the knowledge of which is most essential for the controlled material.

4.2.9. All dashes in open tasks for one test must be made of equal length.

4.2.10. Additions are best placed at the end of the task or as close to the end as possible.

4.2.11. After the dash, if possible, the units of measurement are indicated.

4.2.12. The text of the task should have an extremely simple syntactic construction and contain the minimum amount of information necessary for the correct execution of the task.

4.2.13. In the text of the task, repetitions and double negation are excluded.

4.2.14. When using a test with an answer sheet, each gap must be marked sequentially on the answer sheet with the same number as in the test booklet.

4.2.15. When using the test in dialogue with the computer, the subject must see exactly where on the screen the symbols or words inserted by him appear.

4.3. *Compliance tasks. Compliance requirements.*

4.3.1. The task must be formulated in such a way that all content can be expressed in the form of two sets with the corresponding names.

4.3.2. The elements of the setting column must be placed on the left, and the elements for selection on the right.

4.3.3. For each column, a specific name must be entered that summarizes all the elements of the column.

4.3.4. It is necessary that the right column contains at least some distractors. Even better, if the number of elements in the right set is approximately twice the number of elements in the left column.

4.3.5. It is necessary that all distractors in one task be attractive and believable to those who do not know the correct answer.

4.3.6. Column items must be selected one at a time to include only homogeneous material in each test item.

4.4. Tasks to establish the correct sequence

4.4.1. The condition of the task lists all elements of the algorithmic activity or elements that need to be ordered.

4.4.2. The task clearly formulates the ordering criterion.

4.4.3. The subject is asked to indicate the correct sequence of the elements to be ordered either in a special line of the answer, or by numbering the listed elements on the left according to the indicated criterion.

4.4.4. Ordering tasks are placed on a separate page of the test booklet (in a computer version) with a general warning instruction to avoid confusion when performing these tasks with tasks of a different type (multiple choice).

3.2. Standard oral exam

Exam materials are compiled based on the syllabus of the academic discipline and should cover the most relevant sections and topics.

Examination materials should holistically reflect the amount of theoretical and practical knowledge being tested and are compiled in such a way that the student's answer reveals how well he/she has formed a specific expected learning outcome indicated in the syllabus . Thus, the exam should check not only the amount of knowledge and the strength of their fixation in memory, but also the competencies acquired in the process of studying the discipline, the ability to reason and navigate in various problems of the science being studied. Literal coincidence of the wording of the examination task with the topic of the lecture in the syllabus is unacceptable.

Exam questions should aim to identify a limited number of the most key learning outcomes and competencies. When compiling an examination question, it is necessary to try to ensure its reliability (the student's answer to the question really allows assessing the degree of formation of the result) and validity (the student's answer to the question really allows evaluating exactly the learning outcome that the lecturer want to evaluate). Each exam paper should contain questions that reveal the formation and consistency of theoretical knowledge, the ability to operate with them, critically evaluate and draw conclusions, as well as questions that reveal the ability to apply the acquired knowledge to solve practical issues - exercises and tasks.

Particular attention is paid to the nature of the wording of questions. Their language should be concise, clear and at the same time meaningful. The wording of questions should exclude the possibility of monosyllabic answers and make it necessary to give a detailed answer with detailed arguments. In any case, the question should not be simple.

Exam tasks can be composed without dividing into blocks.

The following forms of questions for the oral examination are currently recommended:
An exemplary model of examination material is a combination of:

Cognitive + functional aspects;

Functional + systemic;

Cognitive + functional + systemic.

The lecturer determines the number of exam questions. 10-30 questions on the application of knowledge, depending on the number of students (regardless of credits for any level of education). In one question, learning outcomes (LO) can be combined. Thus, the exam question should contain two or three actions.

The use of the following verbs is recommended:

Cognitive type:
When formulating, it is recommended to use the following verbs:

1. *to recognize, to reproduce, to formulate,*
2. *to explain;*
3. *to interpret, to justify, to generalize, to evaluate, etc.*

Functional type:
When formulating results, it is recommended to use:

1. *to decide, to use, to build a system, to tabulate, to choose solution methods, to justify, to interpret, to calculate, to classify, etc.*

System type:
When formulating results, use verbs:

1. to assess the quality of research; to justify the choice of methodology, to rank the results of the research, to build the logic of research, to combine research methodology, to synthesize the results, to argue.

The degree of difficulty of examination questions is recommended to vary depending on the level of education and the competence being formed. Examination questions for bachelor's, master's and PhD programs should vary significantly in complexity and content.

For bachelor students, this is the ability to demonstrate knowledge and understanding of advanced knowledge in the field of study, which is based on the content of modern advanced textbooks; the ability to apply their knowledge and understanding through the demonstration of the formation and substantiation of arguments and problem solving within the field of study; ability to prove statements.

When compiling examination questions for master's and PhD students, assessing the knowledge and skills of a higher level should be in focus; give preference to questions that reveal the ability to establish interdisciplinary connections; the ability to find a solution in the face of insufficient or new information; the ability to critically evaluate existing knowledge and methods, as well as the ability to identify problematic and promising areas in a particular subject area.

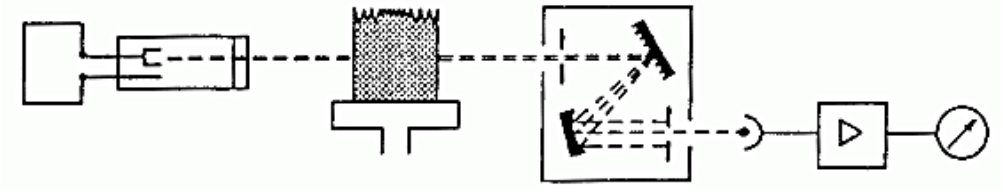
In addition, since the exam is taken orally, the student needs to demonstrate the skills of oral argumentative presentation of his/her thoughts.

For each category of questions, a response quality scale should be drawn up, which allows assessing the degree of formation of the learning outcome and the corresponding assessment. Previously, all questions were divided into 3 blocks according to complexity. At present, as the exam question becomes more difficult, it is recommended to compose the exam questions without division into blocks. Then the examination paper may contain 2 questions (50 points each).

The main rule when compiling the paper is the principle of a fair distribution of questions in them, so that in all papers the tasks are approximately equal in complexity. Since lecturers do not compose papers themselves, it is necessary to create questions of approximately the same complexity. For example, it is reasonable to put a complex task together with an easier theoretical question. Although, this is not always possible.

Examples of combined tasks for a standard oral exam in the disciplines of the EP of the faculty:

1. Explain what processes underlie the appearance of an analytical signal in the method of atomic absorption spectroscopy. Name and describe the main components of the atomic absorption spectrometer, schematically shown in the figure



Justify the purpose of a hollow cathode lamp in an atomic absorption spectrophotometer.

When determining manganese in the alloy by the comparison method, a sample of the alloy weighing 0.2000 g was dissolved in a mixture of acids and transferred to a 500.0-mL volumetric flask. The atomic absorption intensity of this solution at 279.5 nm is 20 divisions of the scale. The atomic absorption of a standard solution of manganese with a concentration of 6.0 μg/mL is 30 divisions. Determine the mass fraction of manganese in the alloy.

2. Give the formulation of the basic law of light absorption. Explain what is called transmittance *T* and optical density *A*. Give an equation relating these values. Explain the physical meaning and factors affecting the value of the molar light absorption coefficient.

Calculate the missing values in the table:

Optical density A	Molar absorption coefficient, ε	Thickness of layer *l* , cm	Concentration
a) 0.345	?	2.00	$4.25 \cdot 10^{-4}$ M
b) ?	$3.70 \cdot 10^{4}$	1.75	1.20 μg/mL (M=325)
c) 0.176	$5.20 \cdot 10^{3}$	?	$2.26 \cdot 10^{-5}$ M
d) 0.982	$2.75 \cdot 10^{4}$	0.98	?, M
e) 0.634	$2.98 \cdot 10^{4}$	2.00	?, μg/mL (M=184)

3.3. Standard written exam

A written exam is a form of final control on the discipline, aimed at identifying the formation of expected learning outcomes and competencies. At the beginning of the semester, each lecturer draws up a final control program, which indicates a list of topics submitted for the final exam, in accordance with the Syllabus. The list of topics should cover the content of all types of classes (lectures, seminars (practical), laboratory), as well as tasks submitted for the IWS (IWM, IWS).

Based on the Program, examination tasks are compiled aimed at assessing the theoretical knowledge and practical skills of the student, allowing to determine the level of formation of the learning outcomes indicated in the Syllabus.

Exam tasks should be formulated clearly, concisely, competently and in an accessible language. They should be equivalent in content, allowing an unambiguous assessment of cognitive, functional and systemic competencies. Tasks should not contain interrogative sentences. When formulating tasks, it is necessary to use active verbs (document "Regulations for EMCD"), which allow to assess the level of achievement of learning outcomes. Exam questions should be combined (complex), including the performance of tasks of a cognitive, functional and systemic orientation. The number of examination tasks does not depend on the number of credits and the number of students for any level of education, but should reflect the full content of the discipline, 10-30 questions on the application of knowledge are recommended. The lecturer independently determines the number of blocks of tasks (one, two or three) and the scale of their assessment.

Explanation 1.

In bachelor programs, one question may contain, for example, cognitive + functional aspects / functional + systemic aspects / cognitive + systemic.

In the master's program: cognitive + systemic aspects / functional + systemic aspects.

In PhD programs, one examination task can combine cognitive + systemic aspects / functional + systemic aspects, or one task that reflects cognitive, functional and systemic aspects.

Exam assignments should not be designed to assess the formation of only one competence.

The level of complexity of examination tasks should depend on the level of study (bachelor's, master's, PhD) and the competencies being formed. According to the guidelines of the "Regulations of the EMCD", students in the bachelor's degree during the final control (final exam) must show the ability to demonstrate knowledge and understanding of advanced achievements in the field of study; the ability to apply their knowledge to solve practical problems within the discipline.

When compiling examination questions for master and PhD students, preference should be given to systemic competencies that reveal the ability to establish interdisciplinary connections; the ability to find a solution in the face of insufficient or new information; the ability to critically evaluate existing knowledge and methods, as well as the ability to identify problematic and promising areas in a particular subject area.

Recommendations for conducting the written exam in the Oqylyq system are given in the Instructions for conducting the final control during the autumn semester of the 2020-2021 academic year.

Examples of combined tasks for a standard written exam in the disciplines of the EP of the faculty:

1. Give ways to express the concentration of solutions in chemical analysis. Specify the difference between solutions of technical and analytical concentration.

The solution is prepared by dissolving exactly 2.375 g of $MgCl_2$ in water and diluting to 200.0 mL. Calculate:

a) molar concentration of $MgCl_2$;

b) molar concentration of Cl^-;

c) percentage concentration of $MgCl_2$ if $\rho = 1.01$ g/mL;

d) mass concentration of $MgCl_2$ in g/L.

2. Explain what characterizes the strength of an acid and a base. What are acidity and basicity constants? Indicate how the constants of acidity and basicity of a conjugated acid-base pair are related.

Write down the expressions for the acidity constants of acetic acid ($K_{a,\ CH_3COOH} = 1.74 \cdot 10^{-5}$) and hypobromous acid ($K_{a,\ HBrO} = 2.2 \cdot 10^{-9}$); basicity constants of an aqueous solution of ammonia ($K_{b,\ NH_3 + H_2O} = 1.76 \cdot 10^{-5}$) and a solution of pyridine ($K_{b\ ,\ C_5H_5N + H_2O} = 1.5 \cdot 10^{-9}$). Calculate the acidity (basicity) constants of the conjugated forms.

3. Give a classification of titrimetry methods according to the type of chemical reaction and the method of titration.

For the examples of titrations presented in the table, determine in what way (direct titration, back titration or substitution titration) the titration was carried out. Give formulas for calculating the results of titration (m) in each case.

Analyzed substance	The equation reactions	Titration
$Ca(HCO_3)_2$	$Ca(HCO_3)_2 + 2HCl = CaCl_2 + 2H_2O + 2CO_2\uparrow$	Titrate solution HCl
$AlCl_3$	$Al^{3+} + H_2Y^{2-}{}_{excess} = AlY^- + 2H^+$	Excess H_2Y^{2-} is titrated with a standard solution of Zn^{2+}
$Na_2S_2O_3$	$Cr_2O_7^{2-} + 6I^-{}_{excess} + 14H^+ = 2Cr^{3+} + 3I_2 + 7H_2O$	I_2 is titrated with $Na_2S_2O_3$ solution
HCOH	$HCOH + NaOH_{excess} + H_2O_2 = HCOONa + 2H_2O$	Excess of NaOH is titrated with HCl solution

4. Formulate the conditions for the precipitation of crystalline and amorphous precipitates in gravimetry. Fill in table

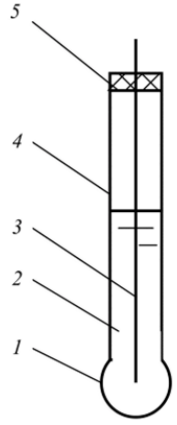
Conditions for the precipitation of crystalline and amorphous precipitates		
Influencing factor	Precipitation	
	crystalline	amorphous
Concentration solutions		
Speed of precipitation		
Temperature		
Mixing		
Presence of foreign substances		
Time of precipitation		

Calculate:

A) What mass of a substance containing about 50% iron should be taken for analysis so that the mass of the calcined Fe_2O_3 precipitate is 0.1 g?

B) What volume of NH_3 solution with a mass fraction of 2% will be required to precipitate iron from 0.2 g of ore containing 50% Fe_2O_3 at a stoichiometric ratio of reactants?

5. Describe the structure of the glass electrode (name the components in the figure). Specify the advantages and disadvantages of the electrode. Explain how buffer solutions are used to calibrate a pH meter with glass and silver chloride electrodes.



Calculate the potential of the glass electrode (const = 0.350 V) in a solution with pH 5.0 relative to the silver chloride reference electrode (E_{SCE} = 0.222 V).

Discipline "Reactivity of solids", master's program, 2nd year.

6. For the process of acid decomposition of the oxidized copper mineral - malachite $CuCO_3 \cdot 2Cu(OH)_2$ give a possible scheme of the process (sequence of stages). Describe the features of each stage. Plot the concentration of copper extracted from the mineral phase into solution against the intensity of mixing from the following kinetics data:

w, rpm	$C \cdot 10^3$ mol/ L
100	52.73
100	53.88
140	79.94
140	74.27
160	100.01
160	98.97
180	103.53
180	102.19
220	103.54
220	102.27
250	104.35
250	103.78

What conclusions can be drawn by analyzing the resulting graph? Explain whether it is possible to select the experimental conditions under which the leaching process will be limited by the rate of the chemical reaction. Suggest an equation to describe the kinetics of this process. Explain which of the parameters, mixing intensity or temperature, will be effective in increasing the speed of this process.

Written exams: Project, Creative task, Case task, Essay are held in Moodle LMS. Exam format – asynchronous. Topics of essays, case-tasks, projects should be of a problematic nature or a solution to a professional problem.

3.4. Case tasks

Case is a problematic task in which the student needs to comprehend a real professionally oriented situation and propose a solution using their skills, abilities and competencies. Students are invited to analyze the situation, understand the essence of the problem, propose possible solutions and choose the best of them. When forming an examination task in the form of a case task focused on assessing the formation of professional competencies among students, it is important to take into account the following requirements for its development:

- firstly, the case should clearly define its intended purpose. It is advisable to indicate which learning outcomes (Cognitive + functional; Functional + systemic; Cognitive + functional + systemic) is being assessed by the content of the case: indicate the name of the learning outcomes being checked, their structural elements in terms of "understand ...", "apply ...", "analyze ...", "synthesize ...", "evaluate ...". Note that the solution of case tasks is focused on the formation of the following abilities of students: critical thinking; reasoning, creativity; carrying out specific actions: for example, calculate data using specific methods and techniques; advancement (development) of problem solving; in general: analytical, creative, communicative, social, introspection;

- secondly, the case should illustrate a plausible situation from the life of the professional community.

- thirdly, the situation proposed in the case should have an internal intrigue and some ambiguity, i.e. contain an actual problem, as a rule, which does not have an unambiguous solution. It is important that the situation of the case does not have clues regarding the solution of the problem posed.

- fourthly, the additional materials attached to the case (diagrams, tables, documentation, etc.) must contain the necessary and sufficient amount of information to solve the problem. Since the size of the case is determined by its purpose, the volume of additional case materials should correspond to the time resources allotted for preparing students for the exam.

- fifthly, the case must have clear instructions for working with it, i.e. contain the task itself: what needs to be done, in what form to present, etc.

- sixthly, the case should be accompanied by parameters for assessing the quality of the task, as well as the level of competence formation in general, which is checked during the exam.

Suitable for all directions of training.

An example of the contents of a student report:

1. Introduction

- a list of the group, highlighting the full name of the author of a specific uploaded document;
- a brief description of the task - exactly the task, you do not need to copy the entire document of the lecturer.

2. Main part:

- description of the results achieved (directly solving the task in the form of a report, images, links to videos, diagrams, graphs, etc., depending on the task);
- description of the progress of the case-task;
- description of the deviations and difficulties that arose during the performance of the assignment, as well as the ways used to overcome them.

1. Teamwork (in case of group work):

- group members: describe their personal contribution to the implementation of the tasks of the case; each student reveals the results he/she has achieved and their significance for the implementation of the case;

- the group leader (responsible for video recording) describes his/her own contribution to the case. In addition, the report of the leader indicates the work performed by each member of the group (from the reports of the other members of the group). The description of the work of each student is made out in the report in separate chapters or by hyperlinks to blocks in the text, which contain a description of the work done by a particular participant. The leader must begin the work

description of a particular student with the last name, first name and patronymic of this student. If necessary, the leader leaves comments on the student's work.
2. Conclusion. Conclusions on the work done.
3. Literature.
• list of references;
• description of the methods and technologies used in the case for solving the tasks (programs, tools, links to key regulatory documents, methods). Each student in his/her report must write the introductory and main parts, conclusion, references (they are the same for everyone, in the case of a group work). In the teamwork block, each student describes only his/her own contribution to the solution of the task set by the lecturer (i.e. this block will be unique in each report), with the exception of the group leader's report, which should list the achievements of each student.

If the work is individual, video recording is not required. Checking for originality is a must.

Example. For the needs of industry in the field of production of insulating materials, it is necessary to obtain a polymer material with the necessary properties using radiation technology.

To solve this problem you need:
1. to write an introduction to the area of problems. (5 points)
2. to write a general scheme of radiation-chemical transformations in the polymer according to the variant. (30 points) Option 1 - linear polyethylene; option 2 - linear polypropylene, option 3 – polymethacrylate; option 4 - polymethyl methacrylate.
3. to formulate a conclusion about the influence of the chemical structure of macromolecules on the predominant direction of radiation-chemical transformations. (30 points)
4. to calculate the radiation-chemical yield of the process. (8 points)
5. to justify the choice of irradiation method. (8 points)
6. to predict the properties of the resulting polymer material. (9 points)
7. to make a conclusion. (10 points)
8. to provide a list of references.

*Learning outcomes achievement system***,** the formation of which is checked during the exam**.**

LO 1. to establish the physicochemical laws of the processes of homo-, co- and graft polymerization of monomers initiated by ionizing radiation and proceeding according to the chain and ionic mechanism;
LO 2. to use the mechanisms of processes occurring under the action of ionizing radiation on macromolecules of various chemical structures to predict the products of the radiation-chemical transformation of polymers;
LO 3. to calculate the radiation-chemical yield of the processes of polymerization, destruction and cross-linking of macromolecules;
LO 4. to assess the radiation resistance, as well as possible directions of radiation modification of polymer materials, taking into account the mechanism of processes occurring under the action of ionizing radiation on macromolecules of various chemical structures.
LO 5. to evaluate the latest achievements, current problems and prospects for the development and application of radiation chemistry of polymers.

Evaluation policy, evaluation criteria.
The final exam is estimated in %:

0 % - refusal to answer due to unpreparedness, the answer is not on the merits.
25-50 % - the work is an unedited compilation of one or more textbooks, Internet texts, there is no analysis of practical material, outdated literature is used. The student is not oriented in the material, cannot answer questions.

50-75 % - the work is a generalization and systematization of the main literature on the topic, it is a logical coherent text on the theory of the question posed, the analysis of real processes is not presented.
75-90% - the work was done mainly based on current literature, there are separate elements of the analysis of real processes and their own conclusions, but they are not of a systemic nature, they have not been fully developed. The student is relatively fluent in the topic of work, and able to answer questions.
90-100% - the work is an independently developed analytical text involving a significant amount of factual material, the latest editions of periodicals and high-quality analytical materials and reviews. Independent substantiated conclusions are made, the student freely navigates the topic of the work and answers the tasks.

3.5. Project

The project examination task is intended to test the student's research skills, and the skills of experimental and methodological work, to determine the depth of his/her knowledge in the chosen scientific and pedagogical field related to the topic of the discipline being studied.

The implementation of the project assignment includes the following steps:

- Search for a problem and study of ways to solve it (research part of the project);
- Development of ideas and reasonable choice of the best solution (design part);
- Planning and finding a solution to the problem (technological part);
- Analysis and evaluation of the object and the design process (reflexive part).

Structural elements of the project:

1. Title page
2. Content.
3. Introduction. The student must: 1) justify and specify the choice of topic; 2) describe goal setting in terms of the expected result; 3) predict the relationship between goals, means and results; 4) justify the choice of methods, tools and technologies presented in the project.
4. Theoretical part - analysis and systematization of scientific knowledge on a given topic.
5 Technological (practical) part - a detailed description of the educational product (materials of the project assignment).
6. Conclusion - analysis of the achieved educational results, evaluation of the work done (reflection), recommendations on the possible use of the results.
7. List of references.
8. Appendices (diagrams, tables, charts, graphs, tests, etc.).

The structure of the project may vary depending on the direction and nature of its content. In the process of learning, the student consults with the lecturer on the selection of content, specifies the specific type of the final project, the necessary tools and didactic features of the development of an educational product.

Requirements for the design of the project.

Students work in Word text editor and Excel editor. It is allowed to perform certain parts of the work (drawings, diagrams) in Power Point format and Paint editor, followed by pasting into Word. The graphic part, made in Excel, is also inserted into the Word document **with the possibility of editing**. The examination paper is submitted for verification in the form of **a single** Word file (.docx). The final exam paper file must contain a minimum of 20 pages.

Project evaluation criteria

1. Assessment of the relevance and novelty of the stated topic:

the significance of the problem (assessment of the literacy of its definition; assessment of the completeness of the projected goals and objectives of the project (pedagogical, development of the educational process);

compliance of the tasks set with the type and content of the submitted project.

Grading policy

The maximum number of points for the examination task is 100. Each item of the task is estimated at a certain number of points (given in the Appendix); the examination grade is derived by simply summing up the scores for each completed task item.

If the uniqueness of the work is 50-74%, the number of points corresponding to the difference between 80% and the actual uniqueness is subtracted from the total score (for example, if the uniqueness is 70%, 5 points are subtracted from the exam score).

Examination papers with uniqueness less than 50% are evaluated at **0 (zero)** points.

An example of the project for the "Quantum Chemistry" course

The examination paper is submitted for verification (uploaded to the *Moodle system* as **a single** Word file (.doc or .docx). This file includes the text part, as well as screenshots of the drawings.

Page settings: all margins 2 cm, font 14, single line spacing.

The final file of the examination paper must contain at least 8 pages, including drawings.

Part 1. Checking the formation of functional competencies (30%)

Carry out a comparison of two specific methods of quantum chemical modeling of chemical reactions (Table 1). The answer must include:

- features of the calculation principles underlying the compared methods;
- advantages and disadvantages of the compared methods;
- examples of calculations that it is expedient to perform by compared methods.

Table 1 - Initial data for Task 1

Option	Compared methods
1	non-empirical; density functional theory (DFT)
2	semi-empirical; non-empirical
3	non-empirical; molecular mechanics
4	semi-empirical; density functional theory (DFT)
5	molecular mechanics; semi-empirical.

Part 2. Checking the formation of functional competencies (35%)

Carry out the calculation of a specific gas-phase chemical reaction (Table 2) by the quantum-chemical method using the Gaussian program. It is necessary to use 2 methods (to choose from).

The response for each method should include:

- optimization of the geometry of all participants in the reaction;
- visualization of the initial and optimized structures of the reaction participants;
- thermodynamic parameters of reactions of formation of reaction participants (enthalpy, entropy, Gibbs free energy)
- visualization of oscillation frequencies;
- visualization of the optimization curve;
- thermodynamic parameters of the reaction at 298 K (enthalpy, entropy, Gibbs free energy, equilibrium constant);
- comparison of the calculated thermodynamic parameters of the reaction under study with reference data;
- explaining the differences between the data obtained by the two methods of quantum chemical modeling;
- explanation of the differences between the data obtained by quantum chemical modeling and reference data.

Table 2 - Initial data for Task 2

Option	gas phase chemical reaction
1	Oxidation of CO to CO_2 by oxygen
2	Dissociation of PCl_5 to form PCl_3 and Cl_2
3	Synthesis of ammonia from nitrogen and hydrogen
4	Oxidation of SO_2 to SO_3 by oxygen
5	Oxidation of NO_2 to N_2O_5 by oxygen

Part 3. Checking the formation of functional competencies (35%)

Using the Gaussian program, calculate the transition state structure for the formation of the acidic form of nitroethane; use the theory level given in Table 3.

The answer must include:

- optimized geometry of molecules of nitromethane and acidic form of nitromethane;
- optimized geometry of the transition state structure;
- calculation of oscillation frequencies for the transition state;
- calculation of descents according to the reaction coordinate;
- visualization of the curve of descents along the reaction coordinate;
- conclusions on calculations.

Table 3 - Initial data for Task 3

Option	Level theories for calculation
1	DFT, 6-31G, B3LYP
2	Hartree Fock , 3-21G
3	MP2, 3-21G
4	DFT, 3-21G, B3LYP
5	Hartree-Fock , 6-31G

3.6. Essay

The student briefly outlines his/her view on the problem under consideration. An essay is written in a small form by deploying own thoughts based on knowledge, facts and experience in the professional field. Prove some statement (one problem) in the professional field, demonstrating the competence and convincing readers of your position or rightness. This is a means of controlling the ability of students to work with information, its analysis, structuring, and the formation of conclusions and recommendations. This type of exam involves students writing one long text on a specific problem within three hours. Students are expected to spend one hour reflecting, sketching and preparing the structure of the essay. Then for two hours they write. This exam format requires you to put together many different elements of the course using your "brains" and your analytical skills.

- essay topics should be determined based on the expected learning outcomes;
- it is necessary to specify the requirements for the format and content of the essay (essay standard);
- it is necessary to describe the evaluation criteria;
- check for plagiarism is required.

Examples of essay topics on the disciplines of the EPs at the faculty:

1. Expand the areas of use of waste and emissions from petrochemical industries. Justify your vision on the improvement of existing technologies in order to implement resource saving.

2. Substantiation of the mechanism of interaction of primary reagents with the catalyst on the example of the technology for obtaining butadiene-1,3 from ethanol, based on the nature of the catalyst and the conditions of the process. Give the most suitable theories to explain the intermediate catalytic action, prove their viability and offer your views on improving existing technologies.

3. Justify the causes of acid rain, smog, and ozone layer destruction using the example of the impact of waste and emissions from chemical and oil and gas industries. Formulate your vision of solving the problem and draw the necessary conclusions and suggestions.

4. Conducting an exam (*Features in conducting an exam, taking into account the specifics of the faculty) The duration of the exam due to the need to write complex formulas, equations, etc. The need for additional resources.*

Taking into account the specifics of the faculty (complicated input of formulas, reaction equations, schemes, etc.), the duration of the exam may increase by 1 hour. By decision of the Scientific Council of the faculty with justification for each discipline in which auxiliary educational tools (rulers, pens, calculators, etc.) will be used, the use of additional resources is allowed.

5. Checking examination papers. Criteria for evaluating examination papers.

Evaluation criteria (Rating scale):

"excellent" - full disclosure of all examination tasks, while the student showed creative abilities; understands, applies theoretical material, finds convincing facts and arguments. The text is logical, clear, consistent on the basis of analysis;

“good” - in general, the questions are disclosed, arguments are given, the student makes an analysis, conclusions;

"satisfactory" - did not fully disclose the questions and picked up the facts superficially, there is no logic in the conclusions;

"unsatisfactory" - there are significant gaps in the disclosure of examination questions, made mistakes, no conclusion.

To assess the quality of assignments, the following criteria are required:

- the ability to evaluate, draw conclusions, taking into account internal conditions or external criteria was demonstrated;

– an interdisciplinary approach to solving the problem was demonstrated, the integration of knowledge from different scientific fields was carried out;

- a system of evidence that convincingly argues the conclusions underlying the solution of the problem was created;

- an unconventional approach to solving the problem was used;

- the decisions underlying the idea and embodied as a result were theoretically substantiate;

- mastering the terminology was demonstrated;

- knowledge, conducting analytics, criticism was applied.

Parameters for assessing the quality of an essay (evaluation criteria)

✓ understanding the purpose of the case task;

✓ the quality and quantity of arguments in favor of one's point of view;

✓ expressing own position on the problem;

✓ range of sources of information used to support their reasoning;

✓ integrity, consistency, completeness of work;

✓ originality of style, language and form of presentation;

✓ originality of the work, not below the threshold of originality.

Essay grading scale:

"excellent" - full disclosure of the topic, while the student showed creative abilities; understands, applies theoretical material; finds convincing facts and arguments. The text is logical, clear, consistent on the basis of analysis, has its own point of view, complies with the requirements for the design of the work;

“good” - in general, the topic is disclosed, arguments are given on the topic of the essay, the student makes an analysis, conclusions, showed own point of view, designed the work on demand;

“satisfactory” – a student revealed the topic and picked up the facts superficially, there is no logic in the conclusions, a student does not sufficiently show own point of view, does not comply with the requirements for the design of the work;

“unsatisfactory” - there are significant gaps in the disclosure of the topic, made mistakes that violate the basic rules for writing and designing the work.

Parameters for assessing the quality of the case:

✓ an integrated approach to solving the problems posed, understanding the key aspects, systematic knowledge of the approaches (completeness of the solution of the case);

✓ the degree of creativity and independence in the approach to case analysis and its solution;

✓ evidence and persuasiveness when solving a case;

✓ the form of presentation of the material, the literacy of written speech and the quality of the presentation;

✓ completeness and comprehensiveness of conclusions;

✓ having one's own view on the problem;

✓ originality of the work, not below the threshold of originality.

Criteria for evaluating the implementation of the case:

"excellent" - the case-task was completed, within the framework of the regulations, there is a complete clear argumentation of the chosen solution based on a qualitatively done analysis. Demonstrates good theoretical knowledge, knows how to solve problems. A structured and detailed analysis of the case was carried out, possible solutions were presented, the final choice of one of the alternative solutions was clearly and reasonably justified;

“good” - the case-task is completed completely, but there is no complete argumentation of the chosen solution, the theoretical justification is not sufficient, not all the reasons have been established, not a complete analysis has been made, there are not enough solution options, there is no clear argumentation for choosing the final solution;

"satisfactory" - the case-task was completed by more than 2/3, but within the established requirements. The conclusions are weak, they indicate an insufficient analysis of the facts, their own point is not justified, there is no detailed analysis, there is no clear argumentation for the final choice of the solution;

"unsatisfactory" - the case-task was not completed, or completed by less than a third. No detail, no solution to the problem.

Project implementation quality parameters:

✓ ability to set project priorities;

✓ ability to determine the purpose of the project;

✓ level of creativity, originality of the disclosure of the topic, approaches, proposed solutions;

✓ reasonableness of decisions, conclusions;

✓ quality, completeness and objectivity of the information provided;

✓ the logic of the project, the correctness of the formulation of conclusions;

✓ quality of project design;

✓ practical value of the completed project;

✓ originality of the work, not below the threshold of originality.

Project evaluation criteria:

✓ correctness and literacy of the design of the project according to the requirements of the lecturer;

✓ logical presentation - reflection in the text of causal relationships, the presence of reasoning and conclusions;

✓ quality of design - a clear structure of text, drawings, graphs;

✓ visibility and accessibility for perception;

✓ independence.

6. Checking for anti-plagiarism of written works.

All written work is subject to a mandatory check for plagiarism in LMS, Univer IS and Moodle LMS. There is an automatic check of work for plagiarism using 2 services: Antiplagiarism (mandatory) and StrikePlagiarism (if necessary). Analysis of the report on the presence of plagiarism in the written work of students is mandatory. For example, for a project, all students upload the final report to Moodle LMS. In the case of group work, when checking the work for the presence of borrowings, the introductory and main parts, the conclusion and the chapter of the personal contribution of the first author (when analyzing the first work of the group) are completely checked. Further, when checking the work of the rest of the group members, only the chapter of the contribution of a specific author of the work is checked (when the lecturer works with the report of the Anti-plagiarism service, the previously evaluated parts of the report are excluded from consideration by the system and the percentage of borrowings is recalculated).

To analyze the legitimacy and correctness of borrowings, it is necessary to analyze the full report. In the full report, fragments of text of different colors are visible, on the right side there is a list of sources for each mark.

Provisions to be paid attention to when assessing the legitimacy and correctness of borrowings:

- Relation to the author of the work (self-quoting);
- Is verbatim borrowing in quotation marks;
- Is there a link (footnote) to the source in the text of the document being checked;
- Whether the source is mentioned in the bibliography;
- Compare the date of the borrowing source and the date of writing the work.

Teaching staff can work with self-citation parameters through:

- Automatic recalculation (after entering the author's name and clicking on the "recalculate" button, an automatic recalculation is performed)

- Manual editing (there is a possibility of evaluating self-citation).

It is also possible to work with the Transferable Borrowings Search Module, which:

- Allows to check Russian-language texts for the presence of borrowings from English-language sources and vice versa;
- Kazakh texts can be checked for borrowing from English and Russian sources.

Transferable borrowings are marked in color, the system issues links.

Anti-plagiarism system also detects text with paraphrased borrowing. The faculty has the ability to edit the full report:

- Disabling the borrowing source with recalculation of results;
- Disabling individual borrowed blocks with recalculation of results;
- Changing the source type (from borrowing to citing/self-citing and vice versa) with recalculation of results.

It is not enough to formally “pass” the text through Antiplagiarism and look at the percentage of originality.

It is necessary to analyze the discovered sources of borrowing; to assess the legitimacy and correctness of borrowings; to edit the full report if necessary.

7. Conditions for annulment of exam results.

If the use of unauthorized materials or the receipt of other prompts by the student is detected, or identification marks (such as the student's name, special characters and designations) are left in the student's work, the exam may be canceled. The maximum time of absence from the exam for technical reasons is 20 minutes. If it is exceeded, a decision will be made to cancel the work or postpone the exam to another day, depending on the circumstances. By the decision of the Scientific Council of the faculty, with justification, the threshold level of originality of written works for the EPs of the faculty for each level of education is approved, works below the threshold level are also canceled.

▶ Written work of the final control of the bachelor's degree with originality 0-20 %, for master's and PhD programs - 0-30 % are canceled without expert review of the full Anti-Plagiarism report .

▶ Written works of the final control, upon reaching the threshold levels of at least 70 % or more for bachelor's and 70 % or more for master's and PhD program, the work is evaluated for a positive assessment at the discretion of the teaching staff.

▶ Written papers with confirmed cases of technical bypasses will be cancelled.