

**AL-FARABI KAZAKH NATIONAL UNIVERSITY**  
**Faculty of Chemistry and Chemical Technology**  
**Department of Physical Chemistry, Catalysis and Petrochemistry**

**Final exam program for the discipline**

**FRMS5305 «Phase Equilibrium Multicomponent Systems»**

**Educational program:**

**7M05301 - Chemistry**

**Almaty 2022**

The final exam program for the discipline is compiled by the lecturer of the Department of Physical Chemistry, Catalysis and Petrochemistry Supiyeva Zh.A.

Reviewed and recommended at the meeting of the Department of Physical Chemistry, Catalysis and Petrochemistry  
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Head of the department \_\_\_\_\_ Ye.A. Aubakirov  
(signature)

## Introduction

**Exam format:** synchronous.

**Exam form:** Oral exam.

**Exam platform:** Zoom.

**Exam type:** online.

**Exam control:** video recording.

**The exam lasts:** Preparation time is 5 minutes; the response time is 20 minutes.

**On the exam in this discipline** the ticket will have 2 tasks (questions).

### Topics for which test tasks will be drawn up

1. Basic concepts used in the study of phase equilibria in multicomponent systems.
2. Phase equilibrium conditions in multicomponent systems. Phase transitions, their thermodynamic description.
3. Behavior of isochores on T-P diagrams of substances with positive and negative volumetric melting effects.
4. Phase transformations of the I and II kind, their features. State diagrams of one-component systems, their general characteristics.
5. Mono- and enantiotropic transformations, conditions for their implementation. Ostwald's rule.
6. Comparative analysis of research methods for preparative and physicochemical analysis, their limitations and advantages.
7. Diagrams composition - property, their characteristics.
8. State diagrams of two-component systems, the components of which do not interact with each other, their practical significance.
9. State diagrams of two-component systems with chemical interaction of components, their practical use.
10. State diagrams of two-component systems with chemical interaction of components, determination of optimal conditions for the formation of new compounds.
11. State diagrams of two-component systems, the components of which show unlimited mutual solubility.
12. State diagrams of two-component systems, the components of which show unlimited mutual solubility.
13. Conditions for the implementation of various types of phase diagrams. Relationship between the compositions of the liquid and solid phases for various types of phase diagrams.
14. Zone melting, areas of its practical use. Application of fusibility diagrams in practice.
15. Determination of the heat of fusion of a component and the molecular masses of substances dissolved in it according to thermal analysis data.

### Rules for conducting the exam

#### Oral exam: traditional - answers to questions

**Important!** The exam is held according to a schedule that should be known in advance to students and teachers.

The organizer of the exam-conference-the teacher or a member of the exam committee who will take the exam, plans the conference in advance on the selected platform and sends an invitation to the exam participants.

On the day of the exam, for 30 minutes, the teacher reminds students about the beginning of the exam in the general chat. If necessary, change the communication platform.

If zoom is used, the examiner should divide the exam into periods of 30-40 minutes for reconnection.

The student must complete the exam in one session.

It is forbidden to start responding in the same session and end after reconnecting.

If the response is interrupted during a new connection, the examiner issues a new ticket to the examinee.

**Important!** The video recording is turned off only at the end of the exam, when the answers of all the examinees are accepted.

#### **General procedure**

After connecting all the participants online in the conference, the teacher or member of the commission:

- starts **Video recording** of the exam;
- greets the participants of the exam;
- warns that video is being recorded;
- announces the rules of the exam;
- names the order of the examinees;
- names the preparation time (at the discretion of the teacher);
- names the response time (at the discretion of the teacher);
- gives permission to compose answers, if necessary, on paper with a pen;
- requires the examinee to show his answer sheet before starting the answer;
- allows other examinees to be on standby - not to be in front of the camera all the time, but not to leave the meeting;
- gives the surname, name and patronymic of the examinee;
- asks the examinee to show the room in which he is located on a video camera - there should be no strangers in the room, no additional sources of information (if possible from the student's side);
- warns about the ban on the use of additional sources of information;
- say to a student: "You can open your ticket";
- gives time for preparation - at the discretion of the teacher and the commission;
- controls the preparation process via video link, making comments if necessary;
- accepts the answer from the examinee;
- allows the examiner to leave the meeting.

The same procedure is repeated with each exam participant.

#### **Student instruction**

##### **The student must:**

1. Have a computer or laptop with a webcam and access to the Internet.
2. Timely before the start of the exam, connect the computer and the video camera and do not turn off the video camera during the exam.
3. Before the start of the exam, it is mandatory to pass identity verification by showing an identification document on a webcam (identity card).

**Important! You must have with you: identity card.** In the absence of supporting documents, the student is not allowed to take the exam! If a third party replaces a student, both the student and the third party are brought to disciplinary responsibility.

4. Carefully read and follow the instructions for passing the exam.
5. The answer to each examination question should be stated consistently, clearly.
6. If the student for technical reasons could not connect, then it is necessary to report the technical problem to the adviser within three hours after the start of the exam.
7. The student has the right to submit an appeal within 24 hours from the moment the grade for the exam in the "Univer" system is set in the event that: the exam ticket contains an incorrect question or a question that does not correspond to the curriculum of the discipline.

**Attention!** The use of headphones, including wireless headphones, is permitted only at the time of receiving additional questions from members of the examination committee. In all other cases, the use of headphones is FORBIDDEN!

**It is prohibited:**

1. To have with you during the exam unauthorized aids (cribs, cell phones (on or off), smart watches, other electronic devices, etc.).
2. To make noise, talk, get up and leave the webcam field, premises.
3. To seek help and provide access to the computer to third parties during the exam.
4. To look away from the computer screen.
5. Additionally, to open the tabs of browsers, instant messengers, MO Excel, additional monitors and computer equipment, except for the one that is directly used for the exam.
6. To use books, drafts, calculators without permission.
7. To turn off or reduce the level of sensitivity of the microphone to sound during the exam.

**Important!**

1. A student who has committed a violation of any of the above requirements, which was recorded by the act, will be given an “F” (“unsatisfactory”) mark for the discipline.
2. The opening of unauthorized educational and methodological materials, electronic means of communication in the student during the exam, as well as violation of these Regulations, is the basis for making a decision to cancel the assessment results and give the grade “unsatisfactory”, regardless of whether they were used in the exam or not.

**Important!**

1. Questions are automatically generated by the Deputy Dean. The student is prohibited from opening the exam ticket until the teacher-examiner says “You can open your ticket”.
2. After opening a ticket in the university system, the time countdown begins.
3. The ticket will have 2 tasks (questions).
4. Read the exam rules carefully and follow them. Answer the teacher’s questions and follow all his instructions.

**Evaluation policy**

The ticket will have 2 tasks (questions). The tasks are estimated in sum as 100 points. The 1st task – 50, the second task – 50. The total result will be the sum for all questions of the ticket.

**Recommended literature sources for exam preparation**

1. Fundamentals of Engineering Thermodynamics, 9th Edition / Michael J. Moran. – Wiley. 2018. – 875 p.
2. Elements of Physical Chemistry: 6th Edition / P. Peter. Atkins. - Oxford: Oxford University Press, 2013. – 591 p.
3. Physical chemistry: a modern introduction: second Edition / updated and revised by W.M.Davis. - USA: CRC Press, 2012. – 501 p.
4. David W. Ball. Physical Chemistry. USA, Thomson Learning, 2011. – 840 p.
5. Peter Atkins, Julio de Paula. Physical Chemistry, Eighth Edition. Oxford University Press, 2006. – 1050 p.
6. Robert J. Silbey, Robert A. Alberty, Mounji G. Bawendi. Physical Chemistry. Hamilton Printing, 2005. – 944 p.
7. Ira N. Levine. Physical Chemistry. Sixth Edition. New York: McGraw-Hill, 2009. – 995 p.