

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

**Final exam program for the discipline**

**IT2224 «Engineering Thermodynamics»**

**Educational program:**

**6B07202 – Food Chemistry and Technology**

**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  
at “10” February 2022, protocol No 8

Head of the department \_\_\_\_\_ Ye.A. Aubakirov  
(signature)

## **Introduction**

**Exam format:** synchronous, i.e. the student takes the exam in real time "here and now"

**Exam form:**

**Writing exam.**

**Exam platform:** UC Univer.

**Exam type:** offline.

**Exam control:** video monitoring.

**The exam lasts:** 3 hours.

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

**Example of exam ticket**

1. Characterize basic concepts and terms of engineering thermodynamics. Assess the first law of thermodynamics and its mathematical expression. Justify your opinion, giving the examples.

2. Critically discuss and provide Thermodynamic potential and its directions in the processes of the food industry.

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

1. Basic concepts and terms of engineering thermodynamics.

2. The first law of thermodynamics and its mathematical expression.

3. Application of the first law of thermodynamics and the energy value of food products.

4. The second law of thermodynamics and its analytical expression. Entropy.

5. Thermodynamic potential and its directions in the processes of the food industry.

6. The Gibbs-Helmholtz equation and its practical application.

7. Chemical potential and its characteristics in open systems.

8. Chemical equilibrium and its signs. Equilibrium constant.

9. Isotherms of chemical equilibrium and the direction of the process.

10. Influence on the state of equilibrium of various factors.

11. Engineering calculations of equilibrium composition depending on temperature.

12. Equilibrium conditions in heterogeneous systems.

13. Heterogeneous equilibria observed in the production and storage of food products.

14. Theory of equilibrium. Laws of ideal solutions.

15. Application of the theory of solutions and their practical application in the production of food products.

**Rules for conducting the exam:**

**3 hours for preparation, after which the work is handed over to the teacher**

**Writing 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.

### **Student instruction**

**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.

Carefully read and follow the instructions for passing the exam.

The answer to each examination question should be stated consistently, clearly.

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 FORBIDDEN!

### **It is prohibited:**

To have with you during the exam unauthorized aids (cribs, cell phones (on or off), smart watches, other electronic devices, etc.).

To make noise, talk, get up and leave the webcam field, premises.

To seek help and provide access to the computer to third parties during the exam.

To look away from the computer screen.

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.

To use books, drafts, calculators without permission.

To turn off or reduce the level of sensitivity of the microphone to sound during the exam.

### **Important!**

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.

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!**

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”.

After opening a ticket in the university system, the time countdown begins.

The ticket will have 2 tasks (questions).

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, Moungi G. Bawendi. Physical Chemistry. Hamilton Printing, 2005. 944 p.

7. Стромберг А.Г., Семченко Д.П. Физическая химия. М.: Высшая школа, - 2003, 527 с.

8. Краснов Г.С., Воробьев Н.К., Годнев И.Н. и др. Физическая химия: в 2-х книгах. М.: Высш.школа, 1995. Кн.1,2.

9. Ira N. Levine. Physical Chemistry. Sixth Edition. New York: McGraw-Hill, 2009. 995 p.

10. Еремин В.В., Каргов С.И., Успенская И.А. и др. Задачи по физической химии. М.: Экзамен, 2005, 318 с.