# AL-FARABI KAZAKH NATIONAL UNIVERSITY

**Faculty of Chemistry and Chemical Technology Department of Physical Chemistry, Catalysis and Petrochemistry**

# Final exam program for the discipline

**TPFH 5301 «Theory and Problems of Physical Chemistry»**

**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

at “10” February 2022, protocol No 8

Head of the department \_

(signature)

Ye.A. Aubakirov

# Introduction

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

# Exam form: writting

**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 of the theory of solutions. Assess crystal lattice energy and various methods of detection. Justify your opinion, giving the examples.
2. Critically discuss and provide solvation energy and heat Born, Born-Bierrum equations and Gaber's thermodynamic cycle. Assess theoretical and applied aspects of real and chemical energetics of solvation.

# Topics for which test tasks will be drawn up

1. The role of D. Mendeleev and his scientific school in creating the theory of solutions.

2. Crystal lattice energy and various methods of detection.

3. Solvation energy and heat Born, Born-Bierrum equations and Gaber's thermodynamic cycle.

4. Theoretical and applied aspects of real and chemical energetics of solvation.

5. The modern concept of the mechanism of solution formation.

6. Thermodynamic justification of the Debye-Hückel theory from the point of view of modern electrostatic theories.

7. Application of the Debye-Hückel theory to solutions of weak electrolytes and the effect of ionic strength of solutions on the rate of ionic reactions.

8. Fundamentals of statistical thermodynamics. Characteristics of macro and micro systems. Thermodynamic probability and distribution function.

9. Distribution functions of Gibbs ensembles. Boltzmann's Law on energy distribution of molecules.

10. According to the state of the molecular compound: translational, rotational, vibrational, electronic and nuclear rotation.

11. Theoretical and applied aspects of active collision theory.

12. Theoretical and applied aspects of activated complex theory. Eyring's model.

13. Statistical and thermodynamic justification of the activated complex theory.

14. Electrochemical reaction rate. Diffusion and kinetic mode of electrochemical processes.

15.The theoretical basis of concentration and electrochemical polarization.

# 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 (onor 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.

# Imporant!

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. C.R. Metz Theory and Problems of Physical Chemistry / McGraw-Hill, 1974.

2. Clyde R. Metz Theory and Problems of Physical Chemistry / McGraw-Hill; First edition (January 1, 1976).

3. Dr. RK Gupta Problems in Physical Chemistry / JEE Main and Advanced - 518 р.

4. Kenneth Schmitz Рhysical Chemistry Concepts and Theory /1st Edition - November 11, 2016.

5. Оспанова А.К., Шабикова Г.Х., Сыздыкова Л.И. Физикалық химиянын теориялары мен мәселерi. Алматы. 2021. с 191.

6. Г.Х. Шабикова, Л.И. Сыздыкова Современное состояние теории сольватации и растворения. Алматы. 2010.

Internet resources:

1. http://elibrary.kaznu.kz/ru

2. https://www.coursera.org/learn/physical-chemistry

3. https://teach-in.ru/lecture/09-02-Korobov