

al – Farabi Kazakh national University
Faculty of chemistry and chemical technology
Department of physical chemistry, catalysis and petrochemistry

Program of final exam on discipline

FH 2212 «Physical chemistry, 1»
6B05301 – Chemistry

Almaty 2022 y.

The program of final exam is composed by senior 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

«28» September 2022 y., protocol № 3

Head of department _____ Ye.A.Aubakirov

Introduction

The form of the exam: standard, written

Exam platform: UC “Univer”

Type of exam - offline

Exam control - video cameras in the classroom and a teacher

Duration: 3 hours to answer the questions.

Topics for which assignments will be compiled

1. Physical chemistry, methods of its research, basic concepts. The first law of thermodynamics, its definitions, analytical formula. Hess's law, its consequences.
2. Heat capacity, its dependence on various factors. Mayer's equation. Temperature dependence of the thermal effect of a chemical reaction, Kirchhoff's equation.
3. Application of the first law of thermodynamics to various processes involving ideal gases.
4. The second law of thermodynamics, its concepts. Carnot cycle and Carnot's principle. Efficiency of an ideal heat engine. Entropy.
5. Entropy is a criterion for the direction of the process (constructive condition). Equations for calculating the change in entropy in various processes. Planck's postulate.
6. Thermodynamic potentials. Characteristic functions and their natural variables. Comparative characteristics of thermodynamic functions (ΔU , ΔH , ΔS , ΔF , ΔG) as a criterion for the direction of the process.
7. Chemical potential, its relationship with thermodynamic functions and composition of the system. Chemical potential of a component in ideal and real solutions. Activity, activity coefficient.
8. Homogeneous equilibrium, its features and conditions. Isothermal equations of chemical reactions and directions of processes for various homogeneous systems. The law of mass interaction and the equilibrium constant of a chemical reaction.
9. Temperature dependence of the equilibrium constant. Isobaric and isochoric Van't Hoff equations.
10. Phase, components, constituent. Heterogeneous chemical systems, equilibrium conditions in them. Gibbs Phase Rule. Clapeyron-Clausius equation. Description of the state of the water diagram by the Clapeyron-Clausius equation and the Gibbs phase rule. Phase transitions of types 1 and 2, their features.
11. Melting diagram of a two-component system: one-eutectic systems, systems in which components interact chemically (forming compounds with congruent and incongruent melting points). Solid solutions, their formation by penetration

and displacement. Melting diagram of solid solutions. Gibbs-Rosebohm Rules I and II.

12. Solubility of two and three liquids in each other. Methods for displaying the composition of a three-component system. Tarasenkov's rule. Crisis melting points. Extraction.

13. Thermodynamic properties of ideal liquid solutions. Real solutions. Raoult's law. Thermodynamic substantiation of the linear dependence of the total and partial vapor pressure on the composition of the system for ideal systems.

14. Boiling point (vapor pressure) - composition (t , P - x) diagrams. Gibbs-Konovalov laws I and II.

15. Ebulliometry. Cryometry. Determination of the molecular weight and molecular state of the solute from cryometric or ebulliometric data. Isotonic Van't Hoff coefficient.

Rules of Exam

The student needs to come to the classroom 20 minutes before the start of the exam and prepare, to sign the attendance sheet and sit in the seat indicated on the attendance sheet. You must have an identity card or ID card, a pen, a pencil with you.

During the exam forbidden:

1. Take and open a ticket without the teacher's permission.
2. To carry unauthorized aids during the exam (cheat sheets, cell phones (turned on or off), smart watches, headphones, other electronic devices, etc.).
3. Make noise, talk, get up and leave the room.
4. Seek help from third parties.
5. Unauthorized use of books, drawings, calculators without the permission of the teacher.

Instruction for the student

Important!

1. A student who has committed a violation of any of the above requirements, which was recorded by the act, is graded "F" ("unsatisfactory") in the discipline.
2. Opening unauthorized educational materials, electronic means of communication with the student during the exam, as well as violation of these Rules is the basis for a decision to cancel the assessment results and give an "unsatisfactory" grade, regardless of whether they were used in the exam or not.

Important!

Assessment policy:

The case – tasks consist of 3 steps and they evaluate by toughly level.

First question – 30 points	Second question – 40 points
Third question – 30 points	

Recommended literature sources for exam preparation

Educational literature: basic:

1. Elements of Physical Chemistry: 6th Edition / P. Peter. Atkins. - Oxford: Oxford University Press, 2013. - 591 p.
2. Physical chemistry: a modern introduction: second Edition / updated and revised by W.M.Davis. - USA: CRC Press, 2012. - 501 p.
3. David W. Ball. Physical Chemistry. USA, Thomson Learning, 2011. 840 p.
4. Peter Atkins,Julio de Paula. Physical Chemistry, Eighth Edition. Oxford University Press, 2006. 1050 p.
5. Robert J. Silbey, Robert A. Alberty, Mounji G. Bawendi. Physical Chemistry. Hamilton Printing, 2005. 944 p.
6. Стромберг А.Г., Семченко Д.П. Физическая химия. М.: Высшая школа,- 2003, 527 с.
7. Краснов Г.С., Воробьев Н.К., Годнев И.Н. и др. Физическая химия: в 2-х книгах. М.: Вышш.школа, 1995. Кн.1,2.
8. Ira N. Levine. Physical Chemistry. Sixth Edition. New York: McGraw-Hill, 2009. 995 p.
9. Еремин В.В., Каргов С.И., Успенская И.А. и др. Задачи по физической химии. М.: Экзамен, 2005, 318 с.

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>