

Chemical faculty
Specialty - chemistry and engineering chemistry
Discipline - Analytical chemistry
Questions of the final graduation State Examination
for the academic year 2018/2019

Simple Questions

- 1 Sensitivity and the ways of increasing it.
- 2 Selectivity and the ways of improving it.
- 3 Equilibrium in heterogeneous systems. Solubility product and solubility. The factors that influence solubility.
- 4 Causes of pollution of precipitate in gravimetric analysis.
- 5 Formation and properties of precipitate, maximum saturation.
- 6 The essence and classification of titrimetric methods.
- 7 Chemical and physical deviations from the Beer's law.
- 8 Sources of radiation in atomic absorption analysis.
- 9 Methods of photometric analysis.
- 10 Construction of titration curves of strong acid with strong base.

Medium questions

- 11 Methods of precipitation titration, construction of titration curves
- 12 Construction of titration curves in the oxidation-reduction method
- 13 Calculations of the pH of strong acids and bases
- 14 Factors affecting the strength of acids and bases
- 15 Complexometric titration methods.
- 16 Luminescence, fluorescence and phosphorescence
- 17 Optimal conditions for photometric determination
- 18 Homogeneous precipitation.
- 19 Method of acid-base titration. Indicators of titration.
- 20 Complexation reactions in analytical chemistry. Equilibrium Constants and Conditional Equilibrium Constants

Complicated questions

- 21 Conductometric analysis method
- 22 Reasons for changing the color of the indicators. Ostwald's ionic theory
- 23 Atomic Spectral Analysis. The main processes occurring in the flame.
- 24 Potentiometric analysis method
- 25 Atomic emission analysis. A comparison of atomic absorption and atomic emission methods
- 26 Thermogravimetry and thermal analysis methods
- 27 Polarographic analysis method
- 28 Indicator electrodes, reference electrodes
- 29 Construction of titration curves in the complexometric analysis method
- 30 Interaction of electromagnetic beams with matter

“Kimya” fakültəsinin
əyani şöbəsi “Kimya” və “Kimya mühəndisliyi” ixtisasları üzrə “Fiziki kimya”
fənnindən
2018/2019-cu tədris ilində keçiriləcək Yekun Dövlət İmthanının sualları

Simple

1. The first law of Thermodynamics. Application in various processes.
2. Osmotic pressure. Van't Hoff equation
3. The rate of a chemical reaction. The order and molecularity of the reaction
4. Classification of electrodes. I, II type of electrodes
5. Temperature dependence of the reaction rate. Arrhenius equation. Activation energy
6. The thermodynamics derivation of the mass action law. Correlation between K_P , K_C and K_N
7. Gibbs phase rule. The phase diagram of water
8. The application of the Hess law to the calculation of the thermal effects of chemical reaction
9. Thermodynamics potentials. Maximal efficiency work
10. Specific, molar and equivalent electrical conductivities

Medium

1. The second law of thermodynamics. Entropy
2. The saturated vapor pressure. Clapeyron – Clausius equation
3. Non-ideal solutions. Derivations from Raoult's law
4. Kinetics of the irreversible first order reaction
5. Solubility of solid substances in liquids. Schroder's equation.
6. Gas solubility in liquids. Henry's law.
7. Galvanic cells. EMF and calculation of the thermodynamics functions
8. The features and kinetics of the homogeneous catalytic reactions
9. Photochemical reactions. The main rules of Photochemistry. Quantum yield
10. Vant-Hoff's chemical isotherm equation

Hard

1. Temperature dependence of the heat effect of the reaction. The Kirchoff's equation
2. Dependence of equilibrium constant on temperature. Isobar and isochor equations of Vant-Hoff
3. Liquid –vapour equilibrium in binary liquid systems. Kononov's rules
4. Chain reactions. The kinetic of unbranched chain reactions
5. Thermodynamics of the strong electrolytes. Force of ion and activity coefficient
6. Caloric coefficients and their physical meaning
7. Characteristic functions
8. Chemical potential.
9. Heterogeneous catalytic reactions and features of the heterogeneous catalytic reactions
10. Two-component systems. The phase diagrams of the systems with congruent melting

Faculty of Chemistry Department of General and Inorganic chemistry Final State Examination Themes for final state examination

Easy questions

1. Atomic orbitals and order of filling of electron shells (levels)
2. Nitrogen and Phosphorus Fertilizers. Composition, production and properties.
3. Carbon. Allotropes of carbon and properties.
4. The most significant sulfur compounds. H_2SO_4 , production and properties.
5. Nitrogen, its compounds and properties. HNO_3 , production and properties
6. Na, K. Production and properties. Production of sodium carbonate (soda)
7. Ca subgroup elements. Preparation and properties.
8. IIIA group elements. Characteristics. Production of Aluminum.
9. Ge subgroup elements. Preparation and properties. Compounds.
10. Ionic equilibrium in solutions and Ion exchange reactions.

Questions of medium complexity

1. Modern Periodic Law. Moseley's Law
2. Chemical bonds, types of chemical bonds. Characteristics of chemical bonds.
3. Hydrolysis. Mechanism of hydrolysis.
4. Si. Preparation and properties. Silicate industry.
5. Characteristics of VIIB group elements. Relationships among them.
6. Cast iron and steel production.
7. Cu. Production and properties. Coordination compounds of copper.
8. V, Nb, Ta. Production and properties. Their most significant compounds.
9. Allotropes of phosphorous. Comparison of Nitrogen and Phosphorus. Acids of Phosphorus
10. Boron. Production and properties. Boranes.

Complex questions

1. State of matter. Crystalline and amorphous solids.
2. Coordination compounds. *Werner's theory of coordination complexes*. *Nomenclature of complexes*. *Their isomerism and stability*.
3. Theories of Acids and Bases.
4. Solid solutions. Types of solid solutions. Types of phase diagrams. Daltonides and Berthollides.
5. Electrolysis. Faraday's law of electrolysis. Redox reactions.
6. Characteristics of VIIA group elements. Production and properties of fluorine and chlorine. Comparison of F_2 and Cl_2 .
7. Platinum family elements. Production and properties. Their most significant compounds.
8. Sc subgroup elements. Lanthanides. Their comparisons.
9. Chromates and Chromites and their mutual conversions.
10. VIIB group elements. Production and properties. Their most significant compounds.

Faculty of Chemistry

Specialty "Chemistry and Engineering Chemistry"

Discipline "Organic Chemistry"

Questions of the final state examination for the 2018/2019 academic year

Easy

1. Physical properties and reactions of alkanes.
2. Reactions of alkynes: hydrogenation, halogenation, addition reactions.
3. Alcohols. Nomenclature and physical properties.
4. Ethers and epoxides. Introduction.
5. Nomenclature of alkenes: JUPAC rules for naming of alkenes.
6. Alkadienes, bonding in conjugated dienes.
7. Amines. Nomenclature, physical properties.
8. Synthesis of esters: esterification.
9. Lactams. Preparation of amines through reduction of amides.
10. Aliphatic diazo compounds.

Average

Reactions of aldehydes and ketones with imines and enamines, hydrazones.

1. Physical properties of ethers. Preparation of ethers: epoxidation of alkenes.
2. Mechanism of acetal formation from aldehydes.
3. Occurrence and preparation of alkenes. The Wurtz reaction.
4. Electrophilic addition reactions of dienes: 1,2 and 1,4 addition.
5. Organolithium compounds. Preparation reaction with reactive metal halides.
6. Heterocyclic aromatic compounds.
7. Reaction of amines with nitrous acids.
8. The Grignard reagent, mechanism of preparation.
9. Heterocyclic aromatic compounds: pyrrole, furan, pyridine.

Difficult

1. Reaction mechanism of halogenation of methane.
2. The acidity of the α -hydrogen of carbonyl compounds. Tautomerism. Keton and enol forms.
3. The Mannich reaction and its mechanism.
4. Reactions of aldehydes and ketones. Hydration: electronic and steric effects.
5. Nucleophilic substitution reaction: S_{N1} , S_{N2} .
6. Carbohydrates: definition and classification.
7. Essential nutrients and antimetabolism.
8. Preparation of amines through Hoffman degradation of amines.
9. Mechanistic explanation of rate effects in aromatic reactions.
10. The sulfa drugs: sulfanyl amide. Mechanism of synthesis of sulfa drugs.