

**APPROVED at the meeting of the
Academic Council of JSC
"Sh. Yesenov Caspian University
of Technology and Engineering".
Minutes No. 09 dated May 26, 2025.**

**The program of the entrance exam for applicants to the
PhD for the group of educational programs
D121 – «Geology»**

1. 1. General provisions.

1. The program is compiled in accordance with the Order of the Minister of Education and Science of the Republic of Kazakhstan dated October 31, 2018 No. 600 'On Approval of the Model Rules for Admission to Education in Educational Organizations Implementing Higher and Postgraduate Education Programs' (hereinafter referred to as the Standard Rules).

2. The entrance examination for doctoral studies consists of an interview with the applicant conducted by the Examination Committee of the higher education institution, writing an essay, and an examination in the speciality of the educational program group.

Block	Points
1. Interview with the applicant conducted by the admissions examination committee of the higher education institution	30
2. Essay	20
3 Exam in the specialty of the educational program group	50
Total	100

3. The duration of the entrance examination is 3 hours and 30 minutes, during which the applicant undergoes an interview, writes an essay, and responds to an electronic examination ticket. The interview is conducted at the higher education institution prior to the entrance examination.

2. Procedure for the entrance examination.

1. Applicants for doctoral studies in the group of educational programs D121 - «Geology» write a problematic / thematic essay. The volume of the essay is at least 250-300 words.

The electronic examination card consists of 3 questions

Topics for exam preparation according to the profile of the group of the educational program.

Topic 1. Introduction. History of the development of science. Basic concepts of the tectonosphere. Subtopics: Development of tectonics as a science and its relationship with other sciences. What the concept of the tectonosphere includes and its field of study.

Topic 2. Tectonic movements and methods of their study.

Subtopics: Concept of tectonic plates. Theories of lithospheric plate motion. Fundamentals of Alfred Wegener's theory and stages of its development.

Topic 3. Structure of the World Ocean. Mid-ocean ridges. Seafloor spreading.

Subtopics: Origin of the Atlantic Ocean. Structure of mid-ocean ridges. Energy sources and tectonic features.

Topic 4. Submarine margins of continents. Subduction of oceanic lithosphere.

Subtopics: Oceanic trenches at continental margins. Seismicity, volcanism, and tsunamis at the boundary of continents and continental plates. Example: Japanese Islands.

Topic 5. Basic principles of lithospheric plate tectonics.

Subtopics: Distribution of major and minor lithospheric plates of the Earth and their tectonic activity. Description of major plates of Kazakhstan, their position, and tectonic history.

Topic 6. Folded (orogenic) belts of continents: structure, origin, and evolution.

Subtopics: Main epochs of folding. Their chronological classification. Regionalization of ancient folded structures in Kazakhstan. Detailed description of the Kokshetau and Northern Tien Shan fold belts.

Topic 7. Continental platforms. Platform magmatism.

Subtopics: Ancient continental platforms of Kazakhstan. Shields and platform cover. Description of the Kazakh Shield and its paleo tectonic features. Causes and consequences of platform magmatism.

Topic 8. Intraplate tectonics. Rifts, epi-platform orogeny.

Subtopics: Processes occurring during tectonic plate movement. Influence of convection on plate motion and its energy source. Role of the asthenosphere. Examples of epi-platform orogeny.

Topic 9. Ocean-floor rift genesis.

Subtopics: Description of oceanic rift genesis using the example of mid-ocean ridges of the Atlantic Ocean.

Topic 10. Continental (land-based) rift genesis.

Subtopics: Formation of continental rift genesis and processes of its development using the example of East Africa.

Topic 11. Regional folded and fault deformations. Ring structures.

Subtopics: Folded regions of Kazakhstan. Geological formations associated with ring structures. Mineral deposits related to ring structures.

Topic 12. Collision processes and fold belts.

Subtopics: Driving forces of continental tectonics and mountain building. Structures formed during collision. The Alpine-Himalayan belt and its geological characteristics.

Topic 13. Principles of tectonic zoning and tectonic maps.

Subtopics: Data used for tectonic zoning. Principles of constructing tectonic maps and systems of data collection.

Topic 14. Main geodynamic conditions.

Subtopics: Description of tectonic processes through geodynamics. Relationship between geodynamics and tectonics. Main directions of geodynamics in geology.

Topic 15. Neotectonics. Tectonic processes in Kazakhstan.

Subtopics: Analysis of modern neotectonic processes. Future changes in lithospheric plates and formation of new structures. Examples: Indo-Australian and African plates. Concept of Pangaea Ultima.

List of References

1. Tissot B.P., Welte D.H. *Petroleum Formation and Occurrence*. - Springer, 1984.
2. Turcotte D.L., Schubert G. *Geodynamics*. - Cambridge University Press, 2014.
3. Kearey P., Klepeis K.A., Vine F.J. *Global Tectonics*. - Wiley-Blackwell, 2009.
4. Condie K.C. *Plate Tectonics and Crustal Evolution*. - Butterworth-Heinemann, 1997.
5. Moores E.M., Twiss R.J. *Tectonics*. - W.H. Freeman, 1995.
6. Allen P.A., Allen J.R. *Basin Analysis: Principles and Applications*. - Wiley-Blackwell, 2013.
7. Magoon L.B., Dow W.G. *The Petroleum System: From Source to Trap*. - AAPG Memoir 60, 1994.
8. Klemme H.D., Ulmishek G.F. *Effective Petroleum Source Rocks of the World*. - AAPG Bulletin, 1991.
9. Fossen H. *Structural Geology*. - Cambridge University Press, 2016.

Discipline: “Oil Formation and Migration”

Topic 1. The process of oil formation and migration: a clear and general overview.

Subtopics: Patterns of formation of oil and gas fields according to the accepted Earth model.

Topic 2. The essence of abiogenic and biogenic origins of hydrocarbons.

Subtopics: Radiator effect of fluids in the Earth’s crust.

Topic 3. The role of tectonic movements (“mortar mill effect”) in fluid migration and Earth dynamics.

Subtopics: Migration, differentiation, and accumulation of hydrocarbons.

Topic 4. General patterns of oil and gas accumulation in the Earth’s crust.

Subtopics: Chemical composition and physical properties of gases. Chemical composition and physical properties of oil.

Topic 5. Laws of oil and gas migration.

Subtopics: Migration pathways and scales, secondary migration.

Topic 6. Vertical and lateral migration of oil and their role in the formation of oil and gas fields.

Subtopics: Types of migration.

Topic 7. Non-hydrocarbon compounds in oil and mineral components.

Subtopics: Geochemistry of oil and gas exploration.

Topic 8. Geochemical correlation of productive horizons based on oil composition.

Subtopics: Geochemical patterns of changes in oil and gas.

Topic 9. Temperature conditions. Thermocatalytic transformations. Differentiation of oils.

Subtopics: Staged processes of oil and gas formation. Catagenesis of organic matter. Carbonization process of organic matter (OM). Hydrocarbon emigration coefficient.

Topic 10. Prospects of subduction (subduction - obduction) regime of oil formation.

Subtopics: The role of source rocks in hydrocarbon formation.

Topic 11. The role of organic matter in sedimentary rocks of island arcs, accretionary prisms, and active continental margins.

Subtopics: Expanded concept of rifting and hydrocarbon formation.

Topic 12. Fundamentals of the depression regime of oil and gas formation in intracratonic basins.

Subtopics: Lateral migration. Vertical upward migration. Vertical downward migration. Processes causing hydrocarbon losses during migration.

Topic 13. Determination of total hydrocarbon migration losses. Hydrocarbon accumulation coefficient. Direct and indirect indicators of hydrocarbon migration traces.

Subtopics: Key principles of the geotectonic concept of “lithospheric plate tectonics (TLP)” as a theoretical basis of mobilism in geotectonics.

Topic 14. Natural reservoirs. Types of natural reservoirs.

Subtopics: Schemes of layered, massive, and lenticular reservoirs. Types based on salt origin. Types of accumulations.

Topic 15. Model of formation and distribution patterns of hydrocarbon fields in the Pre-Caspian Basin.

Subtopics: Role of vertical and lateral migration of oil and gas in field formation.

List of References

1. Tissot B.P., Welte D.H. *Petroleum Formation and Occurrence*. - Springer, 1984.
2. Hunt J.M. *Petroleum Geochemistry and Geology*. - W.H. Freeman, 1996.
3. Peters K.E., Walters C.C., Moldowan J.M. *The Biomarker Guide*. - Cambridge University Press, 2005.
4. Magoon L.B., Dow W.G. *The Petroleum System: From Source to Trap*. - AAPG Memoir 60, 1994.
5. Allen P.A., Allen J.R. *Basin Analysis: Principles and Applications*. - Wiley-Blackwell, 2013.
6. Bordenave M.L. *The Origin of Petroleum in Sedimentary Basins*. - Editions Technip, 1993.
7. Demaison G.J., Huizinga B.J. *Genetic Classification of Petroleum Systems*. - AAPG Bulletin, 1991.
8. Selley R.C., Sonnenberg S.A. *Elements of Petroleum Geology*. - Academic Press, 2015.
9. Lopatin N.V. *Thermal History of Sedimentary Basins and Petroleum Generation*. - (classic geochemistry works).
10. Kazakhstan and Central Asia petroleum geology research papers and geological survey reports.

Discipline: «Hydrocarbon Potential of the Northern Ustyurt Depression»

Topic 1. General characteristics of the Northern Ustyurt Depression.

Subtopics: History of formation of the Northern Ustyurt Depression and its age.

Topic 2. Age of the folded basement of Ustyurt.

Subtopics: Structural composition of the sedimentary cover. Northern Ustyurt zone. Southern Ustyurt zone.

Topic 3. Organization of exploration and assessment of hydrocarbon potential.

Subtopics: Complex of Paleozoic rock formations.

Topic 4. Permian - Triassic deposits.

Subtopics: Jurassic deposits. Lower Jurassic. Middle Jurassic.

Topic 5. Study of hydrogeological conditions of Ustyurt. Scientific works and achievements in petroleum hydrogeology of Ustyurt.

Subtopics: Review of hydrogeological studies.

Topic 6. Oligocene - Miocene aquifers. Eocene aquifer. Dissolved gases in water composition.

Subtopics: Cretaceous aquifer. Formation waters of Southern Ustyurt.

Topic 7. Geochemical characteristics of formation waters.

Subtopics: Principles of structural - hydrogeological zoning.

Topic 8. Industrial hydrocarbon potential of Jurassic, Cretaceous, and Paleogene deposits.

Subtopics: Prospects of hydrocarbon potential in pre-Jurassic deposits.

Topic 9. Structural - geomorphological analysis. Primary generalization of comparative analysis of relief structures.

Subtopics: Evaluation of hydrocarbon potential of Ustyurt. Stages of exploration and prospecting works.

Topic 10. Evaluation of hydrocarbon potential of Upper Paleozoic deposits. Direct indicators of hydrocarbon presence.

Subtopics: Industrial accumulations of oil and gas in Jurassic formations of Ustyurt.

Topic 11. Industrial hydrocarbon potential of the Northern Ustyurt Depression.

Subtopics: Field geophysical studies of Upper Permian and Lower Triassic deposits.

Topic 12. Prospects of hydrocarbon potential of pre - Jurassic deposits.

Subtopics: Hydrocarbon potential of the Mesozoic era.

Topic 13. Arystan field.

Subtopics: Analysis of hydrocarbon potential of the Kuanysh gas condensate field.

Topic 14. Shakhpakty field.

Subtopics: Features of hydrocarbon potential of the Karazhanbas field.

Topic 15. Shagyrlı - Shomyshly gas field. Subtopics: Direct prospects of hydrocarbon-bearing formations.

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1. Tissot B.P., Welte D.H. *Petroleum Formation and Occurrence*. - Springer, 1984.
2. Hunt J.M. *Petroleum Geochemistry and Geology*. - W.H. Freeman, 1996.
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4. Magoon L.B., Dow W.G. *The Petroleum System: From Source to Trap*. - AAPG Memoir 60, 1994.
5. Peters K.E., Walters C.C., Moldowan J.M. *The Biomarker Guide*. - Cambridge University Press, 2005.
6. Ulmishek G.F. *Petroleum Geology of Sedimentary Basins of Central Asia*. - AAPG Studies in Geology, 2003.
7. Kontorovich A.E. *Geology and Petroleum Potential of Sedimentary Basins of Eurasia*. - Russian Geology Reports, 2007.
8. Klemme H.D., Ulmishek G.F. *Effective Petroleum Source Rocks of the World*. - AAPG Bulletin, 1991.