Undergraduate track Program: Earth and Environmental Sciences

1. Olympiad Winner's Skill Set

To win the Olympiad, you should have a firm grasp of:

- the structure and characteristics of the Earth geospheres and biosphere
- geological processes occurring on the surface and in subsoils
- have an idea of the global relationships between the biosphere components as well as the substances circulation
- of the interaction of living organisms with the environment, the ecosystems structure and the biosphere as a global ecosystem
- of global environmental problems and the sustainable development goals, as well as modern sustainability strategies: adaptation to climate change, resource conservation, and the "green economy"

You should also have the following skills:

- assess the human resources availability
- identify minerals, rocks and ores, easily solve spatial and geological puzzles
- assess the state of natural objects by comparing their characteristics with specified norms
- establish cause-and-effect relationships between human impacts on natural systems and changes in their condition
- propose technologies for the natural resources extraction and environmental protection technologies.

2. List of degree programs

2.1 List of bachelor's programs

05.03.01 Geology
05.03.02 Geography
05.03.04 Hydrometeorology
05.03.06 Ecology and nature management

2.2 List of specialist programs

21.05.02 Applied Geology
21.05.04 Mining

3. Program Content

Water Recourses
Geography, Physics, Chemistry:
1. Hydrosphere as the Earth water shell: the main components of the hydrosphere; the forms of water in nature; the water cycle; assessment of water reserves of the world ocean; fresh waters in the hydrosphere.
Geography, Chemistry, Biology:
2. Water as a valuable natural resource: basic concepts of water use and management; water quality; water functions in natural systems and in the economy; provision of water resources in the world regions.
Chemistry, Physics, Biology:
3. Water resources protection: types of impacts on water resources; the state of water resources in the world regions; technologies for protecting water from pollution and depletion; technologies for water bodies restoring.

Geology
Geography topics:
1. Planet Earth, its structure, composition and history of evolution: basic ideas about the Earth's formation, structure and composition; integral geographical sciences (cartography, geoinformatics, geoecology); the main stages of the Earth's evolution; the Earth's crust and its components; the widespread minerals and rocks; physical and chemical concepts, regularities, phenomena and processes.
Geography, Mathematics, Physics:
2. Tectonics and structural geology, physical phenomena and geometry of geological bodies: basic ideas about tectonic structure and Earth's evolution; dynamics, kinematics; thematic maps (geographic, topographic, tectonic, structural, etc.); plane and three-dimensional geometric figures and their spatial relationship; basic concepts about forms of rock occurrence in the Earth's crust.
Geography, Mathematics, Chemistry:
3. Minerals and Energy resources, varieties and mathematical modelling: basic information about types and classifications of minerals; basic information about types and classifications of energy resources; chemical elements and their compounds; chemical and physical properties of natural substances (minerals, rocks).

Geochemistry and Geophysics
Geography:
1. Planet Earth, its structure, composition and history of evolution: basic ideas about the Earth's formation, structure and composition; integral geographical sciences (cartography, geoinformatics, geoecology); the main stages of the Earth's evolution; the Earth's crust and its components; the widespread minerals and rocks; physical and chemical concepts, regularities, phenomena and processes.
Chemistry:
2. Geochemistry: link between geology and chemistry, variety of chemical elements (The Periodic Table of Elements (or Mendeleev's Table)) and isotopes, their occurrences in the Earth and on its surface; chemical properties of inorganic and organic substances, regularities and laws, main academic and applied tasks of geochemistry.
Physics, Mathematics:
3. Geophysics: link between geology and physics; basic understanding of physical processes and physical properties on Earth; effect in the universe of physical laws discovered in terrestrial conditions; physical phenomena, processes, regularities and laws; theoretical and applied issues of geophysics; geophysical methods of studying the Earth and prospecting for minerals.

Meteorology & atmospheric sciences
Geography, Ecology, Physics:
1. Structure, properties and functions of the atmosphere: concepts of the atmospheric structure; the component composition of the modern atmosphere and the history of its formation; changes in atmospheric temperature with altitude; processes of air masses movement in the atmosphere; the role of the atmosphere in the global substances circulation; the ozone layer and the problems of its changes; methods of studying the atmosphere state; sustainable development goals related to atmosphere quality.
Geography, Physics:
2. Climatology and mineralogy; modern climate and problems of its change: concepts of weather and climate; understanding of meteorological conditions and their role in the functioning of living systems and economic objects; history of climate change in the Earth history; greenhouse gases and their impact on the Earth's climate; manifestations of climate change and their consequences; strategies for adaptation to climate change.

Ecology, Chemistry, Physics:
3. Atmospheric pollution and its prevention: ideas about models of the pollutants spread in the atmosphere; natural and anthropogenic sources of pollution and their contribution to the deterioration of atmospheric air quality; consequences of atmospheric pollution: characteristics and examples in the world regions; concepts of the atmospheric quality and quality standards; ideas about technologies for protecting the atmosphere from harmful emissions; main problems of atmospheric quality in the world regions.

Mineralogy
Geography:
1. Planet Earth, its structure, composition and history of evolution: basic ideas about the Earth's formation, structure and composition; regularities in nature, basic geologic processes such as magmatism, metamorphism, and sedimentation that affect the formation of minerals; the main stages of the Earth's evolution; the Earth's crust and its components; the widespread minerals and rocks; physical and chemical concepts, regularities, phenomena and processes; statistical patterns in the real world.
Geography, Physics:
2. Mineralogy - the science of minerals, their optical and other properties: minerals in the Earth's crust, the importance of minerals in practical human activity, the uses of minerals in industry and technology; basic properties of minerals; the amount of minerals in nature and their occurrence; mathematical explanation of processes and events of probabilistic nature; crystal structures, properties of solids and optical phenomena such as refraction and reflection of light.
Geography, Chemistry:
3. Geochemistry: link between geology and chemistry, variety of chemical elements (The Periodic Table of Elements (or Mendeleev's Table)) and isotopes, their occurrences in the Earth and on its surface; chemical properties of inorganic and organic substances, regularities and laws, main academic and applied tasks of geochemistry.

Environmental sciences
Biology, Ecology, Geography:
1. Fundamentals of ecology: relationships between living organisms and their environments. Properties and structure of populations. Environmental factors impact on organisms. Community ecology. Ecosystem structure. Succession. Biological diversity.
Biology, Ecology, Geography, Economy:
2. Nature management: natural conditions and resources. Types of nature management. Environmental and economic approach to solving problems of nature management. Environmental aspects of nature management.

Physical geography
Geography, Mathematics:
1. Climate of the globe: climate-forming factors, types of Earth climate. Human impact on the Earth climate.
Geography:
2. Landscapes and relief, geological structure: the relief concept, endogenous processes, exogenous processes, relief-forming factors, relief types, classification of natural landscapes, anthropogenic landscapes, landscape-forming, natural and anthropogenic factors.
Biology, Geography:
3. Fauna and flora (in particular, their distribution over the planet surface): the concept of biogeography. N.I. Vavilov's doctrine of the cultivated plants origin centers. Floristic regions. Faunistic regions. Biotic regions. Types of biomes. Biogeography of oceans and seas.
Geography, Mathematics:

4. Basics of cartography: Scales and their types. Cartographic projections. Sheet division and nomenclature of topographic plans and maps. Determining geographic and Cartesian ordinates of points. Topographic maps and plans. Relief depiction on topographic maps.

Ecology
Biology, Ecology, Geography:
1. Fundamentals of ecology: relationships between living organisms and their environments. Properties and structure of populations. Environmental factors impact on organisms. Community ecology. Ecosystem structure. Succession. Biological diversity.
Biology, Chemistry:
2. Fundamentals of biology: the unity of life. Structural and functional foundations of life. Cell theory. Cell structure. Living cells and life processes. Photosynthesis. Diversity of living organisms. Theory of evolution.
Geography, Biology:
3. Biodiversity: biodiversity conservation for sustainable development and environmental protection. Biological classification. Species. Species integrity and isolation. Species criteria. Relativity of species criteria. Classification of living organisms.

Mining and Mineral Processing
Geography, Chemistry, Economics:
1. Minerals: basic information about varieties and classifications of minerals; basic concepts about the formation, structure and composition of the Earth; the most widespread minerals and rocks; visual characteristics of the main minerals and rocks; physical and chemical concepts, regularities, phenomena and processes; statistical regularities in the real world.
Geography, Mathematics, Economics:
2. Exploration and geological and economic evaluation of mineral deposits: variety of minerals; plane and spatial geometric figures, their main properties; form of spatial location of a useful component and deposit; properties of geometric figures and formulas for solving problems related to calculations of volumes, percentages of useful components, economic indicators; statistical regularities in nature; quality, quantity, reserves and conditions of occurrence of a mineral; geographical and economic factors.
Mathematics, Chemistry, Geography, Physics:
3. Mining of minerals: basic chemical and physical concepts, regularities, laws and theories; physical, mechanical and chemical properties of natural material; geographical knowledge of territorial and climatic natural conditions; variety of natural events and processes (landslides, rockslides, etc.) methods of mining solid, liquid and gaseous minerals (open-pit, underground, combined open-pit-underground, borehole methods, land and sea types).
Physics, Chemistry, Geography:
4. Processing of minerals: basic chemical and physical concepts, regularities, laws and theories; general information about processing of minerals; purpose of processing and technological effect of beneficiation; classification of beneficiation processes; effect of mining and processing of minerals on the environment.

4. Recommended References
4.1. Reading List

Water Recourses

Sources in English	Topic

1. Cech T.V. Principles of water resources: history, development, management, and policy. John Wiley & Sons, 2018. 528 p. URL: https://books.google.ru/books?hl=en&lr=&id=XeU9EAAAQBAJ&oi=fnd&pg=PR5&dq=water+resources+technology+textbook&ots=oHR19Asvix&sig=26-dVIYBP-hWEQsBUbk-PALEZl0&redir_esc=y#v=onepage&q=water%20resources%20technology%20textbook&f=false (free access).	Water as a valuable natural resource Water resources protection
2. Chamberlain J.F., Sabatini D.A. Fundamentals of Water Security: Quantity, Quality and Equity in Changigng Climate. John Wiley and Sons, 2022. 464 p. URL: https://www.google.ru/books/edition/Fundamentals_of_Water_Security/IKF9EAAAQBAJ?hl=en&gbpv=1&dq=Fundamentals+of+Water+Security:+Quantity,+Quality,+and+Equity+in+a+Changing+Climate&printsec=frontcover (free access).	Water as a valuable natural resource Water resources protection
3. Lant Ch. Natural Resources Sustainability: An introductory synthesis. Publisher: Utah Education Network Digital Press with Pressbooks, 2023. 749 p. URL: https://uen.pressbooks.pub/naturalresourcessustainability/ (free access).	The hydrosphere as the Earth water shell Water as a valuable natural resource

Sources in Russian	**Topic**
1. Водные ресурсы России и их использование / Под ред. проф. И. А. Шикломанова. – СПб.: ГГИ, 2008. – 600 с. URL: https://fileskachat.com/getfile/95429_843afacaba354b1a75932bc2a6e88dfb (free access).	Water as a valuable natural resource
2. Комянко А.В. Гидросфера – водная оболочка Земли. [Электронный ресурс]. URL: https://resh.edu.ru/subject/4/ (free access).	The hydrosphere as the Earth water shell
3. Сидорова Л.П., Снигирева А.Н. Очистка сточных и промышленных вод. Электронное текстовое издание. Екатеринбург: УФУ, 2017. 127 с.	Water resources protection

https://study.urfu.ru/Aid/Publication/13594/1/Sidorova_Snigireva_.pdf (free access).	
4. Суриков В. Современные методы очистки сточных вод. Презентационные материалы. [Электронный ресурс]. URL: https://znanio.ru/media/sovremennye-metody-ochistki-stochnyh-vod-2716513 (free access).	Water resources protection
5. Управление водными ресурсами России / Колл. авт. Под ред. Р.З. Хамитова. М.: АМА-ПРЕСС, 2008. 288 с. URL: http://cawater-info.net/review/pdf/upr-vod-res-rossii.pdf (free access).	Water as a valuable natural resource
6. Яблоков В.А. Учение о гидросфере [Текст]: учеб. пос. для вузов /В.А. Яблоков; Нижегор. гос. архитектур.- строит. ун-т. – Н. Новгород: ННГАСУ, 2016. 90с. URL: https://bibl.nngasu.ru/electronicresources/uch-metod/hydrology/860641-1.pdf (free access).	The hydrosphere as the Earth water shell

Geology

Sources in English	**Topic**
1. Burzynski D., Ellis W. Fundamentals of Mathematics. Publisher: OpenStax CNX, 2008. 699 p. URL: https://open.umn.edu/opentextbooks/textbooks/fundamentals-of-mathematics (free access).	Minerals and Energy resources, varieties and mathematical modelling
2. Jeremy P. Physical Geography - Version 1. Publisher: College of the Canyons, 2020. 295 p. URL: https://open.umn.edu/opentextbooks/textbooks/physical-geography (free access).	Tectonics and structural geology, physical phenomena and geometry of geological bodies
3. Lant Ch. Natural Resources Sustainability: An introductory synthesis. Publisher: Utah Education Network Digital Press with Pressbooks, 2023. 749 p. URL: https://open.umn.edu/opentextbooks/textbooks/natural-resources-sustainability-an-introductory-synthesis (free access).	Planet Earth, its structure, composition and history of evolution

Sources in Russian	**Topic**

1. Башмаков М.И. Математика: алгебра и начала математического анализа, геометрия: учеб. для студ. учреждений сред. проф. образования. М.: Издательский центр «Академия», 2017. 256 с. URL: https://agraruorda.irk.eduru.ru/media/2023/03/27/1276788048/Matematika_algebra_i_nachala_analiza_geo_g._uchebnik_dlya_SPO_compressed.pdf (free access).	Minerals and energy resources, varieties and mathematical modelling
2. Домогацких Е.М., Алексеевский Н.И. География. Экономическая и социальная география мира: В 2 ч. Ч. 2. Региональная характеристика мира: Учебник для 10-11 классов общеобразовательных учреждений. М.: ООО «ТИД «Русское слово – РС», 2008. 488 с. URL: https://fs23.infourok.ru/file/0f50-00079ce7-e524e7d9.pdf (free access)..	Planet Earth, its structure, composition and history of evolution
3. Павлов А.Г. Учебное пособие по геологии: для школьников. М. Изд-во «Академия», 2019. 75 с. URL: http://isoinno.ru/wp-content/uploads/2019/12/Учебное-пособие-по-геологии-для-школьников-.pdf (free access).	Tectonics and structural geology, physical phenomena and geometry of geological bodies

Geochemistry and Geophysics

Sources in English	**Topic**
1. Austin S., Flowers P., Theopold K., Langley R. Chemistry - 2e. Publisher: OpenStax, 2019. 1207 p. URL: https://open.umn.edu/opentextbooks/textbooks/chemistry (free access).	Geochemistry
2. Lant Ch. Natural Resources Sustainability: An introductory synthesis. Publisher: Utah Education Network Digital Press with Pressbooks, 2023. 749 p. URL: https://uen.pressbooks.pub/naturalresourcessustainability/ (free access).	Planet Earth, its structure, composition and history of evolution
3. Urone P.P., Hinrichs R., Dirks K. College Physics - 2e. Publisher: OpenStax, 2022. 1679 p. URL: https://open.umn.edu/opentextbooks/textbooks/college-physics (free access).	Geophysics

Sources in Russian	Topic
1. Габриелян О.С. Химия. 11 класс. Базовый уровень: учеб. для общеобразоват. учреждений. М.: Дрофа, 2007. 218 с. URL: https://agraruorda.irk.eduru.ru/media/2023/03/27/1276787201/Ximiya_11_klass_Gabrielyan_O.S._2014g._compressed.pdf (free access).	Geochemistry
2. Дмитриева В.Ф. Физика для профессий и специальностей технического профиля: учебник для образоват. учреждений нач. и сред. проф. образования. М.: Издательский центр «Академия», 2013. 448 с. URL: https://drive.google.com/file/d/10v3peZ6NOklUWD1wVxA-XbVTNGfBjw72/view URL: https://djvu.online/file/9DftDVuHCoTxF (free access).	Geophysics
3. Домогацких Е.М., Алексеевский Н.И. География. Экономическая и социальная география мира: В 2 ч. Ч. 2. Региональная характеристика мира: Учебник для 10-11 классов общеобразовательных учреждений. М.: ООО «ТИД «Русское слово – РС», 2008. 488 с. URL: https://fs23.infourok.ru/file/0f50-00079ce7-e524e7d9.pdf (free access).	Planet Earth, its structure, composition and history of evolution
4. Павлов А.Г. Учебное пособие по геологии: для школьников. М. Изд-во «Академия», 2019. 75 с. URL: http://isoinno.ru/wp-content/uploads/2019/12/Учебное-пособие-по-геологии-для-школьников-.pdf (free access).	Planet Earth, its structure, composition and history of evolution

Meteorology & atmospheric sciences

Sources in English	Topic
1. Holden J. Physical Geography. The Basics. London and New York: Routhledge. Taylor and Francis Group, 2011. 168 p. URL: https://www.booksfree.org/wp-content/uploads/2022/03/Physical-Geography_-The-Basics-booksfree.org_.pdf (free access).	Structure, properties and functions of the atmosphere Climatology and meteorology; modern climate and problems of its change

2. World atlas of atmospheric pollution/ Editor: Ranjeet S. Sokhi. London, New York, Gelhi: Anthem Press, 2008. 144 p. URL: https://books.google.ru/books?hl=en&lr=&id=pp6e8M58YrQC&oi=fnd&pg=PR9&dq=textbook+atmospheric+pollution&ots=ESAnGUtGwv&sig=uLodvNPoT5fS368vsRZwAl8M5AY&redir_esc=y#v=onepage&q=textbook%20atmospheric%20pollution&f=false (free access).	Atmospheric pollution and its prevention
3. Zehnder C., Manoylov K., Mutiti S. et al. Introduction to Environmental Science: 2nd Edition. (2018). Biological Sciences Open Textbooks. Georgia College and State University, 2018. 160 p. https://oer.galileo.usg.edu/cgi/viewcontent.cgi?article=1003&context=biology-textbooks	Atmospheric pollution and its prevention

Sources in Russian	**Topic**
1. Комянко А.В. География. Раздел 7. Атмосфера – воздушная оболочка Земли. URL: https://resh.edu.ru/subject/4/ (free access).	Structure, properties and functions of the atmosphere
2. Криксунов Е.А. Экология. 10 (11) класс: Учеб. для общеобразоват. учеб. заведений / Е. А. Криксунов, В. В. Пасечник. — 6-е изд., стереотип. М.: Дрофа, 2002. 256 с. URL: https://www.booksite.ru/fulltext/kriksunov/text.pdf (free access).	Atmospheric pollution and its prevention
3. Литвинович А. В. Метеорология и климатология. Презентационные материалы. [Электронный ресурс] URL: https://znanio.ru/media/meteorologiya-i-klimatologiya-kak-nauki-2883686 (free access).	Climatology and meteorology; modern climate and problems of its change

Mineralogy

Sources in English	**Topic**
1. Austin S., Flowers P., Theopold K., Langley R. Chemistry - 2e. Publisher: OpenStax, 2019. 1207 p. URL:	Geochemistry

https://open.umn.edu/opentextbooks/textbooks/chemistry (free access).	
2. Lant Ch. Natural Resources Sustainability: An introductory synthesis. Publisher: Utah Education Network Digital Press with Pressbooks, 2023. 749 p. URL: https://open.umn.edu/opentextbooks/textbooks/natural-resources-sustainability-an-introductory-synthesis (free access).	Planet Earth, its structure, composition and history of evolution
3. Urone P.P., Hinrichs R., Dirks K. College Physics - 2e. Publisher: OpenStax, 2022. 1679 p. URL: https://open.umn.edu/opentextbooks/textbooks/college-physics (free access).	Mineralogy - the science of minerals, their optical and other properties
Sources in Russian	**Topic**
1. Габриелян О.С. Химия. 11 класс. Базовый уровень: учеб. для общеобразоват. учреждений. М.: Дрофа, 2007. 218 с. URL: https://agraruorda.irk.eduru.ru/media/2023/03/27/1276787201/Ximiya_11_klass_Gabrielyan_O.S._2014g._compressed.pdf (free access).	Geochemistry
2. Домогацких Е.М., Алексеевский Н.И. География. Экономическая и социальная география мира: В 2 ч. Ч. 2. Региональная характеристика мира: Учебник для 10-11 классов общеобразовательных учреждений. М.: ООО «ТИД «Русское слово – РС», 2008. 488 с. URL: https://fs23.infourok.ru/file/0f50-00079ce7-e524e7d9.pdf (free access).	Planet Earth, its structure, composition and history of evolution
3. Ферсман А.Е. Занимательная минералогия / А. Е. Ферсман — Изд-во «Гельветика», 2015. 163 с. URL: https://www.geokniga.org/bookfiles/geokniga-zanimatelnaya-mineralogiya_0.pdf (free access).	Mineralogy - the science of minerals, their optical and other properties

Environmental science

Sources in English	**Topic**
1. Ahad Md et al. A Textbook of Ecology, Himachal Publication, Bishal Book Complex. Banglabazar, Dhaka, 2019. 95 p. URL: https://www.researchgate.net/publication/360297819_A_Textbook_Of_Ecology (free access).	Fundamentals of ecology

2. Odum E. P. Ecology, the link between the natural and the social sciences. Oxford and IBH Publishing, 1975. 260 p. URL: https://archive.org/details/ModernBiologySeriesEugenePleasantsOdumEcologyTheLinkBetweenTheNaturalAndTheSocia/page/n5/mode/2up (free access).	Fundamentals of ecology
3. Sunal D. et al. Forest, Land, and Water: Understanding Our Natural Resources. Natural Resources Education Series. 1992. 318 p. URL: https://www.academia.edu/27770007/Forest_Land_and_Water_Understanding_Our_Natural_Resources_Natural_Resources_Education_Series (free access).	Nature management

Sources in Russian	**Topic**
1. Криксунов Е.А. Экология. 10 (11) класс: Учеб. для общеобразоват. учеб. заведений / Е. А. Криксунов, В. В. Пасечник. — 6-е изд., стереотип. М.: Дрофа, 2002. 256 с. URL: https://www.booksite.ru/fulltext/kriksunov/text.pdf (free access).	Fundamentals of ecology
2. Реймерс Н.Ф. Природопользование: словарь- справочник. М.: Мысльб 1990. 637 с. URL: https://djvu.online/file/Lhry8PrT4Erhb (free access).	Nature management
3. Федорос Е. И., Нечаева Г. А. Экология: 10–11 классы: базовый уровень: практикум. М.: Российский учебник, 2019. 384 с. URL: https://rosuchebnik.ru/upload/iblock/654/65409652a37b95469af8fb4db9732853.pdf (free access).	Fundamentals of ecology

Physical geography

Sources in English	**Topic**
1. Berdin V., Dobrolyubova Y., Gracheva E., Konstantinov P., Ryzhova N., Smirnova E., Zamolodchikov D. Climate Box An interactive learning toolkit on climate change Textbook, Moscow: RA ILF publications, 2018, 256 p.	Climate of the globe

URL: https://www.undp.org/sites/g/files/zskgke326/files/migration/eurasia/Climatebox_textbook_EN.pdf (free access).	
2. Huggett R.J. Fundamentals of Geomorphology Second Edition, London and Nye York: Routledge, Taylor and Francis Group, 2011, 533 p. URL: https://sudartomas.wordpress.com/wp-content/uploads/2012/11/fundamentalsofgeomorphology_routledgefundamentalsofphysicalgeography.pdf (free access).	Landscapes and relief, geological structure
3. Lotus Arise World distribution of Plants and Animals. UPSC, 2021 URL: https://lotusarise.com/world-distribution-of-plants-and-animals-upsc/ (free access).	Fauna and flora (in particular, their distribution over the planet surface)
4. Jeremy Patrich MA Physical Geography Zero Textbook Cost, College of Canyons, Version 1, 2020, 295 p. URL: https://open.umn.edu/opentextbooks/formats/1831 (free access).	Landscapes and relief, geological structure
5. Swanson F.J., Kratz T.K., Caine N., Woodmansee R.G. Landform Effects on Ecosystem Patterns and Processes Geomorphic features of the earth's surface regulate the distribution of organisms and processes BioScience Vol. 38 No. 2, pp 92-98 https://andrewsforest.oregonstate.edu/sites/default/files/lter/pubs/pdf/pub718.pdf (free access).	Fauna and flora (in particular, their distribution over the planet surface)
6. Uttar Pradesh Chapter 5 Topographical Maps 2015, pp 50-68 URL: https://ncert.nic.in/ncerts/l/kegy305.pdf (free access).	Basics of cartography

Sources in Russian	**Topic**
1. Алексеева Н.Н., Климанова О.А. Физическая география материков Общие закономерности Учебное пособие., М.: Географический факультет МГУ, 2012., 152 с. URL: http://media.geogr.msu.ru/Library/Books/alexeeva_klimanova_2012_fiz_geographia_materikov.pdf (free access).	Landscapes and relief, geological structure

2. Берлянт А.М. Картография. Учебник для вузов М.: Аспект. 2002, 336 с. URL: https://www.geokniga.org/bookfiles/geokniga-berlyant-am-kartografiya.pdf (free access).	Basics of cartography
3. Орлёнок В.В., Курков А.А., Кучерявый П.П., Тупикин С.Н. Физическая география: Учебное пособие / Под ред. В.В. Орлёнка. Калининград, 1998. 480 с. URL: https://jasulib.org.kg/wp-content/uploads/2023/11/7.-%D0%9E%D1%80%D0%BB%D1%91%D0%BD%D0%BE%D0%BA-%D0%92.%D0%92.-%D0%B8-%D0%B4%D1%80.-%D0%A4%D0%B8%D0%B7%D0%B8%D1%87%D0%B5%D1%81%D0%BA%D0%B0%D1%8F-%D0%B3%D0%B5%D0%BE%D0%B3%D1%80%D0%B0%D1%84%D0%B8%D1%8F.pdf (free access).	Climate of the globe
4. Радченко Т.А. Биогеография: Курс лекций: [учеб. пособие] / Т.А. Радченко, Ю.Е. Михайлов, В.В. Валдайских [Науч. ред. г. И. Махонина] Екатеринбург: Изд-во Урал. ун-та, 2015, 164 с. URL:https://elar.urfu.ru/bitstream/10995/36062/1/978-5-7996-1540-6_2015.pdf (free access).	Fauna and flora (in particular, their distribution over the planet surface)

Ecology

Sources in English	**Topic**
1. Gaston K.J. Biodiversity: an introduction / K.J. Gaston, J.I. Spicer. – 2nd ed. Cornwall: Blackwell Publishing, 1998. 191 p. URL: https://www.researchgate.net/profile/Arvind_Singh56/post/Any_related_literature_on_biodiversity_teaching/attachment/59d64edf79197b80779a8234/AS%3A494919505465344%401495009413879/download/Biodiversity+-+An+Introduction.pdf (free access).	Biodiversity
2. Odum E. P. Ecology, the link between the natural and the social sciences. Oxford and IBH Publishing, 1975. 260 p. URL: https://archive.org/details/ModernBiologySeriesEugenePleasantsOdumEcologyTheLinkBetweenTheNaturalAndTheSocia/page/n5/mode/2up (free access).	Fundamentals of ecology

3. Raven P. et al. EBOOK: Biology. – McGraw Hill, 2013. 1242 p. URL: https://archive.org/details/biologyjohn00rave (free access).	Fundamentals of biology

Sources in Russian	**Topic**
1. Беляев Д.К. Биология. Общая биология. 10-11 классы. Учебник ля общеобразовательных учреждений. Базовый уровень / П.М. Бородин, Н.Н. Воронцов и др. // М: Издательство «Просвещение». 2012, 296 с. URL: https://www.kaptech.ru/upload/files/BIBLIOTEKA/Biologija._10_-_11_klass.pdf (free access).	Fundamentals of biology
2. Криксунов Е.А. Экология. 10 (11) класс: Учеб. для общеобразоват. учеб. заведений / Е. А. Криксунов, В. В. Пасечник. — 6-е изд., стереотип. М.: Дрофа, 2002. 256 с. URL: https://www.booksite.ru/fulltext/kriksunov/text.pdf (free access).	Fundamentals of ecology
3. Понятие вида. Принципы систематики. Биология, 11 класс: уроки, тесты, задания. URL: https://www.yaklass.ru/p/biologia/11-klass/osnovy-evoliutcionnogo-ucheniia-6844066/poniatie-vida-printcipy-sistematiki-6844067 (free access).	Biodiversity

Mining and Mineral Processing

Sources in English	**Topic**
1. Austin S., Flowers P., Theopold K., Langley R. Chemistry - 2e. Publisher: OpenStax, 2019. 1207 p. URL: https://open.umn.edu/opentextbooks/textbooks/chemistry (free access).	Processing of minerals
2. Burzynski D., Ellis W. Fundamentals of Mathematics. Publisher: OpenStax CNX, 2008. 699 p. URL: https://open.umn.edu/opentextbooks/textbooks/fundamentals-of-mathematics (free access).	Exploration and geological and economic evaluation of mineral deposits

3. Patrich J. Physical Geography - Version 1. Publisher: College of the Canyons, 2020. 295 p. URL: https://open.umn.edu/opentextbooks/textbooks/physical-geography (free access).	Minerals and Energy resources
4. Urone P.P., Hinrichs R., Dirks K. College Physics - 2e. Publisher: OpenStax, 2022. 1679 p. URL: https://open.umn.edu/opentextbooks/textbooks/college-physics (free access).	Mining of minerals

Sources in Russian	**Topic**
1. Башмаков М.И. Математика: алгебра и начала математического анализа, геометрия: учеб. для студ. учреждений сред. проф. образования. М.: Издательский центр «Академия», 2017. 256 с. URL: https://agraruorda.irk.eduru.ru/media/2023/03/27/1276788048/Matematika_algebra_i_nachala_analiza_geo_g._uchebnik_dlya_SPO_compressed.pdf (free access).	Exploration and geological and economic evaluation of mineral deposits
2. Воробьев, Н. И. Обогащение полезных ископаемых/ Н. И. Воробьев, Д. М. Новик. – Минск: БГТУ, 2008. – 174 с. URL: https://www.geokniga.org/bookfiles/geokniga-obogashchenie-poleznyh-iskopaemyhnovik.pdf (свободный доступ).	Processing of minerals
3. Габриелян О.С. Химия. 11 класс. Базовый уровень: учеб. для общеобразоват. учреждений. М.: Дрофа, 2007. 218 с. URL: https://agraruorda.irk.eduru.ru/media/2023/03/27/1276787201/Ximiya_11_klass_Gabrielyan_O.S._2014g._compressed.pdf (free access).	Processing of minerals
4. Дмитриева В.Ф. Физика для профессий и специальностей технического профиля: учебник для образоват. учреждений нач. и сред. проф. образования. М.: Издательский центр «Академия», 2013. 448 с. URL: https://djvu.online/file/9DftDVuHCoTxF (free access).	Mining of minerals
5. Домогацких Е.М., Алексеевский Н.И. География. Экономическая и социальная	Minerals and Energy resources

география мира: В 2 ч. Ч. 2. Региональная характеристика мира: Учебник для 10-11 классов общеобразовательных учреждений. М.: ООО «ТИД «Русское слово – РС», 2008. 488 с. URL: https://fs23.infourok.ru/file/0f50-00079ce7-e524e7d9.pdf (free access).	

4.2. Recommended Online Courses

Water Resources

Online courses in English	Link	Summary
Surface Water Quality: management and modeling	Surface Water Quality: management and modeling (Stepik) URL: https://stepik.org/course/89365	The course contains sections on modeling surface water pollution and methods for its prevention and elimination, taking into account water quality standards and characteristics of polluting agents. The course can be used in interdisciplinary programs and to expand the knowledge of representatives of the regional administration, legal, medical and engineering sectors on the role and methods of maintaining the quality of surface waters in the economy and social life of the region. The course is of interest both for territories where there is a need to maintain high quality of surface waters in the absence or low level of compliance with quality standards, and for territories that successfully maintain the quality of surface waters, but are interested in optimizing and increasing the efficiency of relevant procedures.
Environmental Standards and Norms for the Sustainability	Environmental Standards and Norms for the Sustainability (Stepik) URL: https://stepik.org/course/74537	The course provides the scientific basis and practical examples of the development of environmental quality standards and environmental impact standards are presented. In particular, for the purpose of

		preserving the quality of water resources.
Water Science and Water Management	Water Science and Water Management (Stepik) URL: https://stepik.org/course/198492/promo?search=4651337272	The course contains information on the following topics: Precipitation as part of the hydrological cycle, types of precipitation, precipitation rate, precipitation infiltration, formation of surface runoff. Surface runoff as part of the hydrological cycle and as an object of water use, surface runoff patterns. Diffuse runoff, surface runoff quality. Rivers as natural objects and sources of water use. Groundwater as natural objects and as a source of water use. Hydrological regimes of river runoff for water resources management. River catchments, their structure, water use and impact on the river catchment and water quality. River runoff measurements, units of measurement, accuracy, various measurement systems in the world.

Online courses in Russian	**Link**	**Summary**
Geography. Section 6. Hydrosphere – the Earth's water shell	Geography. Section 6. Hydrosphere – the Earth's water shell (Resh.edu) URL: https://resh.edu.ru/subject/lesson/799/	A selection of video materials on the main sections of the school curriculum in the discipline "Geography".
History of water supply	History of water supply (Stepik) URL: https://stepik.org/course/188929/promo?search=4651384973	The course is aimed at forming an idea of the history of the development of water supply and sanitation systems in Russia and the world. The material is focused on issues of professional competence of future specialists in the field of water supply and sanitation. The course contains historical information concerning the development of water supply and sanitation systems.

Rational use of aquatic ecosystems	Rational use of aquatic ecosystems. Lectures of V Petrosyan (MSU) (RuTube) URL: https://rutube.ru/video/a715af41a993c41c9f6d388fb9d6746f/	The course of lectures by the leading scientist of Lomonosov Moscow State University V. Petrosyan covers the main problems of water use, the problems of water pollution by blue-green algae and cyanobacteria as a result of the negative impact of human economic activity on aquatic ecosystems are considered.
Hydrology	Hydrology. Lectures 1-19. Frolova N.L., Dobrolyubov S.A. Faculty of Geography, Moscow State University (teach in) URL: https://teach-in.ru/course/hydrology-dobrolubov	The course forms an understanding of the most general patterns of processes in the hydrosphere, provides a description of the features of the geographical distribution of water bodies, examines information on the main methods of studying water bodies and hydrological processes, and analyzes the impact of water bodies on the population, economy, and aquatic ecosystems.

Geology

Online courses in English	**Link**	**Summary**
Planet Earth...and You!	Planet Earth...and You! (Coursera) URL: https://www.coursera.org/learn/planet-earth	The course presents some chapters of the geography science, revealing the geological structure of the Earth, its evolution, modern geological processes, minerals and energy resources. Shows such phenomena and processes as earthquakes, volcanic eruptions, mountain formation, ice ages, landslides, floods, evolution of life, and plate movement. Basic characteristics of volcanoes, types of eruptions, and typical rocks found in them are reviewed. Also important is an understanding of the energy and mineral production processes on which modern society depends.

DelftX: Pre-University Physics	DelftX: Pre-University Physics (edX) URL: https://www.edx.org/learn/physics/delft-university-of-technology-pre-university-physics?irclickid=zYM3lYz9IxyKRa30qrT6uyWVUkCxLzRiSShyw40&utm_source=affiliate&utm_medium=guru99&utm_campaign=Online%20Tracking%20Link_&utm_content=ONLINE_TRACKING_LINK&irgwc=1	This introductory course covers all the basics of physics and is broad enough to repeat the material. The course covers the basic topics of physics (mechanics, electricity and magnetism, waves). Geology, geophysics, mineralogy, mining and mineral processing are just a few of the very important fields that require an understanding of physics.
DelftX: Pre-University Chemistry	DelftX: Pre-University Chemistry (edX) URL: https://www.edx.org/learn/chemistry/delft-university-of-technology-pre-university-chemistry?index=product&queryID=62debe216b69ef383ec09c9995a8bc10&position=8&linked_from=autocomplete&c=autocomplete	The course contains the basics of general chemistry, organic chemistry, and inorganic chemistry. It includes the performance of quantitative calculations and the application of the basis of calculations to solve chemical problems, as well as combining knowledge of different areas of chemistry to solve complex tasks.
Geoscience: the Earth and its Resources	Geoscience: the Earth and its Resources (TUDelft) URL: https://online-learning.tudelft.nl/courses/geoscience-the-earth-and-its-resources/	The course contains information about the Earth's interior and the processes that form mountains and sedimentary basins, the two most important sources of underground energy: hydrocarbons and geothermal energy. The course deals with fundamental processes, the study of their nature and quantitative interactions.
Fundamentals of Geology	Fundamentals of Geology (Class Central) URL: https://www.classcentral.com/course/swayam-fundamentals-of-geology-292958	The course reviews the fundamental physical processes necessary to understand earth system sciences and a variety of geologic events. Aspects of the Earth's origin and its place in space, the formation and identification of minerals and rocks, various terrestrial and surface processes, volcanism, earthquakes, and groundwater are presented.

Online-courses in Russian	**Link**	**Summary**

Geography (Fundamentals of Earth Sciences)	Geography (Fundamentals of Earth Sciences) (Stepik) URL: https://stepik.org/84400	The course deepens understanding of the spatial heterogeneity of the Earth's surface across various levels of differentiation, from planetary to local. It explores the geographical features of nature and populations in different regions, including Russia, and provides a comprehensive view of the modern world and Russia's place within it. The course also enhances cartographic literacy, clarifies basic geographical concepts and terms, and helps identify and explain the essential features of geographical objects and events, emphasizing cause-and-effect relationships. Additionally, it fosters an understanding of the environment, focusing on its preservation and rational use.
Adapted Physics Course for First Year Students	Adapted Physics Course for First Year Students (Stepik) URL: https://stepik.org/57400	The course reviews the fundamental chapters of science such as mechanics, molecular physics, and thermodynamics.
General Chemistry	General Chemistry (Open Education) URL: https://openedu.ru/course/misis/CHM/	The course contains the main chapters of chemistry and is accompanied by video clips of some chemical experiments. The chapters contain detailed information about the structure of atom and substance, formation and properties of substances, chemical and electrochemical processes, kinetic and thermodynamic assessment of their possibility of occurrence; the variety and formation of complex compounds and various aspects of their application.
General geology. Planet Earth: formation, structure, evolution	General geology. Planet Earth: formation, structure, evolution (Open Education) URL: https://openedu.ru/course/msu/EARTH/	The course is oriented to the formation of understanding of geology as a science about the Earth. It is focused on various issues of formation, structure and evolution of the Earth as a planet. The course consists of

		11 lectures discussing the formation of the Earth as a planet; its internal structure and methods of study; modern geological processes, including earthquakes, volcanism, glaciation, weathering, oceans, surface and underground water, karst, rockslides, landslides; tectonics of lithospheric plates and a number of other problems of dynamic and general geology, including the prediction of catastrophic natural events.
Introduction to mineral geology	Introduction to Mineral Geology (Open Education) URL: https://openedu.ru/course/spbu/GEOLOGYMIN/	The course presents information in the field of mineral geology, including the formation, regularities of location and features of solid mineral deposits, geological and industrial types of deposits within the framework of genetic classification.

Geochemistry and Geophysics

Online-courses in English	**Link**	**Summary**
DelftX: Pre-University Chemistry	DelftX: Pre-University Chemistry (edX) URL: https://www.edx.org/learn/chemistry/delft-university-of-technology-pre-university-chemistry?index=product&queryID=62debe216b69ef383ec09c9995a8bc10&position=8&linked_from=autocomplete&c=autocomplete	The course contains the basics of general chemistry, organic chemistry, and inorganic chemistry. It includes the performance of quantitative calculations and the application of the basis of calculations to solve chemical problems, as well as combining knowledge of different areas of chemistry to solve complex tasks.
DelftX: Pre-University Physics	DelftX: Pre-University Physics (edX) URL: https://www.edx.org/learn/physics/delft-university-of-technology-pre-university-physics?irclickid=zYM3lYz9IxyKRa30qrT6uyWVUkCxLzRiSShyw40&utm_source=affiliate&utm_medium=guru99&utm_campaign=Online%20Tracking%20Link_&utm_co	This introductory course covers all the basics of physics and is broad enough to repeat the material. The course covers the basic topics of physics (mechanics, electricity and magnetism, waves). Geology, geophysics, mineralogy, mining and mineral processing are just a few of the very important fields that require an understanding of physics.

	ntent=ONLINE_TRACKING_LINK&irgwc=1	
LSE: An Introduction to Pre-University Mathematics	LSE: An Introduction to Pre-University Mathematics (edX) URL: https://www.edx.org/learn/math/the-london-school-of-economics-and-political-science-an-introduction-to-pre-university-mathematics?index=product&objectID=course-47e58eaa-191b-465f-ace4-a5156d5ad8a7&webview=false&campaign=An+Introduction+to+Pre-University+Mathematics&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fmath	The course introduces the basic concepts and methods of mathematics with an emphasis on their application. The basic skills developed in the course are: working with and using algebraic expressions; graphing, differentiating, and integrating simple functions; and calculating basic quantities in financial math. Related skills developed in this course include algebra, basic math, calculus, differential calculus, elementary algebra, integral calculus, and linear equations.
SchoolYourself: Introduction to Geometry	SchoolYourself: Introduction to Geometry (edX) URL: https://www.edx.org/learn/geometry/schoolyourself-introduction-to-geometry?index=product&objectID=course-fbef1d85-0ece-434b-8131-417658de3e5f&webview=false&campaign=Introduction+to+Geometry&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fgeometry	The course reviews the fundamentals of geometry, examining the rules for changing angles, definitions and applications of polygon properties, the relationship between line segments and angles in circles, gradually progressing to advanced theorems and proofs of two- and three-dimensional figures.
Planet Earth...and You!	Planet Earth...and You! (Coursera) URL: https://www.coursera.org/learn/planet-earth	The course delves into key aspects of geography, exploring the Earth's geological structure, its evolution, and contemporary geological processes, including the formation and distribution of minerals and energy resources. It examines phenomena such as earthquakes, volcanic eruptions, mountain formation, ice ages, landslides, floods, the evolution of life, and plate tectonics. The course also reviews the basic characteristics

		of volcanoes, types of eruptions, and the typical rocks associated with them, while emphasizing the energy and mineral production processes that underpin modern society.
Geology – Geochemistry	Geology – Geochemistry (Class Central) URL: https://www.classcentral.com/course/swayam-geology-geochemistry-14083	The course introduces the general concepts and principles of geochemistry. The focus is on basic knowledge of crystal chemistry, types of chemical bonds, coordination numbers, colloids in the geological system, ion exchange and geological evidence of earlier colloids, an elementary view of the Mendeleev table, and the composition of planets and meteorites, etc.

Online courses in Russian	**Link**	**Summary**
General Chemistry	General Chemistry (Open Education) URL: https://openedu.ru/course/misis/CHM/	The course contains the main chapters of chemistry and is accompanied by video clips of some chemical experiments. The chapters contain detailed information about the structure of atom and substance, formation and properties of substances, chemical and electrochemical processes, kinetic and thermodynamic assessment of their possibility of occurrence; the variety and formation of complex compounds and various aspects of their application.
Adapted Physics Course for First Year Students	Adapted Physics Course for First Year Students (Stepik) URL: https://stepik.org/57400	The course reviews the fundamental chapters of science such as mechanics, molecular physics, and thermodynamics.
100 math lessons from Alexei Savvateev!	100 math lessons from Alexei Savvateev! (Spepik) URL: https://stepik.org/195511	The course reviews mathematical objects (permutations, polynomials, complex numbers, linear transformations of space, etc.) as elements of algebraic systems and study what laws they "live" by; presents general regularities in the structure of these systems; reveals proofs of

		fundamental theorems from different points of view; introduces transformations of a straight line, plane circle and space, their properties and classification; allows you to master many practical skills, such as solving comparisons, dividing polynomials in the plane and in the space of the plane.
Geography (Fundamentals of Earth Sciences)	Geography (Fundamentals of Earth Sciences) (Stepik) URL: https://stepik.org/84400	The course enables a detailed understanding of the spatial heterogeneity of the Earth's surface across various levels, from planetary to local scales. It explores the geographical features of nature and population in different regions, including Russia, and helps form a comprehensive view of the modern world and Russia's place within it. The course also aims to enhance cartographic literacy, deepen the understanding of key geographical concepts and terms, and identify and explain the essential features of geographical objects and events by uncovering cause-and-effect relationships. Additionally, it fosters an understanding of the environment, along with strategies for its preservation and sustainable use.
General geology. Planet Earth: formation, structure, evolution	General geology. Planet Earth: formation, structure, evolution (Open Education) URL: https://openedu.ru/course/msu/EARTH/	The course is oriented to the formation of understanding of geology as a science about the Earth. It is focused on various issues of formation, structure and evolution of the Earth as a planet. The course consists of 11 lectures discussing the formation of the Earth as a planet; its internal structure and methods of study; modern geological processes, including earthquakes, volcanism, glaciation, weathering, oceans, surface and underground water,

		karst, rockslides, landslides; tectonics of lithospheric plates and a number of other problems of dynamic and general geology, including the prediction of catastrophic natural events.

Meteorology & atmospheric sciences

Online courses in English	Link	Summary
Monitoring Atmospheric Composition. A MOOC on the role of satellite and in situ measurements for Atmospheric monitoring	Monitoring Atmospheric Composition. A MOOC on the role of satellite and in situ measurements for Atmospheric monitoring. (Copernicus) URL: https://www.atmospheremooc.org/about/about	The course introduces the role of ground-based, airborne data, and Earth observation satellite technologies in atmospheric monitoring, providing an overview of various methods used to monitor the atmosphere.
Environmental Standards and Norms for the Sustainability	Environmental Standards and Norms for the Sustainability (Stepik) URL: https://stepik.org/course/74537	The scientific basis and practical examples of the development of environmental quality standards and environmental impact standards are presented. In particular, for the purpose of preserving the quality of water resources.
Planet Earth...and You!	Planet Earth...and You! (Coursera) URL: https://www.coursera.org/learn/planet-earth	The course delves into various aspects of geography, including the geological structure and evolution of the Earth, contemporary geological processes, and the study of minerals and energy resources. It explores phenomena such as earthquakes, volcanic eruptions, mountain formation, ice ages, landslides, floods, and plate tectonics. Key topics include the characteristics of volcanoes, types of eruptions, and associated rock types. Additionally, the course emphasizes the significance of energy and mineral production processes critical to modern society.

Online-courses in Russian	Link	Summary

Climate change and its consequences	Climate change and its consequences (Spepik). URL: https://stepik.org/course/131505/promo?search=4651025610	The course aims to develop knowledge in the physical and social sciences of climate change and its impacts, including adaptation to climate change and mitigation.
Geography. Section 7. Atmosphere – the Earth's air shell	Geography. Section 7. Atmosphere – the Earth's air shell (resh.edu) URL: https://resh.edu.ru/subject/4/	A selection of presentation and video materials on the main sections of the school curriculum in the discipline "Geography".
Climatology with the basics of meteorology	Climatology with the basics of meteorology (Teach in) URL: https://teach-in.ru/course/climatology/lecture	The course contains information about the atmosphere, features of the thermal regime and humidification conditions, circulation systems, the climate system, climate classifications, climate geography, change mechanisms and climate forecasting.

Mineralogy

Online courses in English	**Link**	**Summary**
Planet Earth...and You!	Planet Earth...and You! (Coursera) URL: https://www.coursera.org/learn/planet-earth	The course delves into various aspects of geography, including the geological structure and evolution of the Earth, contemporary geological processes, and the study of minerals and energy resources. It explores phenomena such as earthquakes, volcanic eruptions, mountain formation, ice ages, landslides, floods, and plate tectonics. Key topics include the characteristics of volcanoes, types of eruptions, and associated rock types. Additionally, the course emphasizes the significance of energy and mineral production processes critical to modern society.
DelftX: Pre-University Chemistry	DelftX: Pre-University Chemistry (edX) URL: https://www.edx.org/learn/chemistry/delft-university-of-technology-pre-university-chemistry?index=product&qu	The course contains the basics of general chemistry, organic chemistry, and inorganic chemistry. It includes the performance of quantitative calculations and the application

	eryID=62debe216b69ef383ec09c9995a8bc10&position=8&linked_from=autocomplete&c=autocomplete	of the basis of calculations to solve chemical problems, as well as combining knowledge of different areas of chemistry to solve complex tasks.
RICEx: AP® Physics 2 - Part 3: Optics and Modern Physics	RICEx: AP® Physics 2 - Part 3: Optics and Modern Physics (edX) URL: https://www.edx.org/learn/ap/rice-university-ap-r-physics-2-part-3-optics-and-modern-physics	The course presents material on optics and modern physics. You will study light and its interaction with different media, the atom. These sections of physics are important for understanding mineralogy.
Mineralogy	Mineralogy URL: https://opengeology.org/Mineralogy/1-introduction/	The course reviews the fundamentals of mineralogy in the following aspects: minerals found in rocks or sediments; mineral resources and their potential uses.

Online courses in Russian	**Link**	**Summary**
Geography (Fundamentals of Earth Sciences)	Geography (Fundamentals of Earth Sciences) (Stepik) URL: https://stepik.org/84400	The course provides a detailed exploration of the spatial heterogeneity of the Earth's surface, examining its differentiation from a planetary to a local scale. It highlights the geographical features of various regions, including Russia, and aims to develop a comprehensive understanding of the modern world and Russia's place within it. The course enhances cartographic literacy, clarifies fundamental geographical concepts and terms, and focuses on identifying and explaining the key characteristics of geographical objects and events while revealing their cause-and-effect relationships. Additionally, it fosters an understanding of environmental issues and strategies for preservation and sustainable use.
General Chemistry	General Chemistry (Open Education) URL: https://openedu.ru/course/misis/CHM/	The course contains the main chapters of chemistry and is accompanied by video clips of some chemical experiments. The chapters contain detailed

		information about the structure of atom and substance, formation and properties of substances, chemical and electrochemical processes, kinetic and thermodynamic assessment of their possibility of occurrence; the variety and formation of complex compounds and various aspects of their application.
Adapted Physics Course for First Year Students	Adapted Physics Course for First Year Students (Stepik) URL: https://stepik.org/57400	The course reviews the fundamental chapters of science such as mechanics, molecular physics, and thermodynamics.
Geometry	Geometry (Stepik) URL: https://stepik.org/189586	The course contains materials in the field of stereometry and allows to form spatial thinking.

Environmental sciences

Online courses in English	**Link**	**Summary**
Ecology: from cells to Gaia	Ecology: from cells to Gaia (Stepik) URL: https://stepik.org/course/114944	The course covers fundamental principles of ecology, including evolutionary processes, population dynamics, and communities. It explores energy flow within ecosystems and examines the impact of human activities on these systems.
Biological Diversity	Biological Diversity (Stepik) URL: https://stepik.org/course/114959	The course presents an overview of the theory behind biological diversity evolution and dynamics and of methods for diversity calculation and estimation. We will become familiar with the major alpha, beta, and gamma diversity estimation techniques
Ecology: Ecosystem Dynamics and Conservation	Ecology: Ecosystem Dynamics and Conservation (Coursera) URL: https://www.coursera.org/learn/ecology-conservation	This course is an introduction to ecology and ecosystem dynamics using a systems thinking lens.

Online courses in Russian	**Link**	**Summary**
Biology and Ecology: basic concepts	Biology and Ecology: basic concepts (Open education) URL:	The course is aimed at developing an understanding of life as a material world phenomenon, its specificity,

	https://openedu.ru/course/urfu/BIOECO/?session=fall_2024	diversity, functioning and development.
Introduction to Biology and Ecology	Introduction to Biology and Ecology (Open education) URL: https://openedu.ru/course/urfu/INTROBE/?session=spring_2024	The course provides a comprehensive systematization of knowledge about life as a material phenomenon, showcasing how biological achievements can be applied in medicine, agribusiness, energy solutions, the creation of new materials—including biocompatible ones—and environmental conservation.
Environmental Protection	Environmental Protection (Open education) URL: https://openedu.ru/course/msu/ENVPROTECTION/?session=summer_2024	The course offers an overview of contemporary knowledge in nature conservation, addressing key issues such as biodiversity protection, species extinction, territorial conservation, demographic challenges, food production, energy concerns, and urbanization.

Physical Geography

Online courses in English	**Link**	**Summary**
Geography	Geography (Cursa) URL: https://cursa.app/free-courses-geography-online	The course is designed to explore the diverse aspects of the Earth's physical and cultivated landscapes. It covers a wide range of topics, including the study of natural objects such as mountains, rivers and ecosystems, as well as geographic topics such as population growth, migration patterns and cultural traditions.
The Environment of the Earth's Surface	The Environment of the Earth's Surface (Open Course Ware) URL: https://ocw.mit.edu/courses/12-090-the-environment-of-the-earths-surface-spring-2007/	The course topics include: production and movement of matter on the earth's surface; soils and soil erosion; precipitation; streams and lakes; groundwater; glaciers and their deposits. The course combines aspects of geology, climatology, hydrology, and soil science to provide a coherent introduction to the study of the earth's surface,

		emphasizing both fundamental concepts and practical applications as a basis for understanding and wisely managing the earth's physical and chemical resources.
Introduction to Biogeography	Introduction to Biogeography (Alison) URL: https://alison.com/course/introduction-to-biogeography	The course contains information on the distribution of species and problems of their conservation. The course is aimed at acquiring skills in developing innovative solutions in the field of biogeography.

Online courses in Russian	**Link**	**Summary**
Climatology with the basics of meteorology	Climatology with the basics of meteorology (Teach in) URL: https://teach-in.ru/course/climatology/lecture	The course contains information about the atmosphere, features of the thermal regime and humidification conditions, circulation systems, the climate system, climate classifications, climate geography, mechanisms climate change and forecasting.
Basics of Cartography	Basics of Cartography (Universarium) URL: https://universarium.org/course/971#!	The course is devoted to the basics of cartography as a field of science and production, including digital technologies in modern cartography. Previously, the cartographer's tools were a pen and ink, now these are modern soft- and hardware information' systems with the high-tech solutions including space technologies
Geography	Geography (Open Education) URL: https://openedu.ru/course/nsu/geo/	This course systematizes information about modern geographical research, patterns in the location of continents and oceans, and the diversity of climatic conditions.

Ecology

Online courses in English	Link	Summary
Ecology: from cells to Gaia	Ecology: from cells to Gaia (Stepik) URL: https://stepik.org/course/114944	The course covers fundamental principles of ecology, including evolutionary processes, population dynamics, and community structures. It also explores energy flow within ecosystems and examines human impacts on ecological systems.
Biological Diversity	Biological Diversity (Stepik) URL: https://stepik.org/course/114959	The course presents an overview of the theory behind biological diversity evolution and dynamics and of methods for diversity calculation and estimation. We will become familiar with the major alpha, beta, and gamma diversity estimation techniques
Ecology: Ecosystem Dynamics and Conservation	Ecology: Ecosystem Dynamics and Conservation (Coursera) URL: https://www.coursera.org/learn/ecology-conservation	This course is an introduction to ecology and ecosystem dynamics using a systems thinking lens.

Online courses in Russian	Link	Summary
Lecture course "Cell Biology"	Lecture course "Cell Biology" (YouTube) URL: https://www.youtube.com/watch?v=Gc2h5-isIEw&list=PLKqT_dWub0BhQ9piG3atoDlcdMcI-Y0qM	The course covers issues related to the cell organization and functioning. In particular, information on the cell structure, the features of the organelle's formation are provided. The mechanisms of cell reproduction and death, the principles of the bacterial films and animal tissues formation, the processes of cell communication that allow the creation of multicellular organisms, within which the life of each cell is subordinated to the interests of the whole organism are considered.
100 hours of school biology. General biology	100 hours of school biology. General biology (Teach-un) URL: https://teach-in.ru/course/one-hundred-hours-of-school-biology-general-biology	The course systematizes knowledge in the main sections of the school subject Biology

Introduction to Biology and Ecology	Introduction to Biology and Ecology (Open education) URL: https://openedu.ru/course/urfu/INTROBE/?session=spring_2024	The course systematizes knowledge about life as a material phenomenon and explores the application of biological achievements in various fields. It demonstrates how advances in biology can be applied to medicine, agribusiness, energy solutions, the creation of new materials (including biocompatible ones), and the preservation of environmental quality.

Mining and Mineral Processing

Online courses in English	**Link**	**Summary**
Planet Earth...and You!	Planet Earth...and You! (Coursera) URL: https://www.coursera.org/learn/planet-earth	The course provides an in-depth examination of geographical science, focusing on the Earth's geological structure, its evolution, and current geological processes. It covers phenomena such as earthquakes, volcanic eruptions, mountain formation, ice ages, landslides, floods, and plate movements. The course also reviews the basic characteristics of volcanoes, eruption types, and typical rocks associated with them. Additionally, it emphasizes the significance of energy and mineral production processes that are crucial for modern society.
DelftX: Pre-University Physics	DelftX: Pre-University Physics (edX) URL: https://www.edx.org/learn/physics/delft-university-of-technology-pre-university-physics?irclickid=zYM3lYz9IxyKRa30qrT6uyWVUkCxLzRiSShyw40&utm_source=affiliate&utm_medium=guru99&utm_campaign=Online%20Tracking%20Link_&utm_co	This introductory course covers all the basics of physics and is broad enough to repeat the material. The course covers the basic topics of physics (mechanics, electricity and magnetism, waves). Geology, geophysics, mineralogy, mining and mineral processing are just a few of the very important

	ntent=ONLINE_TRACKING_LINK&irgwc=1	fields that require an understanding of physics.
SchoolYourself: Introduction to Geometry	SchoolYourself: Introduction to Geometry (edX) URL: https://www.edx.org/learn/geometry/schoolyourself-introduction-to-geometry?index=product&objectID=course-fbef1d85-0ece-434b-8131-417658de3e5f&webview=false&campaign=Introduction+to+Geometry&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fgeometry	The course reviews the fundamentals of geometry, examining the rules for changing angles, definitions and applications of polygon properties, the relationship between line segments and angles in circles, gradually progressing to advanced theorems and proofs of two- and three-dimensional figures.

Online courses in Russian	**Link**	**Summary**
Geography (Fundamentals of Earth Sciences)	Geography (Fundamentals of Earth Sciences) (Stepik) URL: https://stepik.org/84400	The course aims to deepen understanding of the spatial heterogeneity of the Earth's surface across various levels of differentiation, from planetary to local scales. It explores geographical features of nature and population across different territories, including Russia, and helps to develop a comprehensive view of the modern world and Russia's role within it. The course enhances cartographic literacy, clarifies basic geographical concepts and terms, and explains the essential characteristics and cause-and-effect relationships of geographical objects and events. It also fosters an understanding of environmental issues and methods for its preservation and rational use.
Adapted Physics Course for First Year Students	Adapted Physics Course for First Year Students (Stepik) URL: https://stepik.org/57400	The course reviews the fundamental chapters of science such as mechanics, molecular physics, and thermodynamics.

Geometry	Geometry (Stepik) URL: https://stepik.org/189586	The course contains materials in the field of stereometry and allows to form spatial thinking.