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ИНСТИТУТ МЕЖДУНАРОДНЫХ ОТНОШЕНИЙ, ИСТОРИИ И ВОСТОКОВЕДЕНИЯ

Кафедра английского языка в сфере медицины и биоинженерии

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READING SCIENCE

Учебное пособие по английскому языку для студентов естественнонаучных направлений

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Предлагаемое учебное пособие предназначено для студентов естественнонаучных направлений: геология, геофизика, геология, геохимия нефти и газа и др. Основная цель пособия познакомить студентов с материалами учебно-профессиональной сферы. Разделы пособия включают тексты, содержащие профессиональную терминологию, а также задания и упражнения, способствующие формированию навыков говорения в рамках профессионального общения.

CONTENTS

ПРЕДИСЛОВИЕ

Учебное пособие **READING SCIENCE** предназначено для студентов естественнонаучного направления по специальностям геология, геофизика, геология и геохимия нефти и газа и рассчитано на обучаемых, имеющих языковую подготовку в пределах программы средней школы.

Основная цель пособия - обучить студентов названных направлений читать и понимать англоязычную литературу по широкому и узкому профилю специальности; уметь обсуждать прочитанное (высказывать своё мнение, делать выводы и т.д.).

Структура пособия: каждый из десяти разделов (Unit) содержит три текста (1,2,3) и упражнения к ним. Все тексты содержат основную терминологию, а также задания и упражнения, способствующие формированию навыков говорения в рамках профессионального общения. Тексты первой группы дают описание определённой области геологии; тексты второй группы знакомят с соответствующими профессиями и специальностями. Завершают раздел тексты, посвященные российским и зарубежным учёным – геологам.

Кроме этого, предусмотрены два раздела повторения (Revision Unit), англо-русский глоссарий (Vocabulary Notes) и ключи к упражнениям. Приложение содержит материал, который, по мнению авторов, дополняет задания разделов повторения.

UNIT ONE

Text 1.1 THE SCIENCE OF GEOLOGY.

Geology, study of the planet earth, its rocky exterior, its history, and the processes that act upon it. Geology is also referred to as earth science and geoscience. The word geology comes from the Greek *geo*, "earth," and *logia*, "the study of". Geologists seek to understand how the earth formed and evolved into what it is today, as well as what made the earth capable of supporting life.

Geologists study the changes that the earth has undergone as its physical, chemical, and biological systems have interacted during its 4.5 billion year history.

Geology is an important way of understanding the world around us, and it enables scientists to predict how our planet will behave. Scientists and others use geology to understand how geological events and earth's geological history affect people, for example, in terms of living with natural disasters and using the earth's natural resources. As human population grows, more and more people live in areas exposed to natural geologic hazards, such as floods, earthquakes, tsunamis, volcanoes, and landslides. Some geologists use their knowledge to try to understand these natural hazards and forecast potential geologic events, such as volcanic eruptions or earthquakes. They study the history of these events as recorded in rocks and try to determine when the next eruption or earthquake will occur.

They also study the geologic record of climate change in order to help predict future changes. As human population grows, geologists' ability to locate fossil and mineral resources, such as oil, coal, iron, and aluminum, becomes more important. Finding and maintaining a clean water supply, and disposing safely of waste products, requires understanding the earth's systems through which they cycle.

The field of geology includes subfields that examine all of the earth's systems, from the deep interior core to the outer atmosphere, including the hydrosphere (the waters of the earth) and the biosphere (the living component of earth). Generally, these subfields are divided into the two major categories of physical and historical geology. Geologists also examine events such as asteroid impacts, mass extinctions, and ages. ice ages.

Geologic history shows that the processes that shaped the earth are still acting on it and that change is normal.

Many other scientific fields overlap extensively with geology, including oceanography, atmospheric sciences, physics, chemistry, botany, zoology, and microbiology. Geology is also used to study other planets and moons in our solar system. Specialized fields of extraterrestrial geology include lunar geology, the study of earth's moon, and astrogeology, the study of other rocky bodies in the solar system and beyond. Scientific teams currently studying Mars and the moons of Jupiter include geologists.

http://microsoftencarta-in-english.blogspot.ru/2012/geology.html

EXERCISES

1. *Put the sentences in the order they are used in the text*

1 c 2 … 3… 4 … 5… 6… 7 …

a) Geologic history shows that the processes that shaped the earth are still acting on it and that change is normal.

b) They study the history of these events as recorded in rocks and try to determine when the next eruption or earthquake will occur.

c) Geology is the study of the planet earth, its rocky exterior, and its history.

d) They also study the geologic record of climate change in order to help predict future changes.

e) Geology enables scientists to predict how our planet will behave in terms of living with natural disasters and using the earth's natural resources.

f) Geology is also used to study other planets and moons in our solar system.

g) Geologists study the changes that the earth has undergone as its physical, chemical, and biological systems have interacted during their long history.

2. *Put the words below into the appropriate boxes*

geology, extensively, predict, solar, change, currently, through, rocky, of, system, determine, history, examine, on, biosphere, into, safely, include, it, chemical, planet, divide, major, interact, asteroid, flood, these, occur, during, around

Noun	Verb	Adjective	Adverb	Pronoun	Preposition
geology, …	determine, …	solar, …	extensively, …	it, …	into, …

3. *Read the following words:*

a) be careful to pronounce them correctly;

b) look up the translation of these words in the vocabulary notes and memorize them:

geology (n)[dʒɪ'ɔlədʒɪ]

earth (n) [ɜ:θ]

capable (adj) of smth ['keɪpəbl]

chemical (adj) ['kemɪk(ə)l]

biological (adj) [ˌbaɪəu'lɔdʒɪk(ə)l)]

to enable (v) [ɪ'neɪbl]

science (n) ['saɪən(t)s]

scientist (n ['saɪəntɪst]

natural (adj) ['nætʃ(ə)r(ə)l]

to affect (v) [ə'fekt]

expose (v) [ɪk'spəuz]

subfield (n) ['sʌbfi:ld]

record (n) ['rekɔ:d]

to record (v) [rɪ'kɔ:d]

climate (n) ['klaɪmət]

microbiology (n) [ˌmaɪkrə(u)baɪ'ɔlədʒɪ]

Text 1.2 GEOLOGIST

Can you guess the meaning of the following words (from the text below):

to extract(v)

to utilize(v) productively / effectively

oil field / site

to utilize effectively coalfields

valuable substances

A geologist is someone who studies the Earth and the processes which shape it. This field, as one might imagine, is incredibly varied, and geologists can be found working in a large number of subsets within the larger field of geology. People who like the sciences and enjoy being outdoors may find geology an interesting and rewarding career, especially if they are willing to apply themselves to a sometimes extensive field of study.

Employment prospects in this field vary, depending on the qualifications and interests of a geologist.

Geology is an incredibly large field. Geologists look at all of the materials which make up the Earth, studying the ways in which they are formed and altered. The field often requires the mingling of scientific disciplines, so a geologist may also be familiar with chemistry, mathematics, physics, geography, engineering, hydrology, environmental studies, urban planning, paleontology, biology, and mineralogy. In the course of his or her work, a geologist learns more about the Earth and the ways in which it can be safely and effectively utilized by humans.

Many geologists find employment in fields which are focused on extracting useful resources from the Earth. Geologists are often sent to various sites around the world to assess their contents, determining whether or not they can be productively mined for valuable substances ranging from garnets to coal. They also work in the petroleum industry, assessing potential oil sites and assisting with their maintenance. http://geology.com/articles/what-is-geology.shtml

EXERCISES

1. *Answer the following questions:*

1) What kind of people may find geology an interesting and rewarding career?

2) What scientific disciplines may a geologist be familiar with?

3) Where can our qualified geologists find employment?

2. *Match the words combinations with their Russian equivalents:*

1	to enjoy being outdoors	A	быть знакомым с чем-либо
2	rewarding career	B	ценные вещества
3	mingling of scientific disciplines	C	любить бывать на свежем воздухе
4	employment prospects	D	различные места по всему миру
5	to be familiar with something	E	успешная карьера
6	various sites around the world	F	связь между научными дисциплинами
7	valuable substances	G	перспективы трудоустройства

3. *Read the text and complete the following sentences:*

1) 1) A geologist is someone who_____ and the processes which_____.

2) People who like ____and enjoy _____may find geology an interesting and rewarding career, especially if they are willing _____themselves to a sometimes extensive_____ of study.

3) Employment prospects in this field vary, depending on the _____and _____ of a geologist.

4) Geology is an _____field.

5) Geologists look at all of the materials which ____, studying the ways in which they are _____ and _____.

6) A geologist may also _____ chemistry, ___, physics, geography, ____, ____, environmental studies, urban planning, _____, biology, and mineralogy.

7) A geologist learns more about the Earth and the _____ in which it can be safely and _____ utilized by humans.

8) Many geologists find ____ in fields which are focused on _____useful resources from the Earth.

9) Geologists ____ often sent to various sites around the world to assess their___.

10) They also work in the petroleum industry, assessing potential ___sites and assisting with ___maintenance.

4. *Read and analyse the sentences. Put the underlined verb forms into the appropriate place in the box.*

Base form	Past Simple	Past Participle	Present Participle

1) Employment prospects in this field <u>vary</u>, depending on the qualifications and interests of a geologist.

2) Geologists <u>look at</u> all of the materials which <u>make up</u> the Earth, <u>studying</u> the ways in which they are formed and <u>altered</u>.

3) Geologists seek to understand how the earth <u>formed</u> and <u>evolved</u> into what it is today.

4) They also <u>work</u> in the petroleum industry, <u>assessing</u> potential oil sites and <u>assisting</u> with their maintenance.

5) Geology <u>is</u> an incredibly large field.

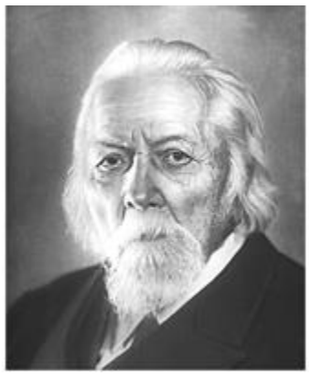
6) A geologist may also <u>be</u> familiar with chemistry, mathematics, physics, geography, engineering, and hydrology.

7) Many geologists <u>find</u> employment in fields which are <u>focused</u> on extracting useful resources from the Earth.

Text 1.3 Alexander Karpinsky

Founder of the Russian Geological Research School

1847 – 1936



Alexander Petrovich Karpinsky a prominent Russian geologist and mineralogist, social activist, founder of the Russian Geological Research School, a member of the

Academy of Sciences of the USSR, the first elected president of the Russian Academy of Sciences, President of the Russian Mineralogical Society, one of the organizers and director of the Geological Committee was born in Turyinskiye Rudniki Krasnoturyinsk, Sverdlovsk region, the Urals. He comes of a family of miners.*****

Karpinsky studied at St. Petersburg Mining Cadet Corps. Having obtained a diploma of mining engineer, he began to conduct geological studies in the Urals, and in 1868 started lecturing on geognosy (historical geology), and petrography at the Mining Institute. In 1886 Karpinsky was elected assistant professor of the Petersburg Academy of Sciences; in 1889 - a supernumerary academician****** and in 1896 - a staff academician. Many of well-known domestic scientists and leading specialists from different fields of natural sciences were once pupils of this in the words of Lunacharsky charming "grand old man", the "father of Russian Geology".

From 1916 he had been serving as vice-president of the Academy, and in 1917 became its first elected president and remained at the post for 20 years until his death. During the presidency of Karpinsky a lot of work had been made to expand the network of academic institutions and structures. The scientist permanently represented the Russian geological science at the International Geological Congresses.

From 1899 to 1936 Karpinsky had been presiding the Russian Mineralogical Society, had been chairing for a long time the Geological Branch of the St. Petersburg Society of Naturalists.

Scientific work of Karpinsky was multifaceted. His research encompasses works on paleontology, stratigraphy and tectonics, petrology, geology and mineral resources. He was the first to describe the main features of the tectonic structure of the Russian platform. Palaeogeographic method he had developed to solve the tectonic problems had been for a long time the basis of the works on the geology of platform areas.

A.P.Karpinsky demonstrated the dependence of distribution of land and sea in the past geological periods on the oscillatory movements of the crust. His geological and petrographic studies were closely related to practical geology and served as the basis for broad practical forecasts in mineral prospecting. He participated in the drafting of geological map of Europe and the unification of graphic notations in geology. His main research was chiefly done in the Ural Mountains, and he completed the first geological map of European Russia. The international recognition of the scientist came to him in Italy (Bologna) on the 2nd Session of the International Geological Congress(1881) where he was awarded the second

Prize for the essay "The experience of a systematic unification of graphic notations in geology."

In 1882 the state geological agency was organized, named the Geological Committee and Karpinsky took an active part in its establishing and organizational activities. In a relatively short period of time the Committee redeveloped the stratigraphy of the entire European part of Russia and the Urals, which resulted in the issue of a supplemented geological map of the region. Also were published a series of geological and paleontological monographs, many of which are now classics. The researcher developed the Russian part of the International Geological Map of Europe, which was highly appreciated and recognized worldwide in 1897 at the St. Petersburg International Geological Congress. For the collection of scientific papers Karpinsky was awarded Konstantinov Gold Medal of the Russian Geographic Society (1892) and J.L.Cuvier Prize of the French Academy of Sciences (1922).

World-famous classical works by A.P. Karpinski in different areas of geological knowledge constitute the fund of the world science. His papers, relatively small in size, are particularly deep and have the novelty in the approach to any object he is studying. His tectonic history of the development of the European part of the country served as the basis for the solution of important problems in theoretical and applied geology.

The bibliography list of A.P. Karpinski creative heritage has 500 publications. His works on paleogeography and geology are widely known not only in Russia but also abroad.

Alexander Petrovich Karpinsky died July 15, 1936 in Moscow. He is buried in the Kremlin Wall Necropolis in Moscow.

In 1946 the USSR Academy of Sciences instituted a prize and a gold medal of Karpinski, awarded for outstanding work in the field of geology.

Notes to the text:

* He comes of a family of miners – Он из семьи потомственных шахтёров.

** a supernumerary academician — экстраординарный академик: a staff academician — ординарный академик)

Journal "Proceedings of the Russian Mineralogical Society" (Zapiski)...
http://www.minsoc.ru/proceedings/

EXERCISES

1. *Say if the sentences below are TRUE or FALSE*

1) Alexander Petrovich Karpinsky was born into a family of iron works engineers.

2) Alexander Petrovich Karpinsky proved to become the most talented of the big miner's dynasty.

3) Karpinsky participated in the drafting of geological map of Eurasia and the unification of graphic notations in geology.

4) The international recognition of the scientist came to him 1881 in Paris (Sorbonne).

5) Works by A.P. Karpinski constitute the fund of the world science.

6) Alexander Petrovich Karpinsky, a member of the Academy of Sciences of the USSR, was one of the founders and creators of petroleum geology as an independent branch of geological science in the world.

7) Although A.P. Karpinski’s papers were not voluminous, still they proved to give profound observations.

2. *Find these words or word combinations in the text and translate them into Russian:*

to conduct geological studies; lecturing on geognosy; to chair the society; well-known domestic scientists; its first elected president ; was first to prove the dependence; highly appreciated and recognized worldwide; served as the basis.

3. *Translate the sentences into English*.

1) Многие крупнейшие отечественные ученые и ведущие специалисты из разных областей естествознания учились у этого, по выражению А. В. Луначарского, благородного «отца русской геологии».

2) Отец, дед и прадед Александра Петровича трудились на шахтах. Александр оказался самым талантливым из многочисленной горняцкой семьи Карпинских.

3) А.П. Карпинский учился в Санкт-Петербургском горном институте, который он окончил в1866 г. и где он проработал 16 лет, начиная с 1868 г.

4) Золотая медаль имени Карпинского присуждается за выдающиеся научные работы в области геологии, стратиграфии.5) В 2011 г. золотая медаль имени Карпинского присуждена Жамойда Александру Ивановичу за совокупность(collection) работ в области геологии, палеонтологии, стратиграфии и геологического картирования.

4. *Be ready to have a talk on the life of A.P. Karpinski.*

a) Start with writing down comments on what you have known from the text.

b) Discuss your comments with your partner.

UNIT TWO

Text 2.1 HISTORY OF GEOLOGY

Geology originated as a modern scientific discipline in the 18th century, but humans have been collecting systematic knowledge of the earth since at least the Stone Age. In the Stone Age, people made stone tools and pottery, and had to know which materials were useful for these tasks. Between the 4th century and 1st century BC, ancient Greek and Roman philosophers began the task of keeping written records relating to geology. Throughout the medieval and Renaissance periods, people began to study mineralogy and made detailed geologic observations. The 18th and 19th centuries brought widespread study of geology, including the publication of Charles Lyell's book *Principles of Geology*, and the National Surveys (expeditions that focused on the collection of geologic and other scientific data). By the early 19th century, many people were studying geologic topics, although the term geologist was not yet in general use.

Scientists, such as Scottish geologist Charles Lyell, and French geologist Louis Constant Prevost, wanted to establish geology as a rational scientific field, like chemistry or physics. At the end of the 19th century and into the 20th century, the field of geology expanded even more. During this time, geologists developed the theories of continental drift, plate tectonics, and seafloor spreading.

In the late 18th and the 19th centuries, naturalists on voyages of exploration began to make important contributions to geology. Reports by German natural historian Alexander von Humboldt about his travels influenced the worlds of science and art. The English naturalist Charles Darwin, well known for his theory of evolution, began his scientific career on the voyage of the HMS Beagle, where he made many geological observations. American geologist James Dwight Dana sailed with the Wilkes Expedition throughout the Pacific and made observations of volcanic islands and coral reefs. In the 1870s, the HMS Challenger was launched as the first expedition specifically to study the oceans.

Expeditions on land also led to new geologic observations. Countries and states established geological surveys in order to collect information and map geologic resources.

For example, in the 1860s and 1870s King, Ferdinand V., John Wesley Powell, and George Wheeler conducted four surveys of the American West.

These surveys led to several new concepts in geology. American geologist Grove Karl Gilbert described the Basin and Range Province and first recognized laccoliths (round igneous rock intrusions). Reports also came back of spectacular sites such as Yellowstone, Yosemite, and the Grand Canyon, which would later become national parks. Competition between these survey parties finally led the Congress of the United States to establish the U.S. Geological Survey in 1879.
http://www.arenalibrary.com/Reference/b-70186/Encarta-Encyclopedia-(F-G)-pag.1525.html

EXERCISES

1. *Put the sentences in the order they are used in the text*

1 d 2 … 3… 4 … 5… 6… 7 …8 … 9 …

a) During this time, geologists developed the theories of continental drift, plate tectonics, and seafloor spreading.

b) Philosophers of the antique kept written records relating to geology.

c) Two well known scientists wanted to establish geology as a rational scientific field, like chemistry or physics.

d) The science of geology came into service in the 18th century, but systematic knowledge of the earth has been collecting since the Stone Age.

e) The publication of Charles Lyell's book *Principles of Geology* took place.

f) Laccoliths were first recognized (round igneous rock intrusions) in Range Province.

g) The English naturalist, Charles Darwin, well known for his theory of evolution, began his scientific career on the sea voyage around world, where he made many geological observations.

h) A group of scientists conducted four surveys of the American West.

i) Mineralogy was studied and detailed geologic observations were made throughout the Medieval and Renaissance periods.

2. *Feel the gaps in the summary of the text you have read.*

Humans have been (1) _____ systematic knowledge of the earth since at least the Stone Age. Between the 4th century and 1st century BC, (2) _____Greek and Roman philosophers began the task of keeping written records relating to geology. Throughout the medieval and Renaissance periods, people began to study mineralogy and made detailed geologic (3) _____. By the early 19th century, many people were studying geologic topics, (4) _____ the term geologist was not yet in general use. In the late 18th and the 19th centuries, naturalists on voyages of exploration began to make important (5) _____ to geology. Reports of (6) _____ naturalists about their travels influenced the worlds of science and art. At the end of the 19th century and into the 20th century, the field of geology expanded even (7) _____.

3. *Read the following words:*

a) be careful to pronounce them correctly;

b) look up the translation of these words in the vocabulary notes and memorize them

scientific (adj) [ˌsaɪən'tɪfɪk]
to expand (v) [ɪk'spænd]
knowledge (n) ['nɔlɪʤ]
theory (n) ['θɪərɪ]
discipline (n) ['dɪsəplɪn]
naturalist (n) ['nætʃ(ə)r(ə)lɪst]
observation (n) [ˌɔbzə'veɪʃ(ə)n]
to launch (v) I [lɔ:nʧ]
throughout (pr) [θru'aut]
laccolith (n) ['lakəlɪθ]
medieval (adj) [ˌmedɪ'i:v(ə)l]
igneous (adj) ['ɪgnɪəs]
mineralogy (n) [ˌmɪn(ə)'rælədʒɪ]
intrusion (n) [ɪn'tru:ʒ(ə)n]

Text 2.2 PETROLEUM GEOLOGIST

Can you guess the meaning of the following words (from the text below)?

region (n)
seabed (n)
subsurface(n)
surface rocks
hydrocarbon(n)
a governmental agency
global positioning systems (GPS)
Geographic Information systems (GIS) promote(v)
graphing software
grant certification

A petroleum geologist uses his or her expert knowledge of geological principles to determine the location and size of crude oil deposits. He or she might work for an oil or gas company, a governmental agency, or as an independent contractor, exploring different locations and pinpointing oil reserves. A petroleum geologist might use advanced computer technology to survey a region so that he or she can inform other experts how and where to drill.

Scientists usually spend a great amount of time conducting field research. A petroleum geologist may work alone or with a team of other professionals, exploring land and ocean seabed for oil deposits. He or she will look for signs that oil may be present in a certain location by taking samples of surface rocks and drilling a small sample well to collect subsurface sediments. Rock samples are evaluated using microscopes, geochemical analysis kits, and other laboratory equipment, to determine the presence of hydrocarbons and other minerals consistent with oil-rich areas.

Modern petroleum geologists frequently employ global positioning systems (GPS) and geographic information systems (GIS) to help them identify and record the locations of new reserves. Using information gathered by GIS and GPS devices, three-dimensional graphing software, and physical samples, a petroleum geologist can determine the exact location of a crude oil deposit, the likely yield, and the depth to which companies should drill.

Geologists usually consider the environment and ecosystems surrounding a potential drill site, and promote careful drilling practices to minimize pollution and disturbances to the earth.

To become a petroleum geologist, a person must typically receive at least a bachelor's degree from an accredited university. Some employers, especially government agencies, require new geologists to hold master's or doctoral degrees. In addition, a beginning petroleum geologist may choose to take a certification exam in order to improve his or her credentials and increase the chances of finding employment. In the United States, the American Association of Professional Geologists (AAPG) offers certification. Many other countries have similar nationally recognized boards which grant certification to petroleum geologists.

The demand for knowledgeable petroleum geologists is generally strong. The dwindling oil supply worldwide is creating new jobs for scientists to find new reserves and maximize the output of known wells. Experts are contracted to conduct new expeditions in unexplored areas, such as Antarctica and deep ocean beds. Geologists are needed to better explore Canadian territories and Alaskan regions, here glaciers and expanses of tundra likely entrap significant petroleum reserves.
http://www.wisegeek.com/what-does-a-petroleum-geologist-do.html

EXERCISES

1. *Answer the following questions*:

1) Where can petroleum geologists be employed and use his or her expert knowledge?

2) Why do petroleum geologists study rock samples and drill a small sample well? What signs are they looking for?

3) What education should people receive to become a petroleum geologist?

4) Do you think the demand for knowledgeable petroleum geologists is generally strong in Russia and Tatarstan?

2. *Match the words combinations with their Russian equivalents:*

1	to promote careful drilling	A	использовать систему спутниковой навигации (GPS)
2	to employ global positioning systems (GPS)	B	проводить новые экспедиции в неисследованные области
3	to maximize the output of known wells	C	максимизировать объём добычи действующих скважин
4	location and size of crude oil deposits	D	уменьшить загрязнение и повреждения
5	to minimize pollution and disturbances	E	спрос на хорошо подготовленных геологов нефтяников
6	the demand for knowledgeable petroleum geologists	F	расположение и размеры месторождений сырой нефти
7	to conduct new expeditions in unexplored areas	G	способствовать осторожному бурению

3. *Render the text given below in English*:

Геологи-нефтяники – это специалисты, занимающиеся добычей и подсчётом запасов нефти, газа и других горючих полезных ископаемых *(combustible fuel),* залегающих на суше и в океане. Профессиональная деятельность геологов-нефтяников в первую очередь связана с определением местоположения и количества этих горючих ископаемых. Такая работа требует от геолога понять происхождение, количество горючих минералов в нефтяном бассейне *(the amount of fuel in the reservoir),* а также их зрелость (maturity) и концентрацию.

Геологи-нефтяники используют различные методы поиска (prospecting) для определения необходимых данных, в том числе геохимический анализ; применяют наземные гидролокаторы *(apply ground-based sonars),* а также спутниковое картографирование для обнаружения нефтяных месторождений. В некоторых случаях такие геологи могут работать бок о бок *(side-by-side)* с нефтяными компаниями.

Text 2.3 The Founder of Modern Geology

James Hutton
(1726–1797)

James Hutton (1726–1797), a Scottish farmer and naturalist, is known as the founder of modern geology. He was a great observer of the world around him. More importantly, he made carefully reasoned geological arguments. Hutton came to believe that the Earth was perpetually being formed; for example, molten material is forced up into mountains, eroded, and then eroded sediments are washed away.

He recognized that the history of the Earth could be determined by understanding howprocesses such as erosion and sedimentation work in the present day. His ideas and approach to studying the Earth established geology as a proper science.

In the late eighteenth century, when Hutton was carefully examining the rocks, it was generally believed that Earth had come into creation only around six thousand years earlier (on October 22, 4004 B.C., to be precise, according to the seventeenth century scholarly analysis of the Bible by Archbishop James Ussher of Ireland), and that fossils were the remains of animals that had perished during the Biblical flood. As for the structure of the Earth, "natural philosophers" agreed that much bedrock consisted of long, parallel layers which occurred at various angles, and that sediments deposited by water were compressed to form stone. Hutton perceived that this sedimentation takes place so slowly that even the oldest rocks are made up of, in his words, "materials furnished from the ruins of former continents." The reverse process occurs when rock exposed to the atmosphere erodes and decays. He called this coupling of destruction and renewal the "great geological cycle," and realized that it had been completed innumerable times.

Hutton came to his chosen field by quite a roundabout route. Born in Edinburgh in 1726, he studied medicine and chemistry at the Universities of Edinburgh,

Paris, and Leiden, in the Netherlands, and then spent fourteen years running two small family farms. It was farming that gave rise to Hutton's obsession with how the land could hold its own against the destructive forces of wind and weather he saw at work around him. Hutton began to devote his scientific knowledge, his philosophical turn of mind, and his extraordinary powers of observation to a subject that had only recently acquired a name: geology.

Around 1768 he moved to Edinburgh, where a visitor a few years later described his study as "so full of fossils and chemical apparatus that there is hardly room to sit down."

In a paper presented in 1788 before the Royal Society of Edinburgh, a newly-founded scientific organization, Hutton described a universe very different from the Biblical cosmos: one formed by a continuous cycle in which rocks and soil are washed into the sea, compacted into bedrock, forced up to the surface by volcanic processes, and eventually worn away into sediment once again. "The result, therefore, of this physical enquiry," Hutton concluded, "is that we find no vestige of a beginning, no prospect of an end."

Relying on the same methods as do modern field geologists, Hutton cited as evidence a cliff at nearby Siccar Point, where the juxtaposition of vertical layers of gray shale and overlying horizontal layers of red sandstone could only be explained by the action of stupendous forces over vast periods of time. There Hutton realized that the sediments now represented by the gray shale had, after deposition, been uplifted, tilted, eroded away, and then covered by an ocean, from which the red sandstone was then deposited. The boundary between the two rock types at Siccar Point is now called the Hutton Unconformity.

The fundamental force, theorized Hutton, was subterranean heat, as evidenced by the existence of hot springs and volcanoes. From his detailed observations of rock formations in Scotland and elsewhere in the British Isles, Hutton shrewdly inferred that high pressures and temperatures deep within the Earth would cause the chemical reactions that created formations of basalt, granite, and mineral veins. He also proposed that internal heat causes the crust to warm and expand, resulting in the upheavals that form mountains. The same process causes rock stratifications to tilt, fold and deform, as exemplified by the Siccar Point rocks.

Another of Hutton's key concepts was the Theory of Uniformitarianism.

This was the belief that geological forces at work in the present day—barely noticeable to the human eye, yet immense in their impact—are the same as those that operated in the past. This means that the rates at which processes such as erosion or sedimentation occur today are similar to past rates, making it possible to estimate the times it took to deposit a sandstone, for example, of a given thickness. It became evident from such analysis that enormous lengths of time were required to account for the thicknesses of exposed rock layers.

Uniformitarianism is one of the fundamental principles of earth science. Hutton's theories amounted to a frontal attack on a popular contemporary school of thought called catastrophism: the belief that only natural catastrophes, such as the Great Flood, could account for the form and nature of a 6,000-year-old Earth. The great age of Earth was the first revolutionary concept to emerge from the new science of geology.

The effect that this portrait of an ancient, dynamic planet had on the thinkers who followed in the next century was profound. Charles Darwin, for example, was well acquainted with Hutton's ideas, which provided a framework for the eons required by the biological evolution he observed in the fossil record. English geologist Sir Charles Lyell, who was born the year Hutton died and whose influential book Principles of Geology won wide acceptance

for the Theory of Uniformitarianism, wrote, “The imagination was first fatigued and overpowered by endeavoring to conceive the immensity of time required for the annihilation of whole continents by so insensible a process.” The “ideas of sublimity” awakened by this “plan of such infinite extent,” as Lyell referred to it, inspired not only Hutton’s contemporaries, but generations of geologists to come.

James Hutton | Scottish geologist | Britannica.com
http://www.britannica.com/biography/James-Hutton

EXERCISES

1. *Find these words or word combinations in the text and translate them into Russian*: carefully reasoned geological arguments; … and then eroded sediments are washed away; scholarly analysis; during the Biblical flood; natural philosophers; the reverse process occurs; it was farming that gave rise to Hutton’s obsession…; contemporary school of thought; the fossil record; generations of geologists to come.

2. *Only one of the sentences below is correct. Say which.*

A. Hutton’s approach to studying the Earth was based on:

1) the seventeenth century scholarly analysis of the Bible by Archbishop James Ussher of Ireland

2) the observation of the world around him

B. Hutton came to believe that:

1) the Earth had come into creation only around six thousand years earlier (on October 22, 4004 B.C.)

2) fossils were the remains of animals that had perished during the Biblical flood.

3) ... that the Earth was perpetually being formed;

C. The Hutton Unconformity is:

1) … the name of one of the J.Hutton’s books.

2) … the place name in the USA

3) … a steep high rock face in Scotland

4) … the contact surface between younger and older rocks representing a discontinuity in the geological record cited by J.Hutton as evidence in his research.

D. The author of one of the most influential books *Principles of Geology* was:

1). Charles Darwin

2). Charles Lyell

3). James Hutton

3. *Answer the questions to the text.*

1) How in James Hutton's view could the history of the Earth be determined?

2) What helped to establish geology as a proper science?

3) What did James Hutton call "the great geological cycle"?

4) How did a visitor describe Hutton's study in Edinburgh?

5) What is now called Hutton Unconformity?

6) Which other fundamental theory of James Hutton was severely criticized?

4. *Find in the left column definitions to the words in the right column*

A	juxtaposition	1	total destruction
B	stupendous	2	operating below the surface of the earth
C	catastrophism	3	comparison , confrontation
D	annihilation	4	having no limits or boundaries in time, space…
E	subterranean	5	deduce , conclude
F	infinite	6	an old doctrine, now discarded, that the earth was created by sudden divine acts rather than by gradual evolutionary processes
G	infer	7	tremendous

5. *Be ready to have a talk on the life of James Hutton.*

a) Start with writing down comments on what you have known from the text.

b) Discuss your comments with your partner.

UNIT THREE

Text 3.1 MINERALOGY

Mineralogy is the identification of minerals and the study of their properties, origin, and classification. The properties of minerals are studied under the convenient subdivisions of chemical mineralogy, physical mineralogy, and crystallography. The properties and classification of individual minerals, their localities and modes of occurrence, and their uses are studied under descriptive mineralogy. Identification according to chemical, physical, and crystallographic properties is called determinative mineralogy.

Minerals are classified on the basis of chemical composition and crystal symmetry. Although chemical classification is not rigid, the various classes of chemical compounds that include a majority of minerals are as follows: (1) elements, such as gold, graphite, diamond, and sulfur, that occur in the native state, that is, in an uncombined form; (2) sulfides, which are minerals composed of various metals combined with sulfur. Many important ore minerals, such as galena and sphalerite, are

in this class; (3) sulfa salts, minerals composed of lead, copper, or silver in combination with sulfur and one or more of the following: antimony, arsenic, and bismuth; (4) oxides, minerals composed of a metal in combination with oxygen, such as hematite. Mineral oxides that contain water also belong to this group; (5) halides, composed of metals in combination with chlorine, fluorine, bromine, or iodine; halite, NaCl, is the most common mineral of this class; (6) carbonates, minerals containing a carbonate group; (7) phosphates, minerals such as apatite that contain a phosphate group; (8) sulfates, minerals such as barite, containing a sulfate group; and (9) silicates, the largest class of minerals, containing various elements in combination with silicon and oxygen, often with complex chemical structure, and minerals composed solely of silicon and oxygen (silica). The silicates include the minerals comprising the feldspar, mica, pyroxene, quartz, and zeolite.

The physical properties of minerals are important aids in identifying and characterizing them. Most of the physical properties can be recognized at sight or determined by simple tests. The most important properties include powder (streak), color, cleavage, fracture, hardness, luster, specific gravity, and fluorescence or phosphorescence.

https://www.google.ru/#newwindow=1&q=Mineralogy+Mineralogy+is+the+identification+of+minerals

EXERCISES

1. *Put the sentences in the order they are used in the text.*

a) Mineral oxides that contain water also belong to this group

b) Most of the physical properties can be recognized at sight or determined by simple tests.

c) Minerals are classified on the basis of chemical composition and crystal symmetry.

d) The silicates include the minerals comprising the feldspar, mica, pyroxene, quartz, and zeolite.

e) Mineralogy is the identification of minerals and the study of their properties, origin, and classification.

f) Elements, such as gold, graphite, diamond, and sulfur occur in the native state.

g) Identification according to chemical, physical, and crystallographic properties is called determinative mineralogy.

2. *Make nouns, adjectives and adverbs from the verbs below following the model*:

determine, include, recognize, important, complex, compose, combine

verb	noun	adjective	adverb
determine	determination	determined determinative	determinedly
			inclusively
		recognisable	---
			importantly
complexity			
			composedly
		combinable	---

3. *Complete the sentences with the appropriate word from the exercise above*.

1) This chemical _____ with air to form a liquid.

2) Various classes of chemical compounds _____ a majority of minerals.

3) Minerals are classified on the basis of chemical _____ and crystal symmetry.

4) Most of the physical properties can be _____ at sight quite easily.

5) Identification according to chemical, physical, and crystallographic properties is called _____ mineralogy.

6) A solid fragment, liquid globule, or pocket of gas enclosed in a mineral or rock is called _____.

7) The chemical reaction of two or more compounds, usually to form one other compound is called _____.

4. *Read the following words**:***

a) be careful to pronounce them correctly;

b) look up the translation of these words in the vocabulary notes and memorize them:

mineralogy [ˌmɪn(ə)'rælədʒɪ]
crystallography [ˌkrɪst(ə)'lɔgrəfɪ]
identification [aɪˌdentɪfɪ'keɪʃ(ə)n]
property ['prɔpətɪ]
occurrence [ə'kʌr(ə)n(t)s]
descriptive [dɪ'skrɪptɪv]
rigid ['rɪdʒɪd]
various['vɛərɪəs]
graphite ['græfaɪt]
diamond ['daɪəmənd]
sulfides ['səlˌfīd]
uncombined [ʌnkəmˈbʌɪmd]
antimony['æntɪmənɪ]
silicate ['sɪlɪkeɪt]
hematite ['hi:mətaɪt]
apatite ['æpətaɪt]
chlorine ['klɔ:ri:n]
fluorine ['flɔ:ri:nˌ 'fluəri:n]
sphalerite ['sfaləˌrīt]
galena [gə'li:nə]

Text 3.2 MINERALOGIST

Can you guess the meaning of the following words (from the text below):
location (n)

identification (n)

chemical analysis

chemical composition

quantity and quality

"indicator" of minerals

A mineralogist is someone who studies minerals. He or she can work in a variety of settings, ranging from state laboratories which analyze mineral samples for the purpose of assay to private industry, where mineralogists determine the value of claimed land and mineral finds by looking at samples from the site. People who work in this branch of geology spend a lot of time in the field, sometimes in very remote locations, and they also work in lab environments where they can analyze minerals.

One of the key components of a mineralogist's job, no matter where he or she works, is accurate identification and classification of minerals. A variety of techniques can be used to test and examine a mineral to determine what it is, including chemical analysis to study its chemical composition. Once a mineral has been identified and classified, a mineralogist can use that information to draw additional conclusions and turn that data into something useful.

For example, a mineralogist who works for a diamond company might take samples from newly claimed land to look for so-called “indicator minerals” which usually accompany diamonds. Without actually finding any diamonds, the mineralogist may be able to determine whether or not diamonds are likely to be present, and conclusions may be drawn about the quantity and quality of the diamonds at the site, based on existing information about indicator minerals and diamond mines.

Without actually finding any diamonds, the mineralogist may be able to determine whether or not diamonds are likely to be present, and conclusions may be drawn about the quantity and quality of the diamonds at the site, based on existing information about indicator minerals and diamond mines.

Some mineralogists focus on high temperature mineralogy, which is concerned with the minerals which form at high temperatures such as those found deep below the Earth's crust and in volcanoes.

Getting a job as a mineralogist is relatively straightforward, although not always easy. Working in this field typically involves research and teaching, and obtaining these positions can take time.

http://www.wisegeek.com/what-does-a-mineralogist-do.htm

EXERCISES

1. *Answer the following questions*:

1) What is the work a mineralogist can do in state laboratories?

2) What is the purpose of assay conducted by mineralogists?

3) How can mineralogists determine the presence of diamonds on the site?

4) What does the phrase “indicator minerals” mean? Why are these “indicator minerals” so important for mineralogists?

2. *Match the words combinations with their Russian equivalents*:

1	to analyze mineral samples	A	определить ценность (заявленных) участков земли
2	to determine the value of claimed land	B	обнаруженные минералы
3	mineral finds	C	работать в очень отдаленных местах
4	to get a job as a mineralogist	D	точная идентификация и классификация минералов
5	to work in lab environments	E	анализировать образцы минералов
6	accurate identification and classification of minerals	F	работать в лабораторных условиях
7	to work in very remote locations	G	устроиться на работу в качестве минералога

3. *Read the text Mineralogist and complete the following sentences*:

1) ___ is someone who studies minerals.

2) Experts on mineralogy can work in state ___ which analyze mineral ___ for the purpose of assay to private industry?

3) They ___ the __ of claimed land and mineral finds by looking at samples from the site.

4) A variety of ___ can be used to test and ___ a mineral to find out what it is, including chemical analysis to study its chemical ___.

5) No matter where a professional mineralogist works his goal is accurate ____ and ___ of minerals.

6) The mineralogist's job is to determine whether or not ___ are likely to be present at the site and conclusions may be drawn about the ___ and ____ of such hard minerals.

7) The minerals formed at high temperatures can be found deep below the Earth's ___ and in ___.

8) Many mineralogists work with professionals such as engineers and geologists, pooling their ___ and ___.

9) To make the use of minerals ___ effective professional mineralogists ___ and study new uses for minerals.

Text 3.3 Charles Lyell and Principles of Geology

1797 – 1875

Early Life and Education:

Charles Lyell was born on November 14, 1797in the Grampian Mountains near Forfarshire, Scotland. When Charles was only two years old, his parents relocated to Southampton, England near where his mother's family lived. Since Charles was the

oldest of ten children in Lyell family, his father spent a lot of time helping to educate Charles in the sciences, and particularly nature. Charles spent many years in and out of expensive private schools, but was said to prefer wandering and learning

from his father. At the age of 19, Charles went off to Oxford to study mathematics and geology. He spent vacations from school travelling and wander of geological formations. Charles Lyell graduated with honours, with a Bachelor's of Art in Classics in 1819. He continued his education and received a Master's of Art in 1821.

Personal Life:

Instead of pursuing his love of Geology, Lyell moved to London and became a lawyer. However, his eyesight began to worsen as time went on and he eventually turned to Geology as a full time career. In 1832, he married Mary Horner, the daughter of a colleague in the Geological Society of London. The couple had no children, but instead spent their time travelling all over the world. Charles Lyell was knighted and later bestowed with the title of Baronet. He was buried in Westminster Abbey.

Biography:

Even while practicing law, Charles Lyell was actually doing more Geology than anything. His father's wealth allowed him to travel and write instead of practicing law. He published his first scientific paper in 1825. Lyell was planning to write a book with radical new ideas for Geology. He set out to prove that all geologic processes were due to natural events rather than supernatural events. Up until his time, the formation and processes of the Earth were attributed to God or another higher being. Lyell was one of the first to propose these processes actually happened very slowly, and that the Earth was extremely ancient rather than the few thousand years old most Bible scholars purposed. Charles Lyell found his evidence when studying Mt. Etna in Italy. He returned to London in 1829 and wrote his most famous work *Principles of Geology*. The book included a large amount of data and very detailed explanations. Perhaps the most important idea to come out of *Principles of Geology* is Uniformitarianism. This theory states that all the natural laws of the universe which are in existence now existed at the beginning of time and all changes happened slowly over time and added up to larger changes. This was an idea that Lyell had first gotten from works by S. James. The book *Principles of Geology*, which influenced the thought of Charles Darwin, successfully promoted the doctrine of uniformitarianism stating that slow geological processes have occurred throughout the Earth's history and are still occurring today. Charles Lyell did not finish revisions on the book until 1833 after several more trips to get more data.

Lyell’s doctrine was seen as the opposite of Georges Cuvier's catastrophism. In contrast, catastrophism is the theory that Earth's features formed in single, catastrophic events and remained unchanged thereafter. Though James Hutton known as the founder of modern geology believed in uniformitarianism, the idea was not widely accepted at the time. However, Lyell was not a firm believer in evolution. It was not until Darwin published *On the Origin of Species* that Lyell began to adopt the idea that species change over time. In 1863, Lyell wrote and published *The Geological Evidence of the Antiquity of Man* which combined Darwin's Theory of Evolution through Natural Selection and his own ideas rooted in Geology. Lyell's staunch Christianity was apparent in his treatment of the Theory of Evolution as a possibility, but not a certainty.

Sir Charles Lyell, Baronet | Scottish geologist | Britannica.com
http://www.britannica.com/.../Sir-Charles-Lyell-Baron...

EXERCISES

1. *Find these words or word combinations in the text and translate them into Russian*:

a large amount of data; antiquity; relocate; revision; catastrophism; eyesight; treatment

2. *Read the text about Charles Lyell and tell if the given sentences are TRUE or FALSE*

1) Charles Lyell was born in the United Kingdom.
2) Charles Lyell was born in the United States.
3) Charles Lyell was born in the United Arab Emirates.
4) He spent vacations from school travelling and making keen observations of geological formations.
5) Lyell moved to London where he married Mary Horner and became a lecture on Geology.

3. *The verbs in the sentences below are in Past Simple Active or Past Simple Passive. Define the voice and translate the sentences into Russian.*

1) Charles Lyell graduated with honours, with a Bachelor's of Art in Classics in 1819.
2) Instead of pursuing his love of Geology, Lyell moved to London and became a lawyer.
3) Charles Lyell was knighted and later bestowed with the title of Baronet.

4) Up until his time, the formation and processes of the Earth were attributed to God or another higher being.

5) The book included a large amount of data and very detailed explanations.

6) Lyell's doctrine was seen as the opposite of Georges Cuvier's catastrophism.

7) Charles Lyell did not finish revisions on the book until 1833 after several more trips to get more data.

8) Though James Hutton known as the founder of modern geology believed in uniformitarianism, the idea was not widely accepted at the time.

9) Charles Lyell was buried in Westminster Abbey.

4. *Find in the left column definitions to the words in the right column.*

A	set out	1	to take on
B	to worsen	2	a learned person, especially in the humanities
C	to find evidence	3	begin a journey
D	to adopt the idea	4	to provide data on which to base proof or to establish truth or falsehood
E	scholar	5	to grow or cause to grow worse
F	supernatural	6	to regard as belonging (to) to ascribe (to)
G	were attributed to	7	of or relating to things that cannot be explained according to natural laws

5. *Make a brief summary of the text using the given key words:*

Scotland - expensive private schools – Oxford - graduated with honours - first scientific paper - radical new ideas - Uniformitarianism - *Principles of Geology* - Theory of Evolution

UNIT FOUR

Text 4.1 GEOPHYSICS

Geophysics is a branch of science that applies physical principles to the study of the earth. Geophysicists examine physical phenomena and their relationships within the earth; such phenomena include the earth's magnetic field, heat flow, the propagation of seismic (earthquake) waves, and the force of gravity. The scope of

geophysics also broadly includes outer-space phenomena that influence the earth, even in subtle ways; the effects of the sun on the earth's magnetic field; and manifestations of cosmic radiation and the solar wind.

A Solid Earth Physics

Embracing all fields devoted to the earth's interior,* solid earth physics involves studying the behavior of earth materials from the crust down to the core, particularly as they relate to the earth's size and shape, gravity, magnetism, and seismicity. Terrestrial Magnetism

Geomagnetism refers to the study of magnetic phenomena exhibited by the earth and its atmosphere. Generation of the magnetic field seems to be related to the motion of fluid, ** electrically conducting material within the earth, so that the planet acts as a self-exciting dynamo.

Gravity and Tides Gravity is the attractive force exerted by the mass of the earth. The gradient of the gravitational potential — that is, the force of gravity — is perpendicular to the surface of the earth, which means that the force acts in the vertical direction. Gravimeters are highly sensitive balances used by geophysicists to make relative gravity measurements.

Volcanology

Volcanologic studies are concerned with the surface eruption of gas-charged magmas (molten rock materials) from within the earth and with the structures, deposits, and landforms associated with such activity. Although no single set of volcanic activities reliably indicates future volcanic events, certain processes provide geophysicists with clues to possible forthcoming eruptions.

Geophysical Surveys

Geophysical exploration, commonly called applied geophysics or geophysical prospecting, is conducted to locate economically significant accumulations of oil, natural gas, and other minerals, including groundwater. Geophysical investigations are also employed with engineering objectives in mind, such as predicting the behavior of earth materials in relation to foundations for roads, railways, buildings, tunnels, and nuclear power plants. Surveys are generally identified by the property being measured — namely, electrical, gravity, magnetic, seismic, thermal, or radioactive properties.

Used primarily in the search for oil, gas, and base metals, electrical and electromagnetic surveys map variations in the conductivity or capacitance of rocks.

Measured by special tools lowered into holes drilled for oil and gas, conductivity variations provide geophysicists with clues from which they can judge the hydrocarbon-bearing potential of rock strata. Direct and alternating

electrical currents are measured in ground surveys, but the lower radio frequencies are used both in ground and in airborne electromagnetic surveys.

Gravity surveys measure density variations in local rock masses. Used mainly in petroleum exploration, these surveys are based on use of a device called a gravimeter. Gravity surveys are made on land, at sea, and down boreholes. In ground magnetic surveys, variations in the earth's magnetic field are measured at stations placed closely together; aeromagnetic surveys may also be conducted, especially in petroleum exploration. Devices called magnetometers, towed by aircraft or behind a seismic research ship, help to detect magnetic anomalies or to distinguish geologic features that might appear similar from seismic data alone.

Measurement of seismic-wave travel time is one of the most common geophysical methods used in surveys. Seismic exploration is divided into refraction and reflection surveys, depending on whether the predominant portion of the seismic waves' travel is horizontal or vertical. Refraction seismic surveys are used in engineering geophysics and petroleum exploration, and to locate groundwater or buried stream channels containing placer mineral deposits. Seismic reflection surveys, on the other hand, detect boundaries between different kinds of rocks; this detection assists in the mapping of geologic structures. Seismic energy is detected on land by using devices called geophones, which react to on-site ground motions; and in water by using piezometric devices, which measure hydrostatic pressure changes.

Geothermal surveys concentrate on temperature variations and the generation, conduction, and loss of heat within the earth. Geothermometry is also important to volcanologic studies as well as to locating geothermal energy resources. Radioactivity surveys conducted on the ground and from the air, measure natural radiation from the earth. Geiger and scintillation counters are used in searching for ores of uranium as well as in searching for rare earth metals, potash deposits, and other radioactive materials.

Notes to the text:

***** Embracing all fields devoted to the earth's interior.

Охватывая все области, касающиеся недр земли …

****** Generation of the magnetic field seems to be related to the motion of fluid…

Образование магнитного поля, как представляется, связано с движением жидкости …

http://www.arenalibrary.com/Reference/70178/Encarta-Encyclopedia-(F-G)-pag.1517.htm

EXERCISES

1. *Feel the gaps in the summary of the text you have read*.

Geophysics is a branch of science that (1) _____ physical principles (2) _____ the study of the earth. The (3) _____ of geophysics includes outer-space phenomena that influence the earth, even in subtle ways; the (4) _____ of the sun on the earth's magnetic field; and manifestations of cosmic radiation and the solar wind. Geophysicists examine physical phenomena and (5) _____ relationships within the earth. Solid earth physics involves (6) _____ the behavior of earth materials from the crust down to the core. Generation of the magnetic field (7) _____ to be related to the motion of fluid, electrically conducting material within the earth, so that the planet acts as a self-exciting dynamo. Gravity is the (8) _____ force exerted by the mass of the earth. Geophysical exploration, commonly called (9) _____ geophysics or geophysical prospecting, is conducted to locate economically significant accumulations of oil, natural gas, and (10) _____ minerals.

2. *From the words in the box form two-word combinations*

natural magnetic radioactive electrical temperature vertical geophysical (2) energy special applied geologic

Model: 1) vertical direction

1) direction, 2) tools, 3) resources, 4) gas, 5) field, 6) variations, 7) prospecting, 8) current, 9) geophysics, 10) exploration, 11) properties, 12) features

3. *Find pairs of synonyms in the boxes below*

Model: exploration – expedition

exploration locate conduct detect examine significant direct motion indicate	**show expedition indirect find carry out situate important investigate movement**

4. *Read the following words:*

a) be careful to pronounce them correctly;

b) look up the translation of these words in the vocabulary notes and memorize them

geophysics (n) [ˌʤi:əu'fɪzɪks]	geophysicist (n) [ʤi:oʊfɪzɪsɪst]
propagation (n) [ˌprɔpə'geɪʃ(ə)n]	earthquake (n) ['ɜ:θkweɪk]
phenomena (n) [fɪ'nɔmɪnə]	seismic (adj) ['saɪzmɪk]
radioactive (adj) [ˌreɪdɪəu'æktɪv]	borehole (n) [ˌ['bɔ:həul]
particularly (adv) [pə'tɪkjələlɪ]	geothermal (adj) [geo|ther|mal]
survey (n) ['sɜ:veɪ]	measure (n) ['meʒə]
gravity (n) ['grævɪtɪ]	behavior (n) [bɪ'heɪvjər]
solar (adj) ['səulə]	wind (n) [wɪnd]
subtle (adj) ['sʌtl]	scintillation (n) [ˌsɪntɪ'leɪʃ(ə)n]

Text 4.2 GEOPHYSICIST

Can you guess the meaning of the following words (from the text below):

master degree
doctorate degree
collect data
calibrate utilize
wide range of activities

A geophysicist is a scientist who studies the physical properties of the Earth, and who may also study the physical properties of other planets along with moons and other objects found in space. In order to work in this field, it is usually necessary to have a graduate degree. Numerous universities around the world offer graduate programs in geophysics, with both masters and doctorate degrees available to students.

The field of geophysics is actually quite broad, and a geophysicist may engage in a wide range of activities as part of his or her work. The study of geophysics includes the study of surface properties of the Earth, like the characteristics of the Earth's crust, the study of the atmosphere, the study of the interior of the Earth, and the study of the Earth's oceans.

One example of the application of geophysics is studying the Earth's core by analyzing seismic waves. Using supercomputers, geophysicists can map irregularities in the Earth's core on scales as small as one kilometer.

One topic currently perplexing geophysicists is the heterogeneity of the Earth's outer core, which is believed to be liquid.

At one point, it was believed the outer core was fairly homogeneous, but geophysics calculations have shown

otherwise. Scientists now suspect that the outer core may consist of alternating layers of liquid and solid material.

A geophysicist can work in the field, collecting data, making observations, and calibrating equipment. Geophysicists are also found in the lab performing controlled experiments and conducting analysis of samples, in the classroom teaching students, and in the employ of government agencies and private organizations interested in topics within geophysics.

Some professionals utilize their knowledge of physical properties to aid in mining, drilling, and construction efforts. Research geophysicist jobs are usually held by experts in geodesics, geodynamics, or geomagnetism.

The largest number of geophysicists find employment in the petroleum industry. Since most of the petroleum deposits are buried deep below the surface, petroleum geophysicists find oil and gas by building a clear picture of what is below the Earth's surface. Petroleum geophysicists can be divided into three categories:

- Acquisition Geophysicists take 'pictures' of the subsurface much like X-Rays reveal details of the human body;
- Processing Geophysicists develop and sharpen the 'picture';
- Interpretation Geophysicists use the sharpened 'picture' to construct the shape of petroleum deposits.

Each of the above three types of geophysicists is described further in the following sections. http://cseg.ca/student/careers/whatis.html

EXERCISES

1. *Answer the following questions:*

1) What do geophysicists study?

2) Where can we get graduate programs in geophysics?

3) Do you know universities around the world offering graduate programs in geophysics, with both masters and doctorate degrees available to students?

4) Can you give a list of geophysicist professional activities?

2. *Match the words combinations with their Russian equivalents:*

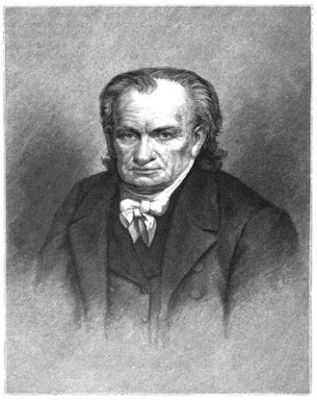
1	to be engaged in a wide range of activities	A	проводить контрольные опыты
2	to study the interior of the Earth	B	собирать данные и проводить наблюдения
3	to perform controlled experiments	C	изучать недра Земли
4	to conduct analysis of samples	D	проводить анализы образцов
5	to collect data and to make observations	E	иметь высшее образование (диплом)
6	to study physical properties of the Earth	F	изучать физические свойства Земли
7	to have a graduate degree	G	заниматься различными видами деятельности

3. *Render the text in English*:

Геофизика, как известно, использует физические принципы для изучения свойств нашей планеты. Геофизика тесно связана с такими дисциплинами как стратиграфия *(stratigraphy),* структурная география и минералогия, квантовая механика *(quantum mechanics)*, классическая физика, а также с теорией электромагнетизма и гравитации. Неудивительно, что учёные геофизики ведут свои исследования в самых разных направлениях. Сейсмологи занимаются созданием глобальной базы данных *(global database)* о землетрясениях *(earthquakes)* и подвижках *(shifts)* в земной коре. Вулканологи изучают процессы и причины образования вулканов, разрабатывают методы предсказания извержений и использование вулканического тепла горячих вод и пара. Специалисты в области тектоники изучают движение земной коры, формы залегания горных пород, то есть тектонические структуры. Геофизики-нефтяники используют различные методы, чтобы найти нефть, железо, медь, и многие другие полезные минералы

Text 4.3 AMOS EATON

(1776-1842)



Amos Eaton, natural scientist, educator, and co-founder of the Rensselaer School, was born on May 17, 1776 in New Concord parish (now Chatham, Columbia County), New York. Eaton graduated from Williams College in 1799, and despite an interest in the natural sciences, undertook the more practical study of law in New York City. He was admitted to the state bar in 1802. From 1802 to 1810 he practiced law and worked as a land agent and surveyor in Catskill, New York.

In 1811 Eaton was imprisoned on charges of forgery in a land dispute. Although Eaton and many others always maintained his innocence he spent nearly five years in jail. During his incarceration he began a course of scientific studies and upon his release spent a year at Yale College studying science under Benjamin Silliman and Eli Ives. He then returned to Williams College where he introduced a very successful course of scientific lectures and published *A Botanical Dictionary* and *Manual of Botany for the Northern States* in 1817.

In 1818 Eaton moved to the Troy-Albany area which had become a center of industrial and commercial growth. He spent the next six years as an itinerant lecturer, ranging from West Point, New York, to the Castleton Medical Academy in Vermont, and compiled textbooks in chemistry, zoology, and geology. Under Stephen Van Rensselaer's patronage he undertook geological and agricultural surveys of Albany and Rensselaer counties and across New York State along the route of the Erie Canal. His published survey reports earned him recognition in American geology and the 1820's have been designated as the "Eatonian era."

Eaton's most significant and lasting contribution was to scientific education. He developed a teaching theory and methods that focused on "the application of science to the common purposes of life." In contrast to the then current method of learning by rote, students were to learn by doing. Field trips were used to gather specimens,

experiments were performed in laboratories, and students prepared and delivered lectures with the instructor and fellow students serving as critics.

To implement his novel ideas, Eaton enlisted the support of Stephen Van Rensselaer in founding the Rensselaer School in 1824. Eaton served as Senior Professor at Rensselaer for the rest of his life and trained a significant number of influential scientists, including James Hall, J.C. Booth, Asa Fitch, Ebenezer Emmons, G.H. Cook, Abram Sager, E.S. Carr, Douglass Houghton, and Eben Horsford.

In 1835 Eaton further developed his curriculum and gave it even more focus on practicality. The Rensselaer School was renamed Rensselaer Institute and was divided into separate departments of science and engineering. Eaton remained at the Institute until his death on May 10, 1842 at age 66.

Amos Eaton, natural scientist, educator, and co-founder of the Rensselaer School, http://www.lib.rpi.edu/Archives/.../Eaton/biography/

EXERCISES

1. *Find these words or word combinations in the text and translate them into Russian*:

practical study; a land dispute; the center of industrial and commercial growth; current method of learning by rote; to implement his novel ideas; a significant number of influential scientists

2. *Read the text about Amos Eaton and tell if the given sentences are TRUE or FALSE*.

1) After graduating from Williams College in 1799 Amos Eaton undertook the practical study of law in New York City.
2) Despite an interest in the natural sciences, he practiced law and worked as a land agent and surveyor in Catskill, New York.
3) It was when he worked as a land agent that Amos Eaton committed a serious crime and was put to prison.
4) In prison Amos Eaton did a lot of scientific studies and after being released spent a year at Yale College.
5) He then returned to Williams College where he introduced a very successful course of lectures on the history of Northern States.
6) He undertook geological surveys and his published survey reports earned him recognition in American geology.

3. *Fill in the gaps with necessary prepositions*.

1) Scientists might **focus __** specific processes, such as plate tectonics, volcanic activity, ocean floor spreading, or weatherization.

2) Experts may also **concentrate ___** certain types of sediments, rocks, or minerals.

3) Numerous universities around the world offer graduate **programs __** geophysics.

4) They **work ___** a diamond company.

5) This evidence **led __** the theories of seafloor spreading and plate tectonics.

6) He then returned **__** Williams College where he introduced a very successful **course of** scientific lectures.

7) The section is **divided ___** several parts.

4. *Make a brief summary of the text using the given key words*

Williams College in 1799 - interest in the natural sciences, - five years in jail – a course of scientific lectures - recognition in American geology - scientific education - to learn by doing - a significant number of influential scientists.

UNIT FIVE

Text 5.1 MARINE GEOLOGY

Geology specific to the ocean environment is called marine geology and it has strong ties to physical oceanography. Marine geologists may be specialists in a number of fields, including petrology, sedimentology, stratigraphy, paleontology, geochemistry, geophysics, and volcanology and do paleontological investigations of the ocean floor and coastal zone. ***** They may take samples from the ocean while out at sea or make measurements through remote sensing techniques. ****** Marine geological studies were of extreme importance in providing the critical evidence for sea floor spreading and plate tectonics in the years following World War II. The deep ocean floor is the last essentially unexplored frontier and detailed mapping in support of both military (submarine) objectives and economic (petroleum and metal mining) objectives drives the research.

Drilling platforms and drilling ships allow earth scientists to make more-detailed studies of the history of the oceans and the ocean floor. For example, in 1984 an international team of geoscientists from 20 nations formed the Ocean Drilling Program, an outgrowth of the earlier Deep Sea Drilling Program. This program is designed to set up drilling through the top sedimentary layer and the

ocean crust in deep-sea sites around the world. This work has helped the field of paleoceanography (the reconstruction of the history of the oceans, including ancient ocean chemistry, temperature, circulation, and biology).

Theory of Seafloor Spreading. After World War II, geophysical evidence began to accumulate which confirmed the lateral motion of continents and indicated the young age of oceanic crust. This evidence led to the theories of seafloor spreading and plate tectonics in the 1960s. American marine geologists Robert S. Dietz and Harry H. Hess proposed the seafloor spreading hypothesis, the concept that *** the oceanic crust is created as the seafloor spreads apart along mid-ocean ridges.

Scientists used paleomagnetism and seafloor spreading to determine that **** the continents had moved relative to the magnetic poles and to each other.

Theory of Plate Tectonics. Canadian geophysicist J. Tuzo Wilson and American geophysicist Jason Morgan, among others, proposed the outline of the theory of plate tectonics in the 1960s. New ocean crust is generated at ocean ridges (underwater mountain chains formed by the young ocean crust). Older ocean crust sinks down, or subducts, into the earth's mantle at subduction zones, which are found at the deepest parts of the ocean, called trenches. As the plates move, they collide and form mountains. The plates recycle crust, generate volcanoes, and move past each other along faults. Using satellites, scientists can now measure movement of the continental plates in centimeters per year. Plate boundaries are the sites of most of the earth's earthquakes and the majority of earth's volcanoes. The continents are made of remelted sediments and partially melted oceanic crust, forming a lower density layer that has collected through time. The mechanism that drives the earth's crustal plates is still not known, but geologists can use plate tectonics to explain most geologic activity.

Notes to the text:

*… take samples from the ocean while out at sea … *брать пробы, находясь в открытом океане*

** Marine geological studies were of extreme importance in providing the critical evidence for sea floor spreading …*Морские геологические исследования имели большое значение в обеспечении фактическими данными по продвижению морского дна* ...

*** the oceanic crust is created as the seafloor spreads apart along mid-ocean ridges… *океаническая кора формируется по мере того, как океаническое дно продвигается по открытому океану…*

**** the continents had moved relative to the magnetic poles and to each other.

континенты переместились по отношению к магнитному полюсу и друг друга

http://www.ocean.washington.edu/story/Marine+Geology+and+Geophysics

EXERCISES

1. *Feel the gaps in the summary of the text you have read.*

Marine geology has 1) _____ ties to physical oceanography. Geophysical 2) _____ confirmed the lateral motion of continents and indicated the 3) _____ age of oceanic crust. Marine geologists may be specialists in 4) _____ fields, including petrology, sedimentology, stratigraphy, paleontology, geochemistry, geophysics, and volcanology and do paleontological 5) _____ of the ocean floor and coastal zone.

The deep ocean floor is the last essentially unexplored frontier and detailed 6) _____ in support of both military (submarine) objectives and economic (petroleum and metal mining) objectives 7) _____ the research.

Drilling platforms and drilling ships 8) _____ earth scientists to make more-detailed studies of the history of the oceans and the ocean floor. Scientists used paleomagnetism and seafloor spreading 9) _____ that the continents had moved relative to the magnetic poles and to each other.

http://geology.uonbi.ac.ke/print/1464

2. *Form two-word combinations from the words in the box*

mountain remelted geologic detailed ocean paleontological lateral continental geophysical sedimentary drilling magnetic seafloor economic

Model: 1) magnetic poles

1) poles 2) chains 3) objectives 4) crust 5) sediments 6) evidence 7) activity 8) spreading 9) platforms 10) plates 11) motion 12) studies 13) layer 14) investigations

B2. *Form the words with the opposite meaning as shown in the model and translate them into Russian*.

Model: explored - unexplored

a) accurate; explored; convincing; natural; available; employment; regular;

b) broad; large; well-known; remote; rare;

3. *Read the following words: a) be careful to pronounce them correctly;*
b) look up the translation of these words in the vocabulary notes and memorize them

marine (adj) [mə'ri:n]
environment (n) [ɪn'vaɪər(ə)nmənt]
sedimentation (n) [ˌsedɪmen'teɪʃ(ə)n]
stratigraphy (n) [strə'tɪgrəfɪ]
paleontological (adj)
[ˌpælɪˌɔntə'lɔdʒɪk(ə)l]
investigation (n) [ɪnˌvestɪ'geɪʃ(ə)n]
unexplored (adj) [ˌʌnɪk'splɔ:d]
frontier (n) [frʌn'tɪə]
to recycle (v) [ˌri:'saɪk(ə)l]
plate (n) [pleɪt]
theory (n) ['θɪərɪ]
mantle (n) ['mæntl]
volcanoe (n) [vɔl'keɪnəu]
volcanic (adj) [vɔl'kænɪk]
ridge (n) [rɪdʒ]
fault (n) [fɔ:lt]
Canadian (adj) [kə'neɪdɪən]
mechanism (n) ['mekənɪz(ə)m]

Text 5.2 MARINE GEOLOGIST

Can you guess the meaning of the following word combinations (from the text below):
to specialize in sedimentology
to specialize in geochemistry
to conduct research
the ocean floor
mapping

A marine geologist is a scientist who studies the different natural processes that occur on ocean floors and beaches. He or she may survey a seabed, collect samples of sediment and rock, and analyze their age and composition in a laboratory.

Scientists typically specialize in one or more areas of marine geology, such as sedimentology, mineralogy, or geochemistry, among many other subfields. A marine geologist might work for a university, a private research institution, an environmental protection organization, or an oil or gas company as an explorer.

Most marine geologists conduct field, computer, and laboratory research to learn about the oceans and the earth. A scientist might explore a site to gather mineral samples or survey the ocean floor. He or she often uses computer technology, such as global positioning system devices, to assist in the mapping or analysis of a certain area. In the laboratory, a marine geologist might try to determine the chemical composition of a sample, the presence of pollutants, or the

age of different rocks. Geologists often write detailed scientific papers about their experiments and findings.

There are many specialities within marine geology. Scientists might focus on specific processes, such as plate tectonics, volcanic activity, ocean floor spreading, or weatherization. Experts may also concentrate on certain types of sediments, rocks, or minerals, tracking their movement, prevalence, and changes over time. Geochemistry experts investigate the chemical properties of different rocks and sediments, while marine paleontologists study fossils and remains from different plants and animals.

http://www.wisegeek.com/what-does-a-marine-geologist-do.htm

EXERCISES

1. *Answer the following questions*:

1) What areas can marine geologists specialize in?

2) Marine geologists might be involved in various types of work; can you name some of them?

3) What modern technical computing facilities can marine geologists use in their professional activities?

4) What are the specific objects of study that marine geologists might focus on?

2. *Match the words combinations with their Russian equivalents:*

1	to assist in the mapping or analysis	A	научно-исследовательский институт
2	plate tectonics	B	распространение (спрединг) морского дна
3	track their movement, prevalence, and changes	C	помогать в составлении карт и исследованиях
4	to specialize in sedimentology	D	следить за движением, распространённостью и изменениями
5	research institution	E	тектоника плит
6	ocean floor spreading	F	проводить (лабораторные) научные, и т.д. исследования
7	conduct (laboratory) research	G	быть специалистом в седиментологии

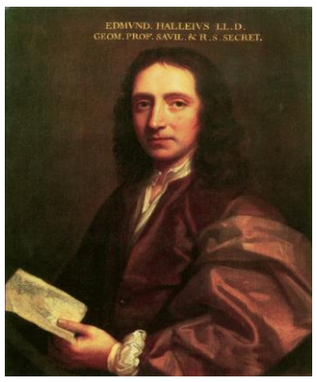
3. *Read the text and complete the following sentences:*

1) A marine geologist is a ____ who studies the different natural processes that occur on ocean floors and beaches.

2) ____ or geological oceanography involves geophysical, geochemical, sedimentological and paleontological investigations of the ____ and coastal margins.
3) The deep ocean floor is the last essentially unexplored frontier and detailed ____ contributes to petroleum and metal mining.
4) Marine geologists may be specialists in a number of fields, including stratigraphy, ___, mineralogy, ___ and volcanology.
5) They may gather ___ from the ocean while out at sea and try to determine their ___ composition in the laboratory.
6) Ocean experiments and ___ are described in detailed scientific papers.
7) Marine geologists concentrate on varied tasks through studies of oceanic ___ and ___.
8) After the World War II marine geological studies provided the convincing evidence for sea floor spreading and ___ ___.
9) There are experts, marine ___ who ___ the chemical properties of different rocks and sediments.

Text 5.3 EDMOND HALLEY

(1656–1742)



Scientists do not reach greatness under their own power alone. Isaac Newton, one of the very greatest, said that he could see so far only because he had stood on the shoulders of giants. In that sense scientists are like trees in a forest—the tallest ones grow where other tall trees surround them. Where would Newton have been without his colleague Edmond Halley, the father of geophysics?

Edmond Halley was a bold and restless prodigy, born to a wealthy family, who published three papers on astronomical subjects while still a college undergraduate.

He left school at age 20 to spend a year on the remote South Atlantic island of St. Helena, observing the skies of the southern hemisphere.

He returned to England and published the first catalog of the southern stars. That achievement earned him membership in the Royal Society at age 22.

Another distinctive thing he did was to reinterpret old data. In 1710 he used the ancient star catalog of Ptolemy, from the second century, to show that in the 15 centuries since then, some stars had changed position. With this single study, he abolished the idea that the stars were fixed in space and proved that all of the sky, not just the solar system, is an active, dynamic place.

His interest in planetary motions led him to Isaac Newton, whose new mathematics of the calculus, laws of physics, and theory of gravitation were being widely scorned and disputed. Halley was so convinced that he financed the publication of Newton's book Principia Mathematica in 1687, which put physics, astronomy, and science itself on a foundation that endured until Einstein's modifications more than 200 years later.

Edmond Halley is not known as the father of geophysics for these achievements. But he earned the title by doing similar things.

Halley and Geophysics

For instance, in 1698 he got himself a commission as a captain in the royal navy—the only time a civilian has ever done that—and the following year he sailed HMS Paramore around the South Atlantic Ocean, taking readings of magnetic north wherever he went. That cruise was the first voyage ever made for a purely scientific purpose. From the data he collected, Halley produced the first map showing the variation of the Earth's magnetic field in 1700. So with that voyage he established not just new science, but a new way of doing science.

The main benefit of his map was for navigation—mariners could correct their compass readings—but it was profoundly significant for studies of the deep Earth, too. For many years, it had been known that the magnetic field was slowly changing, and the map was a valuable baseline for measuring that change. Just as Halley turned the heavens into a lively place, so did he help show that the deep Earth had motion too. He had unearthed a new problem—understanding the geomagnetic field—and while we have made great progress in 300 years, it is still a central mystery of geophysics.

In 1692 Halley proposed that the geomagnetic field moved because Earth had a magnetic "nucleus or inner globe included within ours, with a fluid medium in between." And that was the first theory of geomagnetism. Today, we believe that the Earth's magnetic field is generated as the inner core, a sphere of solid iron inside

the liquid outer core, spins out of phase with the rest of the planet. Essentially, Halley was right.

Similarly Halley made the first map of the world's winds, setting the baseline for another great field of geophysics, atmospheric dynamics. And he applied new physics

to the problem of predicting the tides from the Sun and Moon's Newton's gravity. Thus, he did his part for the Newtonian revolution, which united the physical laws of heaven and Earth. Along those lines, he suggested in 1694 that comets might strike the Earth, a subject he said he would "leave to be discussed by the studious of physical matters." And so we discuss cosmic impacts to this day.

PS: Halley's first geophysical voyage was the model for scientific research cruises of later years. Captain James Cook's first voyage in 1769 was made to observe a transit of Venus. Halley had proposed these observations as the best method of measuring the true distances of the Sun and planets, at the time one of science's most vexing problems. The last one was in 2012, the first since 1882.
http://geology.about.com/od/biographies_dh/a/halley.htm Edmon Halle

EXERCISES

1. *Say if the following statements are true (T) or false (F)*

1) Edmond Halley published three papers on astronomical subjects as soon as he graduated from the college.

2) Halley was able to prove that all of the sky, not just the solar system, is an active, dynamic place.

3) Although Newton’s new laws of physics and theory of gravitation were being widely scorned and disputed Halley saw his colleague greatness and published Newton's book Principia Mathematica in 1687.

4) From the data he collected during his voyage aboard the HMS Beagle Halley produced the first map showing the variation of the Earth's magnetic field in 1700.

5) The benefit of the map produced by Edmond Halley was not only for navigation but it also made a profound contribution to studies of the deep Earth.

6) Halley applied new physics to the problem of predicting which comets might strike the Earth.

7) The scientific research cruises of today follow the model of Halley's first geophysical voyage.

2. *Fill the gaps with a necessary word*.

1) Where would Newton **_____** been without his colleague Edmond Halley, the father of geophysics?

2) Captain James Cook's first voyage in 1769 _____ to observe a transit of Venus

3) Halley made the first map of the world's winds, **_____ the** baseline for another great field of geophysics, atmospheric dynamics.

4) At first Newton's new mathematics of the calculus, laws of physics, and theory of gravitation **_____** widely scorned and disputed.

5) Edmond Halley _____ known as the father of geophysics.

6) In 1694 Halley suggested that comets _____ strike the Earth.

7) That cruise **_____** the first voyage ever made for a purely scientific purpose.

3. *Match the adjectives in column A with the nouns in column B.*

Model: vexing problems

A	B
1. vexing	medium
2. remote	thing
3. restless	star catalogue
4. lively	field
5. ancient	prodigy
6. fluid	problems
7. geomagnetic	place
8. distinctive	island

4. *Be ready to have a talk on the life of Edmond Halley*.

a) Start with writing down comments on what you have known from the text.

b) Discuss your comments with your partner.

REVISION

Units 1-5

EXERCISES

1. *Put the words in the sentences in the right order*

a) chemical are basis classified on of composition the Minerals

b) usually time research spend field of a amount great Scientists conducting

c) Geology world the in programs around Numerous offer universities graduate

d) What the of is main geologist's environmental job purpose?

e) at sight be Most the properties of can recognized physical

2. *Make nouns and adjectives from the verbs*.

Verbs	Nouns	Adjectives
achieve		
estimate		
explain		
generate		
expand		
locate		
regulate		

3. *Complete the sentences with nouns or adjectives formed in the exercise above*

1. There has been a lot of debate among scholars about the _____ universe.
2. The local community uses electricity _____ by the wind turbines.
3. These birds must have a wonderful power of _____**.**
4. There is no convincing _____ of the overall structure of the universe.
5. The results _____ in radiology stimulated progress in other fields of science.
6. Under the new _____, all staff must have safety training.
7. The _____ cost of repairing the roof is $600.

4. *Complete the sentences using the prepositions or prepositional phrases from the box*

at the end in by (2) on land to throughout in order to into under

1. Geology is referred ___ as earth science and geoscience.2. Prospecting geologists are trained __ earth sciences to find geological wonders. 3. _____ of the 19th century and into the 20th century, the field of geology expanded even more. 4._____ the early 19th century, many people were studying geologic topics.

5._____ the medieval and Renaissance periods, people began to study mineralogy and made detailed geologic observations. 6. Seismic energy is detected _____ by using devices called geophones. 7. They also study the geologic record of climate change _____ help predict future changes. 8. Seismic exploration is divided _____ refraction and reflection surveys. 9. Reports _____German natural historian Alexander von Humboldt about his travels influenced the worlds of science and art. 10. Amos Eaton spent a year at Yale College studying science ____ Benjamin Silliman and Eli Ives.

5. *Find the corresponding definitions to the words*

Model: *2) a Infiltration* - The movement of surface water into porous soil.

1) *Gas Field; 2) Infiltration;* 3) *Extractive Industries; 4) Magma; 5) Elevation; 6) Geochronology; 7) Greenhouse Effect; 8) Lava; 9) Geomorphology ; 10) Exploration*

a) - The movement of surface water into porous soil.
b) - The science of Earth's landforms, their description, classification, distribution, origin and significance.
c) - Molten rock material on Earth's surface.
d) - A study of the time relationships of rock units; includes methods of both relative and absolute dating.
e) - Industries involved in mineral resource exploration, acquisition, assessment, development or production.
f) - The geographic area that is directly above an underground accumulation of natural gas that is commercially viable.

g) - The vertical distance between mean sea level and a point or object on, above or below Earth's surface.
h) - A warming of the atmosphere caused by carbon dioxide and water vapor in the lower portions of the atmosphere capturing heat that is radiated from and reflected by Earth's surface.
i) - Molten rock material that occurs below Earth's surface.
j) - The work of identifying areas that may contain viable mineral resources. This work can include surface mapping, remote sensing, exploratory drilling, geophysical testing, geochemical testing and other activities.

UNIT SIX

Text 6.1 ENVIRONMENTAL, ECONOMIC AND ENGINEERING GEOLOGY

Environmental geology is an applied science concerned with the practical application of the principles of geology in the solving of environmental problems. It is a multidisciplinary field that is closely related to engineering geology and, to a lesser extent, to environmental geography. Environmental geology involves the protection of human health and safety through understanding geological processes. For example, it is critically important to understand the geology of areas where people propose to store nuclear waste products. The study of geologic hazards, such as earthquakes and volcanic eruptions, can also be considered part of environmental geology.

Each of these fields involves the study of the interaction of humans with the geologic environment, including the biosphere, the lithosphere, the hydrosphere, and to some extent the atmosphere.

Economic geology is the use of geologic knowledge to find and recover materials that can be used profitably by humans, including fuels, ores, and building materials. Because these products are so diverse, economic geologists must be broadly trained; they commonly specialize in a particular aspect of economic geology, such as petroleum geology or mining geology. Engineering geology is the application of engineering principles to geologic problems. Two fields of engineering that use geology extensively are civil engineering and mining engineering. For example, the stability of a building or bridge requires an understanding of both the foundation material (rocks, soil) and the potential for earthquakes in the area.

Environmental geology also includes: managing geological and hydrogeological resources such as fossil fuels, minerals, water (surface and ground water), and land use.

Environmental geology studies the earth's surface through the disciplines of geomorphology, and edaphology (soil science). Environmental geology also includes managing geological and hydrogeological resources such as fossil fuels, minerals, water (surface and ground water) and land use defining and mitigating exposure of natural hazards on humans.

Environmental geology is the application of geological information to solve conflicts, *minimizing possible adverse environmental degradation or maximizing possible advantageous condition resulting from the use of natural and modified environment

Notes to the text:

*minimizing possible adverse environmental degradation or maximizing possible advantageous condition resulting from the use of natural and modified environment -*минимизируя процессы, разрушающие экологию и повышая эффективность использования естественной и видоизменённой окружающей среды*.

https://www.petropedia.com/definition/8933/environmental-geology

EXERCISES

1. *Put the sentences in the order they are used in the text (the first one is done for you):*

1 d 2 … 3… 4 … 5… 6… 7 …

a) Environmental geology involves the protection of human health and safety through understanding geological processes.

b) In other words environmental geology is the application of geological information to help better organize protection of nature and human health.

c) Economic geology is the use of geologic knowledge to find and recover materials that can be used profitably by humans, including fuels, ores, and building materials.

d) Environmental geology is an applied science concerned with the practical application of the principles of geology in the solving of environmental problems.

e) Engineering geology is the application of engineering principles to geologic problems.

f) Economic geologists commonly specialize in a particular aspect of economic geology, such as petroleum geology or mining geology.

g) The study of geologic hazards, such as earthquakes and volcanic eruptions, can also be considered part of environmental geology.

2. *Now give a Russian translation of the sentences above*.

3. *Feel the gaps in the text below with the preposition from the box*

in to among within up from into with through of

Ecology is a science which studies the relationship between all forms of life on our planet and the environment. This word came (1) … Greek “oikos” which

means home. Ancient Greek philosophers such as Hippocrates and Aristotle laid the foundations of ecology (2) … their studies on natural history. Modern ecology transformed 3) … a more rigorous science in the late 19th century.

Ecology is the scientific analysis and study of interactions 4) … organisms and their environment - the interactions organisms have 5) … each other and with their

abiotic (абиотический, неживой**)** environment. Topics of interest 6) … ecologists include the diversity, distribution, amount (biomass), number (population) of organisms, as well as competition between them 7) ... and among ecosystems. Ecosystems are composed 8) … dynamically interacting parts including organisms, the communities they make 9) …, and the non-living components of their environment. Ecosystem processes regulate the flux of energy and matter 10) … an environment.

4. *Read the following words:*

a) be careful to pronounce them correctly;

b) look up the translation of these words in the vocabulary notes and memorize them

engineering (n) [ˌendʒɪ'nɪərɪŋ]	through (prep) [θru:]
multidisciplinary (adj) [ˌmʌltɪ'dɪsɪˌplɪnərɪ]	hydrosphere (n) ['haɪdrəusfɪə]
process (n) ['prəuses]	lithosphere (n) [ˈlɪθəsfɪə]
area (n) ['eərɪə]	biosphere (n) ['baɪəsfɪə]
health (n) [helθ]	specialize (v) ['speʃ(ə)laɪz]
hazard (n) ['hæzəd]	exposure (n) [ɪk'spəuʒə]
knowledge (n) ['nɔlɪdʒ]	geomorphology (n) [ˌdʒi:ə(ʊ)mɔ:ˈfɒlədʒi]
nuclear (adj) ['nju:klɪə]	edaphology (n) [ˌedə'fɔlədʒɪ]

Text 6.2 ENVIROMENTAL GEOLOGIST

Can you guess the meaning of the following words (from the text below):

consulting firms

public officials

geological sites

policy recommendations

to formulate(v)

man-made contaminants

An environmental geologist is a geologist who studies the interaction between humans and the natural environment, and the impact of various human activities on the environment. Environmental geologists work to keep the environment safe and healthy while also making it accessible and useful for people. They can work for state agencies, private consulting firms, oil companies, real estate developers, and many other organizations, performing a wide range of tasks.

At a minimum, an environmental geologist holds a bachelor's degree in geology.

Many working professionals have master's or doctoral degrees in the subject, especially if they work as teachers or instructors. Environmental geologists spend time in the field, studying geological sites, taking samples, and talking with people involved in a project, and they also work in an office or lab, performing tests, writing up results, and making policy recommendations which will be considered by public officials.

These geology professionals can do things like preparing environmental impact statements for proposed developments, working with resource extraction companies to use natural resources safely, and working with government agencies to formulate water and land use policies. Environmental geologists are also involved in environmental remediation, in which natural or man-made contaminants are cleaned to make an area safe to use, and they also perform routine inspections of sites which may cause pollution, such as landfills. Work as an environmental geologist can be very diverse and interesting, especially in areas with highly varied terrain and human needs.

http://www.environmentalscience.org/career/environmental-geologist

EXERCISES

1. *Answer the following questions*:

1. What is the main purpose of the environmental geologist's job?
2. It is known that environmental geologists have to perform various types of work; can you name some of them?
3. Do environmental geologists share their observations and findings with public officials?
4. How are environmental geologists involved in ecological remediation?

2. *Match the words combinations with their Russian equivalents*:

1	to keep the environment safe and healthy	A	работать на ресурсодобывающие компании
2	impact of various human activities	B	государственные учреждения
3	to perform a wide range of tasks	C	сохранять окружающую среду безопасной и полезной для здоровья
4	to have master's or doctoral degrees	D	разработать политику использования водных и земельных ресурсов
5	government agencies	E	выполнять широкий спектр задач
6	to work with resource extraction companies	F	воздействие различных видов деятельности человека
7	to formulate water and land use policies	G	иметь магистерскую или докторскую степени

3. *Render the text in English*:

Экологическая геология - новое научное направление геологии, изучающее взаимодействие геологического компонента окружающей среды (*environment*) и человеческой деятельности. Анализ этого взаимодействия и прогноз негативных последствий (*negative aftereffects)* в практическом плане стали основными задачами новой науки в настоящее время. Экологические геологи – это специалисты в области охраны окружающей среды, стремящиеся к безопасному использованию природных ресурсов планеты без нанесения ей серьёзного ущерба. Такие специалисты выступают в качестве защитников месторождений природных ископаемых и вносят конструктивные *(functional)* предложения для развития экологически безопасной эксплуатации *(safe exploitation)* природных ресурсов.

Экогеологи могут работать в государственных учреждениях, в частных консалтинговых фирмах, в нефтяных и строительных компаниях, и во многих других организациях, выполняя широкий спектр задач.

Text 6.3 James Dwight Dana

1813-1895

The theory of plate tectonics, radiogenic age-dating methods, and the use of computer modeling have radically changed geologists' view of the earth in the last century. But some things, such as the writings of 19th-century American mineralogist James D. Dana, remain a staple of the science. In this preface to an 1875 introductory textbook, The Geological Story Briefly Told, Dana's remarks on the fundamentals of geologic research are just as pertinent today: Use good observational skills, get some basic field instruments, and be willing to get your fingernails dirty.

Personal. James Dwight Dana was born in Utica, New York, on February 12, 1813, and died in New Haven Connecticut, on April 14, 1895.

Dana's interest in science was fostered during his education at the Bartlett Academy at Utica, where his science teacher was Fay Edgerton, who had been a pupil of Amos Eaton, a pioneer American geologist. Dana entered Yale College at New Haven in 1830; there his science studies were influenced further by the elder Benjamin Silliman, under whom Amos Eaton had studied earlier. Upon graduating from Yale in 1833, Dana spent 15 months as a shipboard mathematics instructor for midshipmen of the U.S. Navy, during which time he cruised the Mediterranean. He studied volcanic phenomena there, and a letter describing his observations to Silliman appeared in the American Journal of Science in 1835; this was his first publication. In 1836 he was an assistant in chemistry to Silliman at Yale. From 1838 to 1842, Dana served as a naturalist responsible for geology and mineralogy, and later, for marine zoology, with the United States Exploring Expedition to the Pacific under the command of Lieutenant Charles Wilkes. In 1849 he was appointed a professor at Yale but, because he continued to work on his reports of the Wilkes expedition, he did not assume his teaching duties until 1855. He remained at Yale until his retirement in 1890. Dana married Professor Benjamin Silliman's daughter, Henrietta, in 1844.

Professional. Dana's System of Mineralogy, published in 1837 when he was just 24 years old, and his Manual of Mineralogy (1848), became the main introduction to mineralogy for generations of geology students. He also published his Manual of Geology in 1862, which for 40 years was a most influential textbook for beginning students of geology. In addition, he published many articles on a variety of geological and zoological topics. Most important among these were articles supporting the subsidence theory of the growth of coral reefs, originally suggested by Charles Darwin, and his studies of volcanism as one phase of a broader igneous activity associated with widespread but slow earth movements that determine the grand features of the Earth's crust. Also, Dana named and expanded the geosynclinal concept, originated by James Hall in 1859, which became one of the main explanations of mountain building for the next 100 years. Dana was much honored by American geologists. In 1854, he was elected President of AAAS, and in 1890, as President of GSA.

Role as a Founder. Dana was in his mid-70s when GSA *(the Geological Society of America)* was born in 1888. Although Dana was not present at the Ithaca meeting on December 27 of that year, as a distinguished elder he had supported the efforts of American geologists to organize a geological society. When in 1889 the new society was established, Dana was elected First Vice-President of the American Geological Society and a year later in 1890 the President of GSA. (from *The Founding of the Geological Society of America: A Retrospect on Its Centennial Birthday 1888–1988*, by Arthur Mirsky*)*

http://www.environmentalscience.org/career/environmental-geologist

EXERCICES

1. *Find these words or word combinations in the text and translate them into Russian*:

was fostered; science teacher; a most influential textbook; a shipboard mathematics instructor for midshipmen; volcanic phenomena; the main introduction to mineralogy for geology students; mountain building.

2 a) *Only one of the sentences below is true. Say which.*

1.Dana's science teacher was Fay Edgerton, a pioneer American geologist.

2. Fay Edgerton and J.Dana met at Yale College at New Haven.

3. American geologist Amos Eaton studied under the elder Benjamin Silllman .

2 b)

1. On graduating from Yale in 1833, Dana spent 15 months as a shipboard naturalist responsible for geology and mineralogy.

2. His first publication appeared in the American Journal of Science in 1835.

3. After the expedition during which he cruised the Mediterranean he was appointed a professor at Yale and started his teaching in 1849.

2 c)

1. Dana's Manual of Mineralogy (1848) became the main introduction to mineralogy for generations of geology students.

2. His studies on volcanic phenomena became the most influential textbook.

3. Dana was elected Editor of the Geological Society of America.

3. *Answer the questions to the text.*

1) Can you give the names of the scientists who had great influence on young James Dana?

2) What kind of James Dana's letter appeared in the American Journal of Science in 1835?

3) What were the reasons that Professor J. Dana could not assume his teaching duties at Yale until 1855?

4) How important was Dana's System of Mineralogy, published in 1837?

5) Were James Dana's scientific interests confined to mineralogy?

4. *Read and analyse the sentences. Put the underlined verb forms into the appropriate place in the box.*

Present Perfect Active	Past Perfect Active	Past Simple Active	Past Simple Passive	Past Participle
				published, …

1) The theory of plate tectonics, radiogenic age-dating methods, and the use of computer modeling <u>have</u> radically <u>changed</u> geologists' view of the earth.

2) In 1849 he <u>was appointed</u> a professor at Yale.

3) Dana's interest in science <u>was fostered</u> during his education at the Bartlett Academy at Utica, where his science teacher was Fay Edgerton, who <u>had been</u> a pupil of Amos Eaton, a pioneer American geologist.

4) Dana's System of Mineralogy, published in 1837 when he was just 24 years old, and his Manual of Mineralogy (1848), became the main introduction to mineralogy for generations of geology students.
5) Most important among these were articles supporting the subsidence theory of the growth of coral reefs, originally suggested by Charles Darwin, and his studies of volcanism as one phase of a broader igneous activity associated with widespread but slow earth movements that determine the grand features of the Earth's crust.
6) Also, J.Dana named and expanded the geosynclinals concept, originated by James Hall in 1859, which became one of the main explanations of mountain building for the next 100 years.
7) Although Dana was not present at the Ithaca meeting on December 27 of that year, as a distinguished elder he had supported the efforts of American geologists to organize a geological society.

UNIT SEVEN

Text 7.1 PROSPECTING GEOLOGY

Prospecting is the first stage of the geological analysis of a territory (exploration is the second). It is physical search for minerals, fossils, precious metals or mineral specimens, and is also known as fossicking. Prospecting is a small-scale form of mineral exploration which is an organized, large scale effort undertaken by commercial mineral companies to find commercially viable ore deposits.

Prospecting involves physical labour: traversing (traditionally on foot or on horseback), panning, sifting and outcrop investigation, looking for signs of mineralization. In some areas a prospector must also make claims, meaning they must erect posts with the appropriate placards on all four corners of a desired land they wish to prospect and register this claim before they may take samples. In other areas publicly held lands are open to prospecting without staking a mining claim.

The first stage involves locating prospective deposits. To do this geologists use their knowledge of ore genesis and occurrence. Geologic environments that are associated with the wanted type of mineral deposit are target of investigation. Methods such as geological surface mapping and sampling, geophysical measurements and geochemical analysis are often applied at an early stage to pin out potential deposits. After a deposit has been located, the next stage is to map the deposit in more detail to evaluate grade and tonnage of the mineral occurrence.

The deposit is then drilled to investigate and sample the mineralization in depth. The density of the drilling is determined by the wanted level of geologic confidence and project economics.

How are hydrocarbon fields discovered

Prospecting for new gas and oil fields is the job of geologists and geoscientists. They have technical and chemical means which help identify accumulations of hydrocarbons fairly precisely. However, the only way to know for sure is to drill a well. Gas can also be partially dissolved in oil or fill the elevated part of an oil field, forming a so-called gas cap. Therefore, gas is often produced with oil and oil with gas.

Geoscientists' maps

Oil and gas prospecting begins with geological surveys. Geological maps representing the structure of areas of the outer crust of the Earth are drawn upon the results of such survey. In the course of field survey, geologists study outcropping rock beds, their composition, origin, age, and deposition forms. Boundaries of distribution of these rocks are plotted on topographical maps and areas of possible deposits of mineral

fossils are outlined. These areas are further prospected and explored in detail; then, fossil minerals are initially estimated. Gravitational, magnetic, and seismic method are used to survey the subsurface.

Gravity prospecting

Gravity prospecting is based on dependence of gravity on density of rocks: oil- or gas-bearing rocks have lower density than similar water-containing rocks. The mission of geoscientists is to find locations with abnormally low gravity.

Magnetic prospecting

Magnetic prospecting is based on different magnetic conductivity of rocks. Airborne magnetic survey enables the identification of anticlines – natural geological traps for migrating hydrocarbons at a depth of up to 7 kilometers.

Seismic prospecting

Seismic prospecting determines the structure of rock deposition using artificially created elastic oscillations (seismic waves) when passing though the stratum. In terms of physics, these are the same acoustic waves as on the surface, which resulted from a medium perturbance and reflected from a surface. Echoes of seismic waves are detected by seismographs. Seismic prospecting is used not only for finding structures, which can contain hydrocarbons, but also for the selection of an optimal site for drilling prospecting wells. Seismic method is often used in

conjunction with drilling to enhance reliability of forecasting 2D, 3D, and now also 4D.Conventional two-dimensional (2D) seismic prospecting has been gradually replaced with more modern three-dimensional (3D), i.e. scientists receive not a flat but stereoscopic image of a crust section, where fossil minerals may occur. Application of four-dimensional (4D) seismic prospecting is started as well – recurrent observations of the three-dimensional (3D) survey allow for better real-time control over the field development conditions.

Geochemical prospecting

There are also geochemical methods for prospecting hydrocarbon deposits based on studies of the chemical composition of underground water and the content of dissolved gases and organic matters in it. Concentration of these components in water increases as it approaches the deposit.

Drilling is reliable

However, the only method to know for sure whether a trap has commercial amounts of gas or oil is to drill a well. On average, only every third drilled well turns out to be a legitimate field.

Exploration: increased reserves

To increase the hydrocarbon reserves, the Energy Strategy of Russia provides for the development of geological exploration operations for the period until 2020 with a view to discovering new fields. Gazprom Group is the world's largest company in terms of natural gas reserves with its over 33 trillion cubic meters. Effective policy in the area of replenishment of hydrocarbon reserves helped the company achieve this result. Gazprom has secured excess of the reserves replenishment over the level of production since 2005. Geological exploration remains one of the most effective means for increasing reserves. In 2010, prospecting and exploration operations enabled an increment of over 547.7 billion cubic meters of natural gas ensuring its replenishment rate of 108 per cent. Gazprom continues working on optimization of the volumes and also concentrates on improvement in efficiency of geological exploration in order to secure stable mid- and long-term production.

growth.https://en.wikipedia.org/wiki/Prospecting#Prospecting_tactics

EXERCISES

1. *Put the sentences in the order they are used in the text; the first one is done for you:*

1d 2 … 3… 4 … 5… 6… 7 …

a) Methods such as geological surface mapping and sampling, geophysical measurements and geochemical analysis are often applied at an early stage to pin out potential deposits.

b) Echoes of seismic waves are detected by seismographs.

c**)** The mission of geoscientists is to find locations with abnormally low gravity.

d) Prospecting is a small-scale form of mineral exploration which is an organised, large scale effort undertaken by commercial mineral companies to find commercially viable ore deposits.

e) Prospecting for new gas and oil fields is the job of geologists and geoscientists.

f) Echoes of seismic waves are detected by seismographs.

g) Seismic method is often used in conjunction with drilling to enhance reliability of forecasting.

2. *Now give a Russian translation of the sentences above*.

3. *Make up correct sentences out of the jumbled words below:*

1. rock seismic deposition prospecting the of structure determines

2. for the of one effective geological reserves remains exploration most increasing means

3. geoscientists locations gravity job the of with find low is to abnormally

4. used are gravitational magnetic seismic and survey the to methods subsurface

5. seismographs waves echoes seismic detected by of are

6. organic methods content based are geochemical matters for underground prospecting hydrocarbon water deposits studies composition dissolved chemical gases on the the of of of in it and and

7. magnetic (2) based rocks prospecting conductivity is on of different

4. *Read the following words:*

a) be careful to pronounce them correctly;

b) look up the translation of these words in the vocabulary notes and memorize them.

to fossick (v) ['fɔsɪk]	analysis (n) [ə'næləsɪs]
viable (adj) ['vaɪəbl]	ore (n) [ɔ:]
company (n) ['kʌmpənɪ]	panning (n) ['pænɪŋ]
to sift (v) [sɪft]	to dissolve (v) [dɪ'zɔlv]
technical (adj) ['teknɪk(ə)l]	reserve (n) [rɪ'zɜ:v]
echo (n) ['ekəu]	to receive (v) [rɪ'si:v]
volume (n) ['vɔlju:m]	depth (n) [depθ]
oscillation (n) [ˌɔsɪ'leɪʃ(ə)n]	legitimate (adj) [lɪ'dʒɪtəmət]

5. *Make up derivatives from the verbs below adding the suffixes*

Model: reflect - reflection

1**) -ment-** achieve manage develop replenish

2) -sion- provide conclude collide include

3) -ing- fossick drill prospect outcrop

6. *Match the halves of the complex adjectives from A and B*

Model: small - scale

A	small -	gas-	three-	water-	long-	oil-

B	bearing	term	dimensional	arc	containing	scale

Text 7.2 PROSPECTING GEOLOGIST

Can you guess the meaning of the following words (from the text below):

data (n,pl.)

drilling (n)

extensive (adj)

extremely (adv)

prospecting (Pr.P.)

topographical (adj)

undetected (adj)

A prospecting geologist is a professional who has extensive experience and expertise when it comes to searching for large deposits of minerals or other types of natural resources that can be mined for commercial purposes.

Prospecting geologists are trained in earth sciences to find geological wonders. They explore specific regions to discover valuable mineral deposits using topographical maps, surveys, reports, and knowledge of geology and mineralogy. They collect data on rock formations using geophysical instruments and devices, such as Geiger counters and electronic sounding equipment, and determine feasibility of staking and developing a claim.

The primary purpose of the prospecting geologist is to quickly and cost-effectively locate all outcropping mineralization within a given area, and to be able to understand areas of non-outcropping mineralization. If significant mineralization is located, a prospector should then decide upon methods of sampling necessary to assess and expand the identified mineralized zones.

While some individuals consider themselves to be recreational or even professional "prospectors" as they independently attempt to discover undetected supplies of valuable natural resources most prospecting geologists are employed by mining companies.

The number one goal of prospecting geologists is to determine if specific locations are rich in minerals or other types of natural resources and if those locations are able to be effectively mined. To do this they often must traverse into extremely remote locations in order to study the geology in the area and take samples which are taken back to a laboratory and examined. Once the decision has been made to begin mining a particular area a prospecting geologist may be assigned to oversee certain aspects of the mining operation.

During their supervision they often provide guidance on the direction that drilling should follow recommendations based on maps and diagrams that are produced by a team of geologists, mineralogists and engineers. Over the course of their careers prospecting geologists often develop a high level of expertise in discovering reserves of particular types of valuable rocks, minerals, metals or other resources.

In order to become a prospecting geologist it's essential that a bachelor's degree in the field of geology be earned but many have master's degrees or doctoral

degrees. Once they become established prospectors, most geologists specialize in a specific type of rock, mineral or precious metal. Some prospecting geologists may

act as quality control advisors in mines, working to ensure that mines produce quality ore. With a post-graduate degree it's possible to find work as a university professor or a consultant.

http://www.allstarjobs.com/careers/Environmental_Science/Prospecting_Geologist

EXERCISES

1. *Answer the following questions*:

1) Can you list the professional responsibilities of prospecting geologists?

2) What according to the text is the number one goal of prospecting geologists?

3) What could be the areas and locations where prospectors take samples and study rocks?

4) Can you list the possible companies or enterprises, which can employ prospecting geologists?

5) What academic degrees could be earned in the field of prospecting geology to become a competitive professional?

2. *In the sentences below define subject and predicate – the main parts of a sentence.*

1) Prospecting geologists are trained in earth sciences to find geological wonders.

2) The English naturalist Charles Darwin, well known for his theory of evolution, began his scientific career on the voyage of the HMS Beagle.

3) Finding and maintaining a clean water supply, and disposing safely of waste products, requires understanding the earth's systems through which they cycle.

4) People who work in this branch of geology spend a lot of time in the field.

5) In contrast to the then current method of learning by rote, students were to learn by doing experiments in laboratories.

6) Another focus of his academic interests was the rational use of hydrocarbon resources.

7) The combined efforts of geologists and petroleum engineers throughout the life of a hydrocarbon accumulation determine the way in which a reservoir is developed and depleted, and usually they have the highest impact on field economics

3. *Match the words combinations with their Russian equivalents:*

1	to have extensive experience and expertise	A	руководить чем-либо
2	to traverse into extremely remote locations	B	обладать опытом, экспертными знаниями, компетентностью
3	prospector	C	неоткрытые залежи ценного природного сырья
4	to oversee certain aspects of mining operation	D	значительное оруденение
5	undetected supplies of valuable natural resources	E	следить за определёнными методами добычи полезных ископаемых
6	significant mineralization	F	геолог-разведчик, рудоискатель, старатель
7	to provide guidance for	G	перемещаться в чрезвычайно отдалённые районы

4. *Read the text and complete the following sentences:*

1) Prospecting geologists are scientifically ____ in earth sciences to find geological wonders.

2) Geophysical instruments and devices help prospecting geologists to collect data and determine feasibility of ____ and developing a claim.

3) The primary purpose of the prospecting geologist is to locate all ____ mineralization within a given area.

4) Very often prospecting geologists have to determine if certain locations are able to be effectively ____**.**

5) When mining works in a particular area are in full swing a prospecting geologist may be assigned ____ certain aspects of the mining operation.

6) Over the course of their careers prospecting geologists often develop a high level of _____ in fulfilling their professional responsibilities.

7) It’s common practice that geologists _____ ___a specific type of rock, mineral or precious metal.

8) In mining the work of quality control ____ is to ensure that mines produce quality ore.

Text 7.3 ACADEMICIAN I. M. GUBKIN (1871-1939)

The name of Ivan Mikhailovich Gubkin is widely known as the prominent scholar who established a new branch of geological science in Russia – petroleum geology.

He was one of the founders and creators of petroleum geology as an independent branch of geological science in the world. He wrote the first books on the geology of oil and the world's oil fields. In his fundamental work, "The doctrine of oil" (1932),

I.M. Gubkin developed the basic theory of the origin of oil, the conditions of formation of its deposits. It was work on the genesis of the oil fields and mud volcanism that brought I.M. Gubkin worldwide fame. The development of his scientific legacy continues to this day.

Ivan Gubkin was born in the village of Pozdnyakovo, Muromsky uezd (district) in the province of Vladimir into a family of a poor peasant. In 1890 he graduated from the Teacher Seminary in a small place Kirzhachi and worked as a village teacher in Murom district. In 1895-1898 he studied at the St. Petersburg Teacher Training College Institute, and then worked as a school teacher in St. Petersburg. In 1903 he entered the St. Petersburg Mining Institute, on graduation in 1910 I.M. Gubkin was appointed Fellow, Associate Geologist of the Geological Committee.

I. M. Gubkin started his scientific work in 1908 being a student at the Mining Institute; his first research was examining the rocks of the northern shore of Lake Ladoga. The first success came to him when exploring the oil-rich regions of Markup and North Caucasus. Having managed to understand the genesis of oil deposits and the regularity of their occurrence, the young scientist even in those years developed new principles of oil deposits search and identified exploration prospects for further development in these regions. In the papers on the geology and

oil-bearing region of Maikop, published in 1912-13 he proposed a new method for constructing maps of underground oil reservoirs relief. This method of preparation of geological and structural mapping was later widely used in Russia and other countries. These outstanding achievements brought I.M. Gubkin wide recognition, and he was elected to the Geological Committee of Russia. As one of the leading specialists in the field of petroleum geology in the summer of 1917 he was sent to the United States to study the American oil industry.

On his return to Russia in 1918, I.M. Gubkin accepted the Soviet power without any reservation and plunged into the scientific and organizational work. He was appointed a member of the Board of the Chief Oil Committee, later - the chairman of the section of applied geology of the Council of Labour and Defense.

Another focus of his academic interests was the rational use of hydrocarbon resources. Particular attention was directed to exploratory drilling and oil field development. In addition to studying the origin of oil Gubkin was interested in the problems of stratigraphy, tectonics and other geological subdisciplines. It was Gubkin who recommended to apply, develop and perfect a multi-disciplined approach in searching for hydrocarbons. He stated that petroleum geology should be integrated with physics, chemistry, biology, mathematics, and other sciences.

Thanks to Gubkin's ideas new oil fields were discovered. Well-known is Gubkin's prediction of oil potential in West Siberia Plain and the Volga-Urals region.

From the first years of Soviet power, I. M. Gubkin repeatedly raised the issue of detailed geological studies in the vast area between the river Volga and the Ural Mountains where more than 150 years ago numerous features of oil deposits were reported but, however, the commercial quantity of oil was not found. In 1928-1929 having been appointed Director of the Moscow branch of the Geological Committee, I. M. Gubkin organized systematic exploration for oil in the Urals and the Volga region.

Apart from the research work I.M.Gubkin was engaged in teaching.

I.M.Gubkin developed a new idea of training a petroleum engineer with a profound academic background. He stated that a petroleum engineer should be an expert in deep drilling, exploitation, chemistry and technology of oil as well as in economics. With this in mind he founded the petroleum department at the Mining Academy. In 1930 on the basis of this department the Moscow Oil Institute was formed and Gubkin was its first rector. Nowadays it is the University of Oil and Gas named after him.

Here he had several years' experience of teaching a special course of petroleum geology which he had introduced into the curriculum.

I.M.Gubkin put forward a new concept of teaching petroleum engineers. He was the first to introduce a special-purpose academic program designed to balance theory and practice, field and laboratory studies.

In the honor of Ivan Mikhailovich Gubkin quite a number of educational and research institutions bear his name. In the cities Moscow and Kazan there are Gubkin streets.

http://www.vladimir.ru/Губкин_Иван_Михайлович
http://www.federalbook.ru

EXERCISES

1. *Questions to the text*

1) Scan the text to list the research interests of I.M. Gubkin.

2) Which ideas of I.M. Gubkin led to the discovery of new oil fields?

3) Which developments proposed by the scientist are still used in geology studies?

4) What is the story of foundation of the University of Oil & Gas named after I.M.Gubkin?

5) What was I.M. Gubkin's teaching philosophy?

2. *Find in the left column definitions to the words in the right column.*

A	genesis	1	a list of all the courses of study offered by a school or college
B	plunged into the scientific and organizational work	2	a cone-shaped mound formed from fine mud ejected, with gases and water, from hot springs, geysers, etc., in volcanic regions
C	curriculum	3	a beginning or origin of anything
D	prediction	4	the art, technique, or practice of compiling or drawing maps or charts
E	mud volcano	5	any organic compound containing only carbon and hydrogen
F	cartography	6	to involve or become involved deeply in(to) something
G	hydrocarbon	7	forecast

3. *Translate the sentences into Russian:*

1) It was work on the genesis of the oil fields and mud volcanism that brought I.M. Gubkin worldwide fame.

2) The young scientist developed new principles of oil deposits search and identified exploration prospects for further development in these regions.

3) Particular attention was directed to exploratory drilling and oil field development.

4) He stated that petroleum geology should be integrated with physics, chemistry, biology, mathematics, and other sciences.

5) Numerous features of oil deposits were reported in the vast area between the river Volga and the Ural Mountains.

6) With this in mind he founded the petroleum department at the Mining Academy.

4. *Read the text and complete the following sentences:*

1) It was work on the genesis of the oil fields and mud volcanism that brought I.M. Gubkin ___ fame.

2) Gubkin's first ___ was examining the rocks of the northern shore of Lake Ladoga.

3) He ____ a new method for constructing maps of underground oil reservoirs relief.

4) In the summer of 1917 he ____ sent to the United States to study the American oil industry.

5) Another focus of his academic interests was the rational use of _____ resources.

6) He stated that petroleum geology should be _____ with physics, chemistry, biology, mathematics, and other sciences.

7) He insisted that a petroleum engineer should be an expert in deep drilling, exploitation, chemistry and technology of oil _____ in economics.

8) Apart from the research work I.M.Gubkin was engaged in _____.

9) He introduced a special-purpose academic program designed to balance theory and practice, field and _____ studies.

10) I.M.Gubkin put _____ a new concept of teaching petroleum engineers.

5. *Render the text in English:*

Основоположник нефтяной геологии, инициатор и организатор высшего нефтяного образования в СССР. Организатор и руководитель первых научно-исследовательских институтов по проблемам нефти и других горючих ископаемых. Автор более 150 научных работ, в том числе учебников по геологии нефти. Разработал теорию нефтеобразования и формирования

нефтяных месторождений. Открыл новый тип промышленных залежей нефти, названных «рукавообразными». Обосновал перспективность Волго-Уральской и Западно-Сибирской нефтегазоносных провинций. Среди важнейших научных работ «Учение о нефти» (1932), «Башкирская нефть. Ее значение и перспективы» (1932), «Мировые нефтяные месторождения» (1934), «Вторая нефтяная база на Востоке СССР и Урало-Эмбенский нефтеносный район».

(1936), «Урало-Волжская нефтеносная область (Второе Баку)» (1940), «Избранные сочинения» т. I, II (1950-1953).

Имя Академика И.М. Губкина в 1930 г. присвоено Московскому нефтяному институту – РГУ нефти и газа, в котором учреждена именная стипендия для студентов.

UNIT EIGHT

Text 8.1 GEOCHEMISTRY

Geochemistry is concerned with the application of chemical principles and

techniques to geologic studies; it helps to understand how chemical elements are distributed in the crust, mantle, and core of the earth. Over a period of several billion years, chemical differentiation of the earth's crust has created vast rafts of silica-rich rocks, the continents, which float on iron- and magnesium - rich rocks of the ocean basins.

Geochemistry is the science that uses the tools and principles of chemistry to explain the mechanisms behind major geological systems such as the Earth's crust and its oceans. The realm of geochemistry extends beyond the Earth, encompassing the entire Solar System and has made important contributions to the understanding of a number of processes including mantle convection, the formation of planets and the origins of granite and basalt.

Exploration on Geochemistry

Rudimentary forms of geochemical prospecting for ore deposits, as described by the German scientist Georgius Agricola in his *De Re Metallica* (1556), have been practiced since the 8th and 9th century AD. Modern methods of exploration geochemistry begin with systematic collection of samples of soil, rock, vegetation, and water. Data obtained by analysis of the samples is now interpreted

using computer programs written specifically for this purpose. In current world markets, with the price of most nonferrous metals at an all-time low, exploration for metallic mineral deposits is confined largely to precious metals, and the chief targets of geochemical prospecting are gold and platinum-group metals.

Environmental Geochemistry

Among the various branches of earth science, environmental geochemistry is unique in focusing directly on public health issues related to the environment. Trace elements, normally present in minute amounts in rocks, soil, and water, are a major influence on health. Beneficial trace elements regulate enzymatic and hormonal activity and are thus essential to growth and metabolism. Calcium, magnesium, iron, manganese, cobalt, copper, zinc, and molybdenum are all essential to good health. Other trace elements, such as mercury, are toxic; some, such as selenium and fluorine, are beneficial in minute quantities but toxic if

concentrated. Selenium tends to be taken up by certain range plants, such as locoweed, which poison the livestock that feed on them.

The type of bedrock beneath the soil in an area helps determine the kinds of trace elements in the water and vegetation of the area. Geochemical analyses of soil, water, and plants indicate how trace elements are distributed. These findings may have serious health implications, revealing, for example, correlations between trace-element distribution and incidence of cardiovascular disease.

Geochemical studies also provide data with which to assess the health hazards of toxic elements and carcinogenic minerals. Selenium is especially harmful to wildlife in heavily irrigated areas, and indoor radon has become a major health concern because it increases the risk of lung cancer. Data on the health effects of the various asbestos minerals suggest enough variation in carcinogenicity to warrant greater discrimination in state and federal regulations governing the use and disposal of these minerals.

Geochemistry is the application of chemistry to the study of the earth, its materials, and the cycling of chemicals through its systems. It is essential in numerical dating and in reconstructing past conditions on the earth. Geochemistry is important for tracing the transport of chemicals through the earth’s four component systems: the lithosphere (rocky exterior), the hydrosphere (waters of the earth), the atmosphere (air), and the biosphere (the system of living things). Biogeochemistry is an emerging field that examines the chemical interactions between living and nonliving systems - for example, microorganisms that act in soil formation.

Geochemistry has important applications in environmental and economic geology as well as in the fields of mineralogy and petrology.
http://www.memidex.com/geochemistry

EXERCISES

1. *Feel the gaps in the summary of the text you have read*.

Geochemistry is the geology and chemistry concerned 1) … the chemical composition and chemical reactions taking 2) … within, the earth's crust. Geochemistry is the application of chemistry to the study of the earth, its materials, and the cycling of chemicals 3) … its systems.

The sphere of geochemistry extends 4) … the Earth, encompassing the entire Solar System and has made 5) … contributions to the understanding of a number of processes including mantle convection, 6) … formation of planets and the origins of granite and basalt.

Among the various 7) … of earth science, environmental geochemistry is unique in focusing directly 8) … public health issues related to the environment.

Biogeochemistry is an 9) … field that examines the chemical interactions between living and nonliving systems - for example, microorganisms that act in soil formation.

http://www.wisegeek.com/what-does-a-geochemist-do.htm

2. *Find the spelling errors in the words below*.

atmosphere, application, billion, cycling, encompassing, essential, formation, governing, harmfull, normaly, process, systematic, uniqe

3. *a) Match the verbs in column A with the words in column B*

Model: obtain data

A	**B**
make gain *obtain*	way(s) experience
conduct follow concentrate find	recommendation(s) *data*
analyze	surveys and statistics
	research contribution efforts

b) *Now use the combinations you've made to complete the sentences below*

1) Professionals _____ to determine the most efficient, safest ways to access groundwater.
2) Several factors _____ to Nebraskas's depopulation.
3) In their field work undergraduates _____ their academic adviser's _____ .
4) Most new postgraduates work as field researchers or laboratory assistants for several years so that they can ____ the practical _____ necessary to organize original projects.
5) Scientists may _____ on the earth's components to develop theories on how and why the earth is changing.
6) Computer programs help to interpret the _____ by analysis of the samples.
7) We must _____ to reduce the costs of drilling.
8) These geology professionals often work with resource extraction companies _____ to make an area safe to use.

4. *Read the following words:*
a) be careful to pronounce them correctly
b) look up the translation of these words in the vocabulary notes and memorize them !

geochemistry (n) [ˌdʒi:əu'kemɪstrɪ]	sphere (n) [sfɪə]
application (n) [ˌæplɪ'keɪʃ(ə)n]	realm (n) [relm]
iron (n) ['aɪən]	to encompass (v) [ɪn'kʌmpəs]
to irrigate (v) ['ɪrɪgeɪt]	magnesium (n) [mæg'ni:zɪəm]
enzyme ['enzaɪm]	to emerge (v) [ɪ'mɜ:dʒ]
carcinogenicity (n) [ˌkɑ:s(ɪ)nəˈdʒɛnɪsitɪ]	microorganism (n) [ˌmaɪkrə(u)'ɔ:g(ə)nɪz(ə)m]

Text 8.2 GEOCHEMIST

Can you guess the meaning of the following words (from the text below):

Substance interaction
human inteference
petroleum geologists data
to minimize and repair damage

EXERCISES

1. *Answer the following questions*:

1) What do geochemists study working primarily with rocks and minerals?

2) What are usual companies and agencies where geochemists can work?

3) Do you think they can work for oil companies? If yes, give examples.

4) Have you ever read *Geochemistry International* journal?

5) If yes, what does this scientific resource give to its readers?

2. *Match the words combinations with their Russian equivalents*:

1	Study the chemical make up	A	достоверные данные
2	to travel nationally or worldwide	B	избавиться от опасных или токсичных материалов
3	to minimize damage due to human interference	C	различные вещества, содержащиеся в земле
4	hard data	D	путешествовать внутри своей страны и по всему миру
5	to dispose of hazardous or toxic materials	E	работать в государственном или частном секторе
6	various substances found in the earth	F	свести к минимуму ущерб от вмешательства человека
7	to work in the public or private sector	G	изучить химические составляющие

3. *Render the text given below in English*:

Геохимики анализируют химический состав горных пород, газов и полезных ископаемых; определяют их влияние на окружающую среду, и на процессы, происходящие в земной коре. Специалисты этого профиля сотрудничают с нефтяными компаниями, совместно с геофизиками определяют место бурения *(well drilling)* новых скважин, консультируют горнодобывающие предприятия, стремясь предотвратить эрозию горных склонов и загрязнение рек.

Кроме того, геохимики выполняют научные исследования геолого-геохимического, минералого-петрографического и эколого-геохимического профиля в специализированных лабораториях.

Для подготовки профессиональных геохимиков необходимы фундаментальные знания в области геологии и химии. Геохимики должны владеть методами экспериментального и теоретического моделирования *(modelling)* природных процессов, методами инструментального *(instrumental)*

анализа химического состава природных объектов, определения абсолютного возраста минералов и горных пород.

Text 8.3 MARIA MATILDA OGILVIE GORDON

A woman geoscientist in the Dolomites

(1864-1939)

The Scottish Maria Matilda Ogilvie Gordon (1864-1939), or May as she was known, was the oldest daughter of a pastoral family composed of eight children, five boys and three girls.

The parents had good connections and friends in various schools and colleges - all the surviving children (one died in infanthood) experienced a profound education. Maria entered Merchant Company Schools' Ladies College in Edinburgh at age of 9.

Already in these early years she showed a profound interest in nature, so during holidays she enjoyed to explore the landscape of the Highlands accompanied by her elder brother, the later geologist Sir Francis Ogilvie.

May aspired to become a musician and at age 18 she went to London to study music, becoming a promising pianist, but already in the first year her interest to nature prevailed and she decided for a career in science.

Studying both in London and Edinburgh she obtained her degree in geology, botany and zoology in 1890. Maria Ogilvie hoped to follow-up their studies in Germany, but in 1891, despite efforts and friends, even by the famous geologist Baron Ferdinand Freiherr von Richthofen (a pioneer geologist of the Dolomites), she was refused at the University of Berlin - as women were still not permitted to enroll for higher education in England and Germany. She went to Munich, where she was received friendly by eminent paleontologist Karl von Zittel (1839-1904) and

zoologist Richard von Hertwig (1850-1927), in contrast mineralogist Paul Heinrich von Groth (1843-1927) refused to allow the young women to enter his laboratory. Maria Ogilvie was not allowed to enroll in a regular course of studies even at

Munich, research was done as private person and to listen to lectures she had to sit in a separate room with the doors half-open.

In July 1891 the couple von Richthofen invited her to join a 5-week trip to the nearby Dolomites Mountains, visiting the Gröden-Valley.

From the first day Maria Ogilvie was immensely impressed by the landscape and soon she started an intense exploration of the area. She learned rock climbing and visited the Mecca of geology, the small village of Predazzo. Richthofen introduced Maria Ogilvie to alpine geology, and the travel party visited the meadows of Stuores in the Gader-Valley. At the time Maria Ogilvie had studied modern corals and was inclined to become a zoologist, but Richthofen, maybe also after showing her the beautiful preserved fossil corals of Stuores, advised her to become rather a geologist and to study and map this area.

Richthofen was over 60 and therefore he couldn't provide much support in the field, Maria Ogilvie remembers the challenge and danger of field work, sometimes accompanied by a local rock climber named Josef Kostner:

"When I began my field work, I was not under the eye of any Professor. There was no one to include me in his official round of visits among the young geologists in the field, and to subject my maps and sections to tough criticism on the ground. The lack of supervision at the outset was undoubtedly a serious handicap."

(Ogilvie Gordon 1932)

For two summers she hiked, climbed and studied various areas in the Dolomites and instructed local collectors to carefully record and describe their fossil sites. In 1893 she published the results in an article titled "Contributions to the geology of the Wengen and St. Cassian Strata in southern Tyrol", where she, as gifted drawer, published not only detailed figures of the landscape of the Dolomites, but also important contributions to the, at the time still poorly known, stratigraphic record of the Dolomites, establishing marker horizons and describing the ecology of various fossil corals associations. She alone described 345 species from the today 1.400 known species of molluscs and corals of the Wengen and St. Cassian Formations.

The published paper, extract of their thesis "The geology of the Wengen and Saint Cassian Strata in southern Tyrol", finally earned her respect by the scientific

community, and more important: her DSc degree in 1893 from the University of London (times finally had changed) - the first female DSc in the United Kingdom.

The same year she returned into the Dolomites to proceed with her geological and paleontological research and in 1894 she published her second important

contribution, the "Coral in the Dolomites of south Tyrol." Therein Maria Ogilvie emphasized that the systematic of corals must be based on microscopic examination and characteristics, not as it was usually done at the time, simply on superficial resemblance.

In 1895 she returned to Aberdeen, where she married a longstanding admirer, the physician Dr. John Gordon, husband who (unusual for the times) respected and encouraged her passion for the Dolomites. He and the four children accompanied Maria Ogilvie, despite the difficulties of travels, on various excursions into the Pale Mountains.

In 1900 she returned to Munich, becoming the first woman to obtain a PhD at the local University for her previous work in this city (also in Germany times changed). As thank to her old mentor, paleontologist von Zittel, she translated his extensive

German research on the "Geschichte der Geologie und Palaeontologie" into English as "The History of Geology and Paleontology."

Maria Ogilvie continued her studies and continued to publish, mostly privately. In 1913 she was preparing another important work about the geology and geomorphology of the Dolomites, to be published in Germany, but in 1914 with the onset of World War I and the death of the publisher the finished maps, plates and manuscripts were lost in the general chaos.

This was a hard setback, but like so many times before Ogilvie would not surrender. In 1922 she returned into the Dolomites, where she encountered the young palaeontologist Julius Pia, who, during the war, had carried out research in the Prags Dolomites. Both became friends, and in 1922 to 1925 they explored the Dolomites many times together.

She published copious volumes of the tectonic evolution of the Dolomites, and also books of geology for the interested layman, hoping to share her fascination of the Dolomites with others - one of the first examples of modern geological guide books for the region.

Maria Matilda Ogilvie Gordon succeeded against all odds and unequal treatment of women to study geology and achieve important results in this field. Still

today, mapping in the field, many observations of Maria can only be confirmed by modern geologists; some of their field work is based on her heritage.

To remember her contributions in paleontology in 2000 a new fossil fern genus discovered in Triassic sediments of the Dolomites was named after Maria Gordon – Gordonopteris lorigae.

http://historyofgeology.fieldofscience.com/2011/06/women-geoscientist-in-dolomites-maria.html#sthash.1K6VYx8B.dpuf

EXERCISES

1. *Answer the questions to the text.*

1) What kind of education did Maria get?

2) At what age did Maria Ogilvie decide to take up a carrier in science?

3) How deep was Maria's interest in music?

4) At the end of the XIX-th century it was not at all easy for women to enroll for higher education. Can you describe how Maria Ogilvie Gordon managed to study in Munich?

5) What did Maria consider as a serious handicap at the outset?

6) Did Maria Ogilvie realized the risks of the field work?

7) What was so special about her article titled "Contributions to the geology of the Wengen and St. Cassian Strata in southern Tyrol", which she published in 1893?

2. *Match the adjectives in column A with the nouns in column B.*

A	B
1. superficial	admirer
2. important	volumes
3. tectonic	family
4. microscopic	interest
5. profound	evolution
6. pastoral	resemblance
7. copious	examination
8. longstanding	contribution

3. *Fill the gaps with a word from the text*.

1) Already in these early years she showed a _____ interest in nature, so during

holidays she enjoyed to explore the landscape of the Highlands accompanied by her elder brother,

2) Studying both in London and Edinburgh she obtained her _____ in geology, botany and zoology in 1890.

3) Julius Pia _____out research in the Prags Dolomites.

4) She published _____ volumes of the tectonic evolution of the Dolomites.

5) Dr. John Dr. John Gordon, Maria's husband _____ and encouraged her passion for the Dolomites.

6) Maria Matilda Ogilvie Gordon succeeded against all odds and unequal _____ of women to study geology and achieve important results in this field.

4. *Be ready to have a talk on the hard way to higher education and science for women at the end of the XIX-th century*.

UNIT NINE

Text 9.1 HYDROGEOLOGY

Hydrogeology is the branch of geology dealing with the waters below the earth's surface and with the geological aspects of surface waters. It is the study of water movement through rock: the movement of subsurface water through rocks and the effect of moving water on rocks, including their erosion. This branch of the earth sciences investigates the flow of water through aquifers and other shallow porous media (typically less than 450 m or 1,500 ft below the land surface.) The general flow of fluids (water, hydrocarbons, geothermal fluids, etc.) in deeper formations is also a concern of geologists, geophysicists and petroleum geologists. Hydrogeology is an interdisciplinary subject; it can be difficult to account for the chemical, physical, biological and even legal interactions between soil, water, nature and society.

Groundwater is a slow-moving, viscous fluid; many of the empirically derived laws of groundwater flow can be alternately derived in fluid mechanics from the special case of Stokes flow (viscosity and pressure terms, but no inertial term). The study of the interaction between groundwater movement and geology can be quite complex. Groundwater does not always flow in the subsurface down-hill following the surface topography; groundwater follows pressure gradients (flow from high pressure to low) often following fractures and conduits in circuitous paths.

Traditionally, the movement of groundwater has been studied separately from surface water, climatology, and even the chemical and microbiological aspects of hydrogeology (the processes are uncoupled). As the field of hydrogeology matures, the strong interactions between groundwater, surface water, water chemistry, soil moisture and even climate are becoming more and more clear. For example: Aquifer

drawdown or overdrafting and the pumping of fossil water may be a contributing factor to sea-level rise.

Groundwater is a highly useful and often abundant resource. However, over-use, or overdraft, can cause major problems to human users and to the environment. The most evident problem (as far as human groundwater use is concerned) is a lowering of the water table beyond the reach of existing wells. As a consequence, wells must be drilled deeper to reach the groundwater; in some places (e.g., California, Texas, and India) the water table has dropped hundreds of feet because of extensive well pumping. In the Punjab region of India, for example, groundwater levels have dropped 10 meters since 1979, and the rate of depletion is accelerating. A lowered water table may, in turn, cause other problems such as groundwater-related subsidence and saltwater intrusion. Groundwater is also ecologically important. The importance of groundwater to ecosystems is often overlooked, even by freshwater biologists and ecologists. Ground waters sustain rivers, wetlands, and lakes, as well as subterranean ecosystems within karst or alluvial aquifers.

Not all ecosystems need groundwater, of course. Some terrestrial ecosystems – for example, those of the open deserts and similar arid environments – exist on irregular rainfall and the moisture it delivers to the soil, supplemented by moisture in the air. While there are other terrestrial ecosystems in more hospitable environments where groundwater plays no central role, groundwater is in fact fundamental to many of the world's major ecosystems. Water flows between groundwaters and surface waters. Most rivers, lakes, and wetlands are fed by, and (at other places or times) feed groundwater, to varying degrees. Groundwater feeds soil moisture through percolation, and many terrestrial vegetation communities depend directly on either groundwater or the percolated soil moisture above the aquifer for at least part of each year. Hyperemic zones (the mixing zone of stream water and groundwater) and riparian zones are examples of ecotones largely or totally dependent on groundwater.

Taking into account the interplay of the different facets of a multi-component system often requires knowledge in several diverse fields at both the experimental and theoretical levels.

http://www.scienceclarified.com/everyday/Real-Life-Chemistry-Vol-8/Hydrology.html

EXERCISES

1. *Put the sentences in the order they are used in the text (the first one is done for you):*

1 c 2 … 3… 4 … 5… 6… 7 …

a) Not all ecosystems need groundwater, of course.

b) Traditionally, the movement of groundwater has been studied separately from surface water, climatology, and even the chemical and microbiological aspects of hydrogeology (the processes are uncoupled).

c) Hydrogeology is the branch of geology dealing with the waters below the earth's surface and with the geological aspects of surface waters.

d) Groundwater feeds soil moisture through percolation, and many terrestrial vegetation communities depend directly on either groundwater or the percolated soil moisture above the aquifer for at least part of each year.

e) The general flow of fluids (water, hydrocarbons, geothermal fluids, etc.) in deeper formations is also a concern of geologists, geophysicists and petroleum geologists.

f) The importance of groundwater to ecosystems is often overlooked, even by freshwater biologists and ecologists.

g) The study of the interaction between groundwater movement and geology can be quite complex.

2. *Now give a Russian translation of the sentences above*.

3. *Feel the gaps in the text below with the words from the box.*

significant, deep, water, human, important, arid, industrial, close, multiple, urban, unsaturated, some

Most land areas on Earth have some form of aquifer underlying them, sometimes at 1) … depths. In some cases, these aquifers are rapidly being depleted by the 2) … population.

Aquifers are critically 3) … in human habitation and agriculture.

Deep aquifers in 4) … areas have long been water sources for irrigation. Many villages and even large cities draw their 5) … supply from wells in aquifers. Municipal irrigation and 6) … water supplies are provided through large wells. 7) … wells for one water supply source are termed "wellfields", which may withdraw water from confined or unconfined aquifers.

Using ground water from 8) …, confined aquifers provides more protection from surface water contamination. 9) … wells, termed "collector wells," are specifically designed to induce infiltration of surface (usually river) water.

Aquifers that provide sustainable fresh groundwater to 10) … areas and for agricultural irrigation are typically 11) … to the ground surface (within a couple of hundred metres) and have some recharge by fresh water. This recharge is typically from rivers or meteoric water (precipitation) that percolates into the aquifer through overlying 12) … materials.

4. *Read the following words*:

a) be careful to pronounce them correctly;

b) look up the translation of these words in the vocabulary notes and memorize them

aquifers (n) ['ækwɪfə]
subsurface (n) [ˌsʌb'sɜ:fɪs]
to uncouple (v) [ʌn'kʌpl]
to drawdown (v) ['drɔ:ˌdaun]
subsidence (n) [səb'saɪd(ə)n(t)s]
moisture (n) ['mɔɪsʧə]
abundant (adj) [ə'bʌndənt]
percolation (n) [ˌpɜ:k(ə)'leɪʃ(ə)n]
intrusion (n) [ɪn'tru:ʒ(ə)n]
arid (adj) ['ærɪd]
karst (adj) [kɑ:st]
alluvial (adj) [ə'lu:vɪəl]
riparian (adj) [raɪ'peərɪən]
overdraft (n) ['əuvədrɑ:ft]

Text 9.2 HYDROGEOLOGIST

Can you guess the meaning of the following words (from the text below):

hydrogeologist (n)
water reservoir
underground wate
pollution(n)

well tapping
strategies.

A hydrogeologist is a geologist or a scientist who studies the earth and how water interacts with the earth - how it is distributed in the earth and how the earth affects its properties. He or she conducts field studies to determine the location, size, and movement of underground water reservoirs. Research hydrogeologists often analyze soil, rock, and water samples in laboratories to check for contaminants and other abnormalities. Professionals who work for private research foundations and nonprofit environmental groups advocate public awareness of pollution concerns and advocate more responsible use of groundwater resources. A strong knowledge of geologic principles, environmental science, statistics, and physics is essential in the job.

Most hydrogeologists work for universities and private research laboratories. They conduct independent field and laboratory research to learn more about the hydrogeologic activity in a particular area. Scientists might take soil and water samples from a reservoir to test them for pollution and natural contaminants, such as toxic elements and living bacteria.

A research hydrogeologist can determine whether groundwater is safe for use in industry and commercial consumption.

A hydrogeologist may be employed by a consulting firm to help determine the best ways to access and extract groundwater resources. Scientists utilize advanced computer programs and imaging technology to map groundwater reservoirs and simulate different drilling and well tapping strategies. A detailed understanding of engineering is important in the design of drills and water treatment facilities.

Government hydrogeologists are often involved in making and improving laws related to groundwater usage. Professionals analyze geologic surveys and statistics to determine the most efficient, safest ways to access groundwater. They calculate the size of wells and predict when resources are eventually drained. Scientists use their data to create detailed, official reports and advise government officials on the creation of new policies.

An experienced hydrogeologist might choose to work for an environmental protection group or specialized research facility to help educate the public about groundwater issues. They create educational websites and books, and work directly with the public to promote awareness of the dangers of pollution and the importance of sustainability. Many hydrogeologists become involved in active cleanup efforts in areas that have become polluted by waste or oil spills.

In most countries, the minimum educational requirement to become a hydrogeologist is a bachelor's degree in hydrology, geology, or environmental science. Individuals who want to conduct independent research studies or become involved in policymaking are often required to hold doctoral degrees. Most new hydrogeologists work as field researchers or laboratory assistants for several years so that they can gain the practical experience necessary to organize original projects. http://water.usgs.gov/edu/hydrology.html

EXERCISES

1. *Answer the following questions*:

1) What disciplines are of primary importance for studying hydrogeology?

2) What are professional duties of a research hydrogeologist?

3) How do hydrogeologists determine whether groundwater is safe for use in industry and commercial consumption?

4) Which way may professional hydrogeologists influence groundwater usage?

5) What can experienced hydrogeologists do to help educate the public about groundwater issues?

6) Do you think there is a difference between the words geohydrologists and hydrogeologists? Which one refers to specialists working within geology and which means a geologist who works within hydrology?

2. *Match the words combinations with their Russian equivalents*:

1	to test for toxic elements and living bacteria	A	резервуар грунтовых вод
2	to conduct field studies	B	проверять на токсические элементы и микроорганизмы
3	to clean up polluted areas	C	проводить полевые исследования
4	to create new environmental policies	D	создавать новую стратегию охраны окружающей среды
5	underground water reservoirs	E	водоочистные сооружения
6	water treatment facilities	F	природные загрязняющие вещества
7	natural contaminants	G	приводить в порядок загрязнённые территории

3. *Read the text* Hydrogeologist *again and complete the following sentences:*

1) Hydrogeology studies how waters are distributed in the earth and how the earth affects its _____ .

2) A hydrogeologist is a _____ who researches ____ systems.

3) Some people think that ___ and hydrogeology work on the same problems but their methods are different.

4) Groundwater hydrogeologists usually concentrate on how groundwater ___ with other surfaces like soil and air.

5) One of the hydrogeologists' tasks is to predict when water resources eventually be ____.

6) Field research is conducted to learn more about the hydrogeologic activity in a particular ___.

7) Advanced computer programs and imaging technology can also be ____ to map groundwater reservoirs and simulate different drilling and well tapping strategies .

8) Very often hydrogeologists take part in ____ efforts in areas that have become polluted by waste or oil spills.

9) To promote awareness of the dangers of pollution and the importance of ____ sustainability educational websites and books are created.

Text 9.3 GOLOVKINSKY NIKOLAY ALEKSEEVITCH

A GEOLOGIST, PROFESSOR, AND WRITER

(1834-1897)

Russian geologist Nikolay Alekseevich Golovkinsky was born in a small town of Yaran in Kazan province to the family of district court investigator. Due diligence in the service his father was awarded the Order of St. Anne 3rd degree and thus granted the nobility, which gave his children the right to study at the university. And the family was large - five sons and two daughters.

In 1851 N.A. Golovkinsky entered Kazan Imperial University to study medicine but after a year he realized it was not his line and left the university to join the army.

Soon after the beginning of the Crimean war he was sent to Sevastopol by personal request. For taking part in the Crimean campaign he received decoration – a bronze medal on Andrew's ribbon. On having resigned from the military service N.A. Golovkinsky entered Kazan University again and in 1861 he graduated from the Physics and Mathematics Department.

In 1864 -1868 N.A. Golovkinsky worked in Kazan University as a freelance associate professor; worked and studied abroad; 1868 – 1869 publishes famous paper. On Permian formations in the central part of the Volga-Kama basin. This brought him Doctor's degree and professorship.

Nikolay Alekseyevich Golovkinskiy is better known as a famous Crimean geologist. In 1877-1881 he headed Novorossiya (modern Odessa) University. Conducting geological and hydro-geological researches on Crimea Peninsular Golovkinsky was one of those who organized the first "artesian observatory" as a model of hydro-geological station. Full member of St. Petersburg Mineralogy Society (since 1867) he took part in several meetings of Russian naturalists.He spent 25 years working in the University of Novorossiya (nowadays the University of Odessa). In 1886 he retires and moves from Odessa to the Crimea, where he already had a mansion near Alushta. The place got the name of "Professors' Corner'' since a lot of eminent scientists built their cottages near the house of Golovkinskiy. Not far from Alushta there is a beatiful waterfall named after him ***Golovkinsky Waterfall*** because the scientist was the first to describe it.

Distinguished Crimean professor Nikolay Alekseyevich Golovkinskiy did a lot for the peninsula: he devoted many years making active studies of the hydrogeology of the Crimea, and of its mountain relief. It was him who found the rests of mammoth's skeleton, in the valley of Sotera. Only thanks to Professor Golovkinskiy first urban water supply appeared in the Crimea, so new ground irrigation and artesian water extraction systems were introduced.

http://paleostratmuseum.ru/Golovkinsky.html

EXERCISES

1. *Put the words in the sentences in the right order*

1) geologist province in (2) Russian was N. A. Golovkinsky a of Yaran small town born Kazan.

2) Kazan 1851 medicine N.A. Golovkinsky University in to Imperial study entered

3) Sevastopol Crimean after Soon he to the (2) sent of war beginning was

4) University In as professor freelance N.A. Golovkinsky associate a Kazan worked

5) from to the and moves Odessa retires Crimea When he(2)

2. *Read the text about N.A. Golovkinsky and tell if the given sentences are TRUE or FALSE.*

1) N.A. Golovkinsky spent 25 years working in the University of Kazan.

2) In the Crimea Professor had a mansion near Alushta next to a beautiful waterfall.

3) On having resigned from the military service N.A. Golovkinsky entered Kazan University.

4) His famous paper “On Permian formations in the central part of the Volga - Kama basin.” brought him Doctor’s degree and professorship.

5) His father received decoration – a bronze medal on Andrew’s ribbon.

6) Golovkinsky was one of those who organized the first "artesian observatory" as a model of hydro-geological station.

7) Only thanks to Professor Golovkinskiy first urban water supply appeared in Kazan.

3. *Render in English the text about Professor P.I. Krotov, the geologist of Kazan University.*

Кротов Петр Иванович (1852 - 1914)

геолог, географ, геоморфолог.

Кротов Петр Иванович родился в селе Елово Глазовского уезда Вятской губернии. Образование получил на физико-математическом факультете Казанского университета, где окончил курс в 1878 году.

Служебная деятельность Кротова связана с Казанским университетом.

С 1878 г. – преподаватель Казанского университета. В 1880 году защитил диссертацию (to defend a dissertation/thesis) «О минеральном составе окаменелостей» и с осени того же года преподавал минералогию и геологию на медицинском факультете. В 1883 – 1914 гг. – первый профессор географии Казанского университета, заведующий кафедрой географии (head of Geography department).

Научная деятельность (research activity) Петра Кротова всецело посвящена изучению геологического строения и полезных ископаемых

(minerals) северо-восточных губерний (provinces) Европейской России. Кротовым напечатаны более 40 статей в «Трудах» (“Proceedings”) Казанского Научного Общества. Из них важнейшие: «Материалы для геологии Вятской губернии»; «Геологические исследования (geological investigations) по Волге между Нижним Новгородом и Казанью»; «К вопросу об относительной древности остатков каменного века на р. Оке»; «Следы ледникового периода в северо-восточной части Европейской России и на Урале и на западнем склоне Чердынского и Соликамского Урала»; «О дислокациях пермских пластов в Вятской и Казанской губернии»; «Задачи научной географии и постановка её преподавания к Казанскому университету» и пр.

В 1888 году П.И.Кротов получил степень доктора за сочинение «Геологические исследования на западном склоне Чердынского и Соликамского Урала».

http://kpfu.ru/imoiv/etnograficheskij-muzej/personalii/krotov-petr-ivanovich

4. *Be ready to have a talk (conference) about the scientists who worked or studied in the field of geology in Kazan University.*

UNIT TEN

Text 10.1 LAND AND RESOURCES OF RUSSIA

Area	17,075,200 sq km 6,592,770 sq mi
Coastline	37,653 km 23,396 mi
Highest point	Elbrus 5,642 m/18,510 ft

Russia is the largest country in the world, covering more than one-eighth of the Earth's inhabited land area. Russia is also the world's ninth most populous nation with nearly 144 million people (November of 2014).

Russia’s expansive border measures more than 62, 269 km (38,700 miles), abutting a great number of countries and bodies of water. On the north Russia is bounded by extensions of the Arctic Ocean: the Barents, Kara, Laptev, East

Siberian, and Chukchi seas. On the east the country is bounded by the Pacific Ocean and several of its extensions: the Bering Strait (which separates Russia from Alaska), the Bering Sea, the Sea of Okhotsk, and the Sea of Japan (East Sea). In the

extreme southeast Russia touches the northeastern tip of North Korea.

On the south it is bounded by China, Mongolia, Kazakhstan, the Caspian Sea, Azerbaijan, Georgia, and the Black Sea. On the southwest it is bounded by Ukraine, and on the west by Belarus, Latvia, Estonia, the Gulf of Finland, and Finland. In the extreme northwest, Russia is bounded by Norway. Lithuania and Poland border Kaliningrad, a Russian *oblast* (region) on the Baltic Sea that is isolated from the main part of Russia.

The Russian economy ranks as the fifteenth largest by nominal GDP and sixth largest by purchasing power parity (in 2015). Russia's extensive mineral and energy resources, the largest reserves in the world, have made it one of the largest producers of oil and natural gas globally.

Mining is a major sector of the Russian economy and provides a sizable share of the country’s exports. Russia is a leading producer of nickel and aluminum. Nickel ores are extracted primarily in eastern Siberia, although significant deposits are also located in the Kola Peninsula near Murmansk. Aluminum bauxite deposits are located mainly in the Urals and northwest European Russia near Saint Petersburg; other deposits are found in western and eastern Siberia.

Russia ranks among the world’s top five producers of gold, silver, and diamonds. Gold is mined in the Urals, western Siberia, and the Lena River valley of eastern Siberia. Most diamonds are extracted in the republic of Sakha (Yakutia) in northeastern Siberia, and nearly all the output is exported. Silver is mined in the far eastern region, and as a coproduct at gold mines in the Urals and western Siberia.

Russia is also among the top five producers of lead, copper, and uranium ores. Lead is mined in European Russia and western Siberia, copper in the southern Urals, and uranium in eastern Siberia. Russia is also an important producer of iron and zinc ores. Most iron extraction takes place in the Kursk region of western Russia, while zinc is mined in Siberia.

Russia leads the world in reserves of natural gas. It ranks second in reserves of coal, and eighth in reserves of oil. Coal accounted for most Soviet energy production until the late 1950s, when a gradual shift to oil and gas began.

Today, Russia is the world’s largest exporter of natural gas and the second largest exporter of oil. Because Soviet economic planners built an economy that ignored the real cost of energy use, Russia is also the world’s third-largest energy

consumer even though its GDP is small by Western standards. Steam-driven power plants fueled primarily by natural gas supply 65 percent of the country's electricity. Hydroelectric power plants and nuclear power plants provide most of the remainder.

The energy sector is essential to Russia's long-term economic recovery. After dropping sharply in the 1990s, oil production expanded dramatically. In the early 2000s increased oil and gas production accounted for about 50 percent of the country's total industrial growth.

Oil and gas were the leading earners of foreign exchange, accounting for approximately half of total Russian exports. Private oil companies led the surge in oil production. To continue rapid growth in the future, the oil industry would need to speed up exploration activities and develop new oil fields. In the long run, natural gas has the potential to become even more important to Russia's economic prosperity than oil.

Russia's principal oil and gas fields lie in western Siberia, which accounts for about two-thirds of total oil production and more than four-fifths of total gas production. Fields in the Volga-Urals region account for about one-quarter of total oil production and less than one-tenth of gas output. Key regions of coal production include western Siberia, which produces about three-quarters of the country's coal, and the Kuznetsk Basin in the Volga-Urals region. Most coal output is mined in Siberian fields along the Trans-Siberian Railroad.

http://countrystudies.us/russia/59.htm

EXERCISES

1.*Put the sentences in the order they are used in the text (the first one is done for you)*:

1 b 2 … 3 … 4 … 5… 6… 7… 8 … 9 …

a) Mining is a major sector of the Russian economy and provides a sizable share of the country's exports.

b) Russia is the largest country in the world, covering more than one-eighth of the Earth's inhabited land area.

c) Aluminum bauxite deposits are located mainly in the Urals and northwest European Russia near Saint Petersburg.

d) Russia's extensive mineral and energy resources, the largest reserves in the world, have made it one of the largest producers of oil and natural gas globally.

e) Russia’s principal oil and gas fields lie in western Siberia, which accounts for about two-thirds of total oil production and more than four-fifths of total gas production.
f) Today, Russia is the world’s largest exporter of natural gas and the second largest exporter of oil.
g) To continue rapid growth in the future, the oil industry would need to speed up exploration activities and develop new oil fields.
h) After dropping sharply in the 1990s, oil production expanded dramatically.
i) Russia’s expansive border measures more than 62, 269 km (38,700 miles), abutting a great number of countries and bodies of water.
j) Nickel ores are extracted primarily in eastern Siberia.

2. *Now give a Russian translation of the sentences above*.

3. *Fill the gaps in the text below with the words from the box*.

among extraction world leading globally economy top coal mined

The Russian 1) … ranks as the fifteenth largest by nominal GDP and sixth largest by purchasing power parity (in 2015). Russia's extensive mineral and energy resources have made it one of the largest producers of oil and natural gas 2) …. Russia is a 3) … producer of nickel and aluminum. Mining areas of lead, copper, and uranium ores have placed Russia 4) … the world’s top five producers of these metals. Most iron 5) … takes place in the Kursk region of western Russia, while zinc is mined in Siberia. Russia ranks among the world’s

6) … five producers of gold, silver, and diamonds. Russia leads the 7) … in reserves of natural gas. 8) It ranks second in reserves of 8) …, and eighth in reserves of oil. Most coal output is 9) … in Siberian fields.

4. *Read the following words:*
a) be careful to pronounce them correctly;
b) look up the translation of these words in the vocabulary notes and memorize them.

economy (n) [ɪ'kɔnəmɪ]
inhabited (adj) [ɪn'hæbɪtɪd]
growth (n) [grəuθ]
to purchase (v) ['pɜ:ʧəs]
uranium (n) [juə'reɪnɪəm]
coal (n) [kəul]
lead (n) [led]
ore (n) [ɔ:]
copper (n) I ['kɔpə]
bauxite (n) ['bɔ:ksaɪt]
consumer (n) [kən'sju:mə]
producer (n) [prə'dju:sə]
exporter (n) [ɪk'spɔ:tə], [ek-]
mine (n) [maɪn]
to rank (v) [ræŋk]
expansive (adj) [ɪk'spæn(t)sɪv]

Text 10.2 OIL AND GAZ ENGINEERING

Can you guess the meaning of the following words (from the text below):

logging(n)

to deplete(v)

reservoir simulation

reservoir rock

artificial (adj)

estimation (n)

Gas and Oil engineering is a field of engineering concerned with the activities related to the production of hydrocarbons, which can be either crude oil or natural gas. Exploration by earth scientists and petroleum engineering are the oil and gas industry's two main subsurface disciplines, which focus on maximizing economic recovery of hydrocarbons from subsurface reservoirs. Petroleum geology and geophysics focus on provision of a static description of the hydrocarbon reservoir rock, while petroleum engineering focuses on estimation of the recoverable volume of this resource using a detailed understanding of the physical behavior of oil, water and gas within porous rock at very high pressure.

The combined efforts of geologists and petroleum engineers throughout the life of a hydrocarbon accumulation determine the way in which a reservoir is developed and depleted, and usually they have the highest impact on field economics. Petroleum engineering requires a good knowledge of many other related

disciplines, such as geophysics, chemical engineering and mining engineering, petroleum geology, formation evaluation (well logging), drilling, economics, reservoir simulation, reservoir engineering, well engineering, artificial lift systems, completions and oil and gas facilities engineering.

Oil and gas engineers ask questions such as: Can refining processes be redesigned to reduce pollution? How is crude oil refined into marketable products? Can natural gas be more efficiently extracted?

Oil and gas engineering involves the production of oil and gas in an economical and environmentally safe manner. The technical knowledge and hands-on experience you'll gain in this program are specific to industry requirements, so you can be sure your degree will be relevant to your chosen field. During the course of your studies, much of your learning will occur in class, during tutorials, and through completing a team-based design course in your fourth year.

Oil and gas engineers enjoy local and international career prospects because the skills they possess are in constant demand. You'll have global opportunities to work for various petroleum industry organizations, production and service companies, regulatory agencies, and more.

A degree in engineering can also be used as a stepping-stone to graduate studies or a professional degree such as law, medicine, veterinary medicine, or architecture.

http://www.coventry.ac.uk/course-structure/engineering-environment-and

EXERCISES

1. *Answer the following questions*:

1) What questions do oil and gas engineers set as a priority in their professional activities?

2) What is the difference in the activities of Petroleum geology scientists and Oil and gas engineers?

3) What helps oil and gas engineering professionals to be in great demand?

4) Why do you think combined efforts of petroleum geologists and oil and gas engineers are so important?

5) Can you name the disciplines that oil and gas engineers should study?

2. *Match the words combinations with their Russian equivalents*

1	related to the production of hydrocarbons	A	сосредоточиться на предоставлении описания
2	combined efforts	B	иметь хорошие шансы сделать карьеру как дома, так и за рубежом
3	technical knowledge and hands-on experience	C	совместные усилия
4	to focus on provision of a description	D	технические знания и практический опыт
5	oil refining processes	E	продукция, отвечающая требованиям рынка;
6	enjoy local and international career prospects	F	процессы переработки нефти
7	marketable products	G	связанные с производством углеводоролов

3. *Read the text again and complete the following sentences*:

1) Two main oil and gas subsurface disciplines, are ___ by earth scientists and petroleum__.

2) Petroleum geology and geophysics accomplish a static description of the hydrocarbon ___ rock.

3) Petroleum engineering focuses on ____ of the recoverable volume of resource of oil, water or gas.

4) Oil and gas engineering involves the production of oil and gas in an economical and ____ safe manner.

5) Subsequent development training for oil and gas ____ has usually been done within oil companies.

6) Specific to industry ____technical knowledge and hands-on experience will be gained in this program.

7) Oil and gas engineering experts are given global ____ to work for various industry organizations and oil companies.

8) A degree in engineering might be a stepping-stone to ___ studies or various professional degrees.
9) Crude oil and natural gas should be efficiently ___ and refined into marketable products?

4. *Render the text given below in English*:

Нефтегазовые инженеры занимаются поиском углеводородных ресурсов *(hydrocarbon resources*), участвуют в восстановлении *(recovery)*, развитии и переработке *(processing)* нефти и газа. Их навыки охватывают широкий спектр инженерных дисциплин, включая геологию, химическое, механическое и гражданское строительства.

Эти специалисты обеспечивают промышленные предприятия новейшими технологиями для оптимизации производства, способствуют повышению эффективности процесса добычи горючих *(combustible)* углеводородов. Современные методы работы нефтегазовых инженеров дают возможность операторам *(operators)* увеличить производительность углеводородных месторождений.

Инженеры нефтегазовой отрасли составляют описание пластового резервуара *(reservoir)* и контролируют динамику расхода углеводородов. Профессиональная деятельность нефтегазовые инженеров проходит через весь жизненный цикла месторождения от интерпретации геологических информации до сбора и анализа производственных данных *(data)* в режиме реального *(real-time)* времени.

Text 10.3 ALFRED NOBEL A MAN OF CONTRAST

Alfred Nobel, the great Swedish inventor and industrialist, was a man of many contrasts. He was the son of a bankrupt, but became a millionaire; a scientist with a love of literature, an industrialist who managed to remain an idealist. He made a fortune but lived a simple life, and although cheerful in company he was often sad in private. A lover of mankind, he never had a wife or family to love him; a patriotic son of his native land, he died alone on foreign soil. He invented a new explosive, dynamite, to improve the peacetime industries of mining and road building, but saw it used as a weapon of war to kill and injure his fellow men. During his useful life he often felt he was useless: “Alfred Nobel”, he once wrote of himself, “ought to have been put to death by a kind doctor as soon as, with a cry, he

entered life.” World-famous for his works he was never personally well known, for throughout his life he avoided publicity. “I do not see”, he once said, “that 1 have deserved any fame and I have no taste for it,” but since his death, his name has brought fame and glory to others.

He was born in Stockholm on October 21, 1833 but moved to Russia with his parents in 1842, where his father, Immanuel, made a strong position for himself in the engineering industry. Immanuel Nobel invented the landmine and made a lot of money from government orders for it during the Crimean War, but went bankrupt soon after. Most of the family returned to Sweden in 1859, where Alfred rejoined them in 1863, beginning his own study of explosives in his father's laboratory. He had never been to school or university but he had studied privately and by the time he was twenty was a skilful chemist and excellent linguist, speaking Swedish, Russian, German, French and English. Like his farther, Alfred Nobel was imaginative and inventive, but he had better luck in business and showed more financial sense. He was quick to see industrial openings for his scientific inventions and build up over 80 companies in 20 different countries. Indeed his greatness lay in his understanding ability to combine the qualities of an original scientist with those of a forward-looking industrialist.

But Nobel’s main concern was never with making money or even with making scientific discoveries. Seldom happy, he was always for a meaning to life, and from his youth had taken a serious interest in literature and philosophy. Perhaps because he could not find ordinary human love – he never married – he came to care deeply about the whole of mankind. He was always generous to the poor: “I’d rather take care of the stomachs of the living than the glory of the dead in the form of stone memorials.” He once said. His greatest wish however was to see an end to wars and thus peace between nations, and he spent much time and money working for this cause until his death in Italy in 1896. His famous will, in which he left money to provide prizes for outstanding work in Physics, Chemistry, Physiology, Medicine, Literature and Peace is a memorial to his interests and ideals. The man who felt he should have died at birth is remembered and respected long after his death

Nobel Prize Facts

On 27 November 1895, Alfred Nobel signed his last will and testament, giving the largest share of his fortune to a series of prizes in Physics, Chemistry, Physiology or Medicine, Literature and Peace - the Nobel Prizes. In 1968, Sveriges Riksbank (Sweden's central bank) established The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel.

Nobel Laureates - 567 Nobel Prizes!

Between 1901 and 2014, the Nobel Prizes and the Prize in Economic Sciences were awarded 567 times.

The Nobel Prize in Chemistry 1911 was awarded to Marie Curie "in recognition of her services to the advancement of chemistry by the discovery of the elements radium and polonium, by the isolation of radium and the study of the nature and compounds of this remarkable element".

From “Reading for Adults” by Richard Lewis, McVincent, Susan Weir

http://bacheng.idhost.kz/alfred-nobel-man-contrasts

EXERCISES

1. *Say if the sentences below are TRUE or FALSE*

1) Alfred Nobel’s father went bankrupt before the birth of Alfred.

2) Immanuel Nobel was quick to see industrial openings for his scientific inventions and build up over 80 companies in 20 different countries

3) Alfred Nobel did not have a University degree.

4) Alfred Nobel knew science but was a poor linguist.

5) Throughout his life Alfred Nobel avoided publicity.

6) Alfred Nobel was more successful in business than his father.

7) Alfred Nobel died in Paris in 1896.

2. *In this exercise you will see the answers to questions. Can you guess what these questions were*?

Model: *1) Stockholm, 1833 (born) - When and where was Alfred Nobel born?*

1) Stockholm, 1833 (born*)*

2) In the engineering industry (father)

3) Soon after the Crimean War (bankrupt)

4) Swedish, Russian, German, French and English (could speak)

5) Alfred had never been to school or university but studied privately (What education?)

6) Alfred Nobel instituted prizes for outstanding work in Physics, Chemistry, Physiology, Medicine, Literature and Peace. (Which fields?)

3. *Be ready to have a talk on Russian Nobel laureates*.

REVISION

Units 6-10

EXERCISES

1 *Give the names to the definitions given below.*

1) This branch of the earth sciences investigates the flow of water through aquifers and other shallow porous media.

2) These geological studies were of extreme importance in providing the critical evidence for sea floor spreading.

3) Identification according to chemical, physical, and crystallographic properties is called …….. .

4) The properties and classification of individual minerals, their localities and modes of occurrence, and their uses are studied under ……...

5) This branch of the earth sciences helps to understand how chemical elements are distributed in the crust, mantle, and core of the earth.

6) This exploration is conducted to locate economically significant accumulations of oil, natural gas, and other minerals, including groundwater.

7) These studies are concerned with the surface eruption of gas-charged magmas from within the earth.

8) This type of prospecting is based on different magnetic conductivity of rocks.

9) This branch of geology involves the protection of human health and safety through understanding geological processes.

2. *Match the English words in A with their synonyms in B.*

Model: *prospective = potential*

viable (adj)	coastal (adj)
riparian (adj)	produce (v)
inventive (adj)	territory (n)
prospective(adj)	4) resourceful (adj)
exploration geologist (n)	5) fulfill (v)
production (n)	**potential (adj)**

investigation (n)	extraction (n)
deposit (n)	focus on (v)
generate (v)	exploration (n)
recovery (n)	inflammable(adj)
perform (v)	usage (n)
area (n)	accumulation(n)
concentrate (v)	prospector (adj)
combustible(adj)	output (n)
application (n)	fruitful (adj)

3. *Complete the table.*

Verbs	**Nouns**	**Adjectives**
		designed
	drilling	
		mining
evaluate		
	provision	
percolate		
		refining

4. *Match the professionals and their responsibilities.*

Geophysicists / studying the Earth's core and surface by analyzing seismic waves; collecting data, making observations using supercomputers.

Model: *Geophysicists study the Earth's core and surface by analyzing seismic waves, collecting data, making observations using supercomputers*

Professionals	Responsibilities & Occupations
1.Oil and Gas Engineers	A study the chemical make up of and interaction between various substances found in the earth
2.Geochemists	B explore specific regions to discover valuable mineral deposits using their knowledge of geology and mineralogy
3.Hydrogeologists	C surve of a seabed, collecting samples of sediment and rock specializing in one or more areas: sedimentology, mineralogy, or geochemistry
4. Marine Geologists	D conduct field studies to determine the location, size, and movement of underground water reservoirs
5. Prospecting Geologists	E focus on maximizing economic recovery of hydrocarbons from subsurface reservoirs

5. *Feel the gaps with the prepositions from the box.*

on(2) for in(3) over
with(2) around between by(2)

1. Petroleum geologists are scientists who focus ___ the extraction and estimation of oil, gas and other combustible resources buried in the Earth.
2. Qualifications are useful but they are no substitute ___experience.
3. Several schools are involved __the project.
4. He graduated _____ honors, with a Bachelor's of Art ___ Classics.
5. Refineries that process petrochemicals can be found all ____ the world.
6. The Black Sea is an inland sea bounded __Europe, Anatolia and the Caucasus.
7. The Black Sea was originally a land-locked fresh water lake and was flooded _____ salt water during the Holocene.
8. An asteroid is any of numerous small celestial bodies that move _____ the sun mainly _____ he orbits of Mars and Jupiter.

9. A degree ___ engineering is an academic award conferred __ a university or college on successful completion of a course.

10. Groundwater hydrologists usually concentrate __ how groundwater interacts with other surfaces like soil and air.

6. *Render the text in English.*

Андре́й Алексе́евич Трофиму́к

(1911 – 1999)

Советский и российский ученый в области геологии и разведки нефтяных и газовых месторождений, доктор геолого-минералогических наук, академик АН СССР и академик РАН.

Родился 3 (16) августа 1911 года в деревне Хветковичи Кобринского уезда Гродненской губернии (ныне Жабинковский район, Брестская область, Белоруссия).

С 1929 года учился на геологическом факультете Казанского государственного университета. Одновременно с 1930 года трудился начальником научно-исследовательской партии *(research prospecting party)*, занимавшейся изучением железных руд и бокситов Урала. После окончания университета и поступления в аспирантуру (1933 год) А. А. Трофимук добился перевода*(transfer)* на работу в Башкирию, где в те годы были открыты первые нефтяные месторождения. Здесь он прошёл путь от старшего геолога до главного геолога треста *Ишимбайнефть*. Уже в первые годы работы на производстве (at the production plant)он провел комплексное изучение нефтяных месторождений Ишимбаевского района и выявил рифогенную природу ловушек (*revealed reef trap)*. В кандидатской диссертации (*Candidate dissertation)* «Нефтеносные известняки Ишимбаево»

А. А. Трофимук доказал необходимость поисков в Приуралье нефтяных месторождений нового типа (1938 год).

С началом войны потребность в нефти резко возросла. А. А. Трофимук обосновал поисковое бурение на девонскую нефть и в 1944 году на Туймазинской площади в Башкирии было открыто большое месторождение нефти, а 1946году — Бавлинское и другие месторождения. Это были выдающиеся достижения геологов героического военного времени, показавшие, что Волго-Уральская нефтегазоносная *(oil-and-gas bearing)* провинция является одной из крупнейших в мире. Открытия военных лет и широкое применение новых для того времени технологий вскрытия и испытания нефтегазоносных горизонтов (соляно-кислотная обработка известняков, законтурное и внутриконтурное заводнение – (*contour waterflooding*) позволили резко увеличить добычу нефти, столь необходимой для страны в суровые годы войны, и обеспечить наши танки и авиацию нефтепродуктами. Всего Андрей Алексеевич прожил в БАССР 16 лет.

В 1949 А.А. Трофимук получает звание доктора наук *(Doctor of Science)* и в 1950 году возглавляет геологическую службу Министерства нефтяной промышленности СССР. Под его руководством были открыты новые месторождения нефти в Татарии, на Украине и в других регионах. Одновременно он продолжал научные исследования и в 1953 году был избран членом-корреспондентом АН СССР *(corresponding member of the Academy of Science of the USSR).* В годы работы в Министерстве нефтяной промышленности А. А. Трофимук начал заниматься проблемами поисков нефти и газа в Сибири. Ещё в 1951 году А. А. Трофимук возглавил Правительственную комиссию по оценке перспектив нефтегазоносности (*oil-and-gas content*) северных районов Красноярского края и Якутии. В 1952 году он предпринял активные меры для усиления нефтегазопоисковых *(exploration for oil and gas)* работ в Западной и Восточной Сибири. В 1957 году А.А. Трофимук по приглашению академика М.А. Лаврентьева переехал в Новосибирск. Работая в Новосибирске, убедительно доказал необходимость поиска нефти в недрах Западной Сибири, практически способствовал открытию новых нефтяных провинций и горизонтов на Крайнем Севере, в Восточной Сибири, в Якутии, таких как Уренгойское и Самотлорское.https://ru.wikipedia.org/wiki/Троф

ADDITIONAL MATERIAL

1. Read and give your comments on the interesting facts that are given here.
2.

DID YOU KNOW THAT?

1. Oil or petroleum, together with coal and natural gases are a part of the biogenic deposits which are found in the earth crust

2. Raw oil (not refined) contains over 17 000 organic complex substances, reason for which is the most important raw material for the chemistry industry (paint, drugs, plastic materials) and the fuel producing

3. As a curiosity, it could be mentioned that some types of petroleum become phosphorescent in the presence of ultraviolet light

4. Oil was already discovered a few thousand years ago, through the fact that it has a lower density than the salted water, being found in caverns and in regions with calcareous, argillaceous or sandy sedimentation layers, at the surface, for example around Honovrei and Braunschweig from Germany

5. The oil layers situated at the surface through oxidation transform in asphalt, this one being already discovered almost 12 000 years ago in Ancient Mesopotamia. People have learned to use the asphalt, by mixing the sand and other materials which makes the air-tight for the ship walls

6. From the time of Babilon originates the name naptu (nabatu= illuminate) which indicates us the fact that oil was used for illuminate, this was mentioned in the Laws of Hammurabi in 1857 a.Ch. being the first written historical proof for regulating the oil use

7. Petroleum is a word with roman origin which comes from “oleum petrae”= stone oil, name which the Romans had taken from Egyptians which discover oil at the surface of the earth in Suez Bay’s Mountains. It is supposed that in Antiquity Romans used the oil as a lubricant for the roman axle cart or in the time of the Byzantine Empire the oil was a part of the Greek fire, a feared weapon in the formerly naval battle

8. Oil was used in the ancient medicine too, being sold as a miraculous universally cure

9. Inextinguishable fire maintained by the gases which were bursting from the ground in the Apseron Peninsula oil field - where there are now the exploitation from Baku - have giving birth, in ancient times, to Zoroaster cult, the cult of fire

10. Massif exploitation of the oil begins in the XIX century as a result of spreading the use of oil in illumination, which gave a better light producing less smoke comparing with the whale oil lamp or the waxen candles

11. Asia holds the first place in the world for oil reserves and production

12. Saudi Arabia is the biggest oil producer on the globe

13. "The Science of Petroleum" certifies in 1938 the fact that Romania was the first country with an oil production of 275 tones officially registered in the international statistics. It was followed by the United Stated in 1859, Italy in 1860, Canada in 1862, Russia in 1863.

14. The first refinery in the world was set up in Ploiesti, built by the Mehedinteanu brothers in the city's outskirts, near the South Station

15. The first School of Driller Foreman from Romania and from the world was established in 1904, in Campina

16. In 1907, in Ploiesti was set up Concodia plant for repairing and producing the oil equipment

17. In the first world war in Romania were destroyed 1677 oil well, from which 1047 productive, oil refinery, oil derrick and refinery with all their annexes equipment and a quantity of oil derivates of 827.000 tones

18. Starting with 1929 and since 1938, all the oil based products obtained in the greatest Romanian refineries Concordia (Vega), Steaua Romana, Unirea (Orion and Speranta), Columbia, Creditul Minier (Brazi, Doicesti), Prahova (Petrolul Bucuresti), Xenia, Dacia Romana and Petrol Block (Standard) were asked for export

19. A table regarding the world probably reserves (including the certain ones) sets Romania in 1937 on the 7th place in the world after: Russia, USA, Iraq, Iran, Venezuela, Dutch Indies

20. Romanian Scientist, Lazar Edeleanu, had managed, for the first time in the world, to refine oil based products with sulphur dioxide, in other words separation from the oil of some hydrocarbon groups, without their chemical alteration

21.Ing. Virgiliu tacit and ing. Valeriu Puscariu had built up a valve, remained in the oil history under the name “Tacit Valve”, which adapted to the blowing out oil wells, could close them hydraulic from any distance, even if the eruptive oil well was on fire. It applies to the free eruptions with a maximum pressure of 100 atm. The valve was licensed in Romania on 15 May 1912, then in Germany, Austria-Hungary and Mexico and its license was asked in other countries in which the oil was exploited.

22.According to a United States Geological Survey estimate, around 22 percent of the world's as yet undiscovered, exploitable oil reserves will be found in the Arctic

20-Minute Geophysicist Quiz

1) What is the purpose of seismic exploration?

a) To search for buried archeological artifacts.

b) To discover the size and nature of the earth's core.

c) To render the most accurate possible graphic representation of specific portions of the earth's subsurface geologic structure.

d) There's no purpose, it's a futile endeavor.

2) What is done with seismic images?

a) They are turned into screensavers for home computers.

b) Exploration companies use them to accurately and cost-effectively evaluate a promising target (prospect) for its oil and gas yielding potential.

c) They are studied carefully, as they are believed to hold the key to predicting future geologic events.

d) Cartographers translate the data into topographic maps.

3) How do we acquire the seismic data?

a) By sneaking up on it.

b) Via the process of Seismosis.

c) It is excavated using a very large backhoe.

d) By transmitting controlled acoustic energy into the earth, and recording the energy that is reflected back from geologic boundaries in the subsurface.

4) How is acquiring seismic data at sea different from acquiring seismic data on land?

a) Seismic data at sea is much wetter than it is on land.

b) The source and recording instruments are continuously moving.

c) It's exactly the same procedure.

d) Salt water affects the sound waves, making the process a bit more complicated.

5) What is 4D seismic data?

a) 2 or more 3D seismic surveys taken at different times, where elapsed time is the fourth dimension.

b) When you look at seismic data wearing special 4D glasses.

c) There is no such thing as 4D.

d) Two sets of 2D seismic data stacked on top of one another.

6) What are the five key ingredients to acquiring useful seismic data?

a) Digging, Vibrations, Recording, Reading, and Cinnamon.

b) Proactivity, Prioritizing, Understanding, Synergy, and Planning.

c) Persistence, Trust, Planning, Funding, and Locating.

d) Positioning/ Surveying, Seismic Energy Source, Data Recording, Data Processing, and Data Interpretation.

7) Why is Positioning and Surveying important?

a) So we don't survey the same area twice.

b) In case we find somewhere we'd like to go for a company retreat.

c) No matter how good the quality of recorded seismic data, it’s worthless if we don’t know where it came from.

d) So we know how to get home from the surveying site.

8) What is the most common acoustic energy source for land?

a) The acoustic guitar.

b) Plastic explosives.

c) Big speakers with heavy bass.

d) Servo-hydraulic vibrators on vibroseis trucks. These trucks generate a controlled vibratory force of up to 70,000 lbs.

9) How does an airgun work?

a) The operator loads it with an air cartridge and pulls the trigger.

b) By explosively releasing high pressure air through portholes of a firing chamber by action of a sliding shuttle with pistons at each end. This creates seismic energy which is reflected back from geologic boundaries in the sub-surface.

c) The operator pumps a lever creating high pressure, which is then released through the firing chamber.

d) It works alright.

10) How is the data produced by the acoustic energy recorded ?.

a) As MP4 files.

b) In a recording studio.

c) By a connected network of geophones for land, or hydrophones for sea. These devices convert the reflected energy into electrical energy which is transmitted to a recording system.

d) With a smart phone.

11) Is it faster to acquire data on land or at sea?

a) At sea, because we are able to record several lines of seismic data at one time.

b) At sea, because the salt water accelerates the process.

c) On land, because trucks are faster and more maneuverable than boats.

d) On land, because there is less set up required.

12) What is data processing?

a) Saving the seismic data to discs for later review.

b) Creating abstract art pieces from the rough data.

c) Converting the seismic data into binary code.

d) Making sense of the recorded seismic ‘squiggles’ to produce the truest possible image of the earth’s sub-surface geologic structure.

13) What does the ideal seismic response look like?

a) A single sharp reflection for each sub-surface rock layer boundary.

b) A bit like layers in a lasagna.

c) Like the waves on a heart rate monitor.

d) A 3D detailed video of the sub-surface.

14) Why would you want to stack seismic traces?

a) To save disk space.

b) To make data processing go faster.

c) For a clearer seismic signal. As the seismic traces are merged into one, background noise cancels itself out while the seismic signals add together, producing a stronger signal to noise ratio.

d) This is a terrible idea. Never stack seismic traces.

15) Why would anybody want a graphic 3D representation of the earth's sub-surface structure?

a) To see if there are dinosaur bones beneath the ground.

b) Based largely on this information, exploration companies will decide where (or if!) to drill for oil and gas.

c) To decide if it's a good place to build an underground shelter.

d) Curiosity - People often want to know what's beneath their homes.

16) 'AVO' stands for?

a) Azimuth Variation and Orientation

b) Acoustic Velocity Overdrive

c) Amplitude Variation with Offset

d) Asynchronous Vibroseis Operations

17) Fill in the blank space in this sentence:

Accurate 3D seismic images can mean the difference between _____ , or an expensive dry hole.

a) Porosity

b) Success

c) Deconvolution

d) Horizontal drilling

18) What is a 'multiple'?

a) Stacked seismic traces from the same reflecting point.

b) A fast-track process for delivering field data immediately after recording.

c) A combination of more than one source and receiver.

d) A seismic 'echo' of the seafloor caused by energy bouncing back and forth within the water layer to produce a 'false' reflection obscuring the real data.

19) What does PSDM stand for and what can it do?

a) Processed Stacked Data Modullud. Reduces signal to noise ratio to achieve a clearer seismic image.

b) Prestack Depth Migration. Can significantly improve seismic imaging, especially in areas of complex geology.

c) Preservation of Safety Directives Manifesto: HSE system that reduces work risks to a minimum enabling everyone to come home safely at the end of every day.

d) Post-stack Deconvolution Median. Helps differentiate between shallow and deep seismic data.

20) Bonus Question (not in the slideshow) - The core values of CGG are:

a) Research, Productivity, Capability and Pioneering

b) Performance, Innovation, People, Integrity

c) Surveying, Seismic, Processing and Interpretation

d) Ethics, Vision, Safety, Environment

http://archive-com.com/com/c/cggveritas.com/2014-03 16_3843789_55/CGG_Technical_Abstracts/

Multiple Choice Geologist Quiz

Earth's Interior and Geophysical Properties

1. Felsic and mafic are terms used by geologists to describe:
    1) composition of continental and oceanic crust.
    2) behavior of earthquake waves.
    3) the mechanical behavior of rocks.
    4) none of these.

2.The boundary that separates the crust from the mantle is called:
    1) the crust-mantle boundary.
    2) the lithosphere.
    3) the Moho.
    4) all of these.

3. The inner core is most likely composed of:

1) silicon.
2) oxygen.
3) sulfur.
4) iron.

4. The principle of continents being in buoyant equilibrium is known as:

1) isostasy.
2) the principle of buoyant equilibrium.
3) the elastic rebound theory.
4) none of these.

5. A positive gravity anomaly indicates:

1) an excess of mass.
2) a deficiency in mass.
3) a reversal of the gravitational field.
4) none of these.

6. Positive gravity anomalies are often associated with:

1) deep ocean trenches
2) ore bodies beneath Earth's surface.
3) large cavern systems beneath Earth's surface
4) all of these.

7. A positive magnetic anomaly indicates:

1) a body of magnetic ore.
2) an intrusion of gabbro.
3) mafic rock masses.
4) all of the above.

8. Which of the following is not an example of isostasy?

1) deep mountain roots.
2) crustal rebound.
3) ocean basins are deeper than continents.
4) all of these.

9. The S-wave shadow zone is evidence that:

1) the outer core is liquid.
2) the outer core is composed of iron and nickel oxides.
3) the inner core is solid.
4) it is very hot near the core.

10. The physical evidence that the core is composed mostly of iron is:

1) the known mass of Earth requires material of high density at the core.
2) scientists have sampled the core and determined its composition.
3) volcanoes regularly erupt material from the core to the surface.
4) all of these.

11. The velocity of seismic waves varies through Earth because:

1) temperature varies within the Earth.
2) density of rocks varies within the Earth.
3) the composition of rocks varies within the Earth.
4) all of these.

12. Convection is likely occurring in:

1) the mantle.
2) the outer core.
3) both the mantle and the outer core.
4) throughout the Earth.

13. The interior composition and structure of Earth have been deduced in part from:

1) studies of meteorites.
2) deep drilling projects.
3) analyses of the behavior of seismic waves.
4) all of these.

14. Heat inside Earth:

1) is generated by radioactive decay.
2) is uniform throughout the interior.
3) decreases with increasing depth.
4) none of these.

15. The geothermal gradient in the crust averages:

1) 25 degrees Celsius per kilometer.
2) 1 degree Celsius per kilometer.
3) 10 degrees Celsius per kilometer.
4) 100 degrees Celsius per kilometer.

16. Heat flow to the surface of Earth:

1) varies from place to place.
2) is highest in areas of active volcanism
3) is lowest in stable continental interiors.
4) all of these.

17. The boundary between the crust and mantle:

1) coincides with the boundary between the asthenosphere and lithosphere.
2) is marked by a change is velocity of seismic waves.
3) is the source of the S-wave shadow zone.
4) none of these.

18. The largest portion of Earth's volume is:

1) the crust.
2) the mantle.
3) the inner core.
4) the outer core.

19. The composition of the upper mantle is known because:

1) samples of mantle rock have been analyzed by scientists.
2) meteorites are believed to be similar to the mantle.
3) some caves on Earth extend into the mantle.
4) none of these.

20. The average thickness of the crust is:

1) 10-12 km.
2) 30-50 km.
3) 100-150 km.
4) 1 km.

http://highered.mheducation.com/sites/0072402466/student_view0/chapter17/multiple_choice_quiz.

VOCABULARY NOTES

UNIT ONE

Text 1.1 The Science of Geology

earth (n) - 1) земля, почва, грунт 2) ил .

capable (adj) of smth - 1) способный на что-л. 2) способный, одарённый, талантливый, восприимчивый

to enable (v) - а) давать возможность, право (что-л. сделать) syn: authorize , sanction , empower б) делать возможным (что-л.) 2) включать, запускать в работу (какое-л. устройство)

sedimentation (n) - осаждение; отложение осадка

scientist (n) - ученый; естествоиспытатель syn: material scientist

scholar (n) - 1) учёный (обычно гуманитарий)

to affect (v) - действовать, воздействовать, влиять

hazard (n) - риск, опасность

record (n) – 1) запись; регистрация; учёт 2) акт 3)протокол (испытаний)

to record (v) – 1) записывать; 2) регистрировать; протоколировать

climate (n) - климат

microbiology (n) – микробиология

Text 1.2 Geologist

to assess (v) - оценивать, давать оценку

coal (n) - (каменный) уголь

coalfield (n) - месторождение угля

to determine (v) - определять, устанавливать

to extract (n) (e.g. resources) - получать, извлекать, добывать с трудом

field of science - область науки

garnet (n) - *геол.* гранат (прототипический цвет этого камня - красный)

maintenance (n) - техническое обслуживание; уход; содержание в исправности; текущий ремонт; поддержка

to mingle (v) - смешиваться

to shape (v) - формировать; формироваться

subset (n) - подмножество; подгруппа

urban (adj) (e.g. planning) – городское (планирование)

valuable (e.g. substances) – ценные (вещества)

Text 1.3 Alexander Karpinsky

academician (n) 1) академик, член академии
He was elected a Royal Academician at the age of 53. — Его избрали членом Королевской Академии искусств в возрасте 53 лет. Syn: member of the Academy
2) (AE) преподаватель высшего учебного заведения The Conference on Education will be the gathering place for academicians and professionals from Education from all over the world. — Конференция по образованию будет местом встречи преподавателей и специалистов в области образования со всего мира.
3) supernumerary academician - нештатный, сверхштатный преподаватель высшего учебного заведения (экстраординарный академик);
a staff academician - штатный преподаватель (ординарный академик).
Mining Cadet Corps - Горный кадетский корпус
to conduct geological studies - проводить геологические исследования
to be chairing - быть председателем (e.g.: научного общества, собрания и т.д.…)
domestic (adj) - внутренний; отечественный, находящийся в пределах страны
the drafting of geological map - разработка геологической карты
multifaceted (adj) - многогранный
novelty (n) - новизна, инновация, нововведение
the unification of graphic presentations in geology унификация графических изображений в геологии.
to result in - иметь результатом; приводить к; давать в результате
stratigraphy - 1) стратиграфия (отдел геологии, изучающий геологические пласты) 2) стратиграфические особенности местности

UNIT TWO

Text 2.1 History of Geology

scientific (adj) - научный
to collect (v) knowledge (n) – собирать знания
observation (n) - 1) наблюдение; визуальное наблюдение; визуальный контроль 2) результат наблюдений
throughout (pr) the medieval (adj) and Ren**ai**ssance (n) periods –на всём протяжении Средневековья и эпохи Возрождения

to expand (v) - 1) расширять, расширяться; увеличиваться в объёме; вытягивать, вытягиваться, растягивать

launch (v)- запускать; пускать в ход

laccolith(n) – геол. лакколит (грибообразный интрузив с выпуклой кровлей и плоской подошвой)

intrusion (n) - внедрение, интрузия

igneous (n)- геол. пирогенный, вулканического происхожденя

Text 2.2 Petroleum Geologist

crude oil - сырая, неочищенная нефть

governmental (adj.) - правительственный, государственный

to conduct (v) - вести, руководить; проводить

consistent (adj) with - совместимый с…

to dwindle (v) - сокращаться, уменьшаться, убывать, истощаться

to entrap (v) - улавливать; задерживать (нефть, воду);

to explore (v) - исследовать, рассматривать, изучать, анализировать

grant certification - выдавать свидетельство, диплом, аттестат, сертификат

output (n) - *(нефт.)* 1). производительность; отдача 2). добыча

to pinpoint (v) - засекать, точно определять (нахождение)

sediment (n) *геол.* - осадочная порода, отложение

to survey (v) - обследовать, делать обзор

to take samples - отбирать образцы или пробы

three-dimensional graphing software - (трехмерное) программное обеспечение (ПО); компьютерные программы, "софт"

yield (n) - количество добытого, произведённого, собранного

Text 2.3

James Hutton

aeon (n) - 1) неизмеримый промежуток времени, бесконечно долгий промежуток времени 2) эон (геологическая эра)

bedrock (n) (геол.) - коренная подстилающая порода

cliff (n) - 1) утёс; крутой откос; обрыв 2) трещина, расселина

to erode (v) - эродировать, размывать

to perceive(v)- воспринимать; чувствовать; понимать

vestige (n) - след, остаток

juxtaposition (n) 1) а) непосредственное соседство, соприкосновение б) размещение рядом 2) сличение, сопоставление, сравнение

stupendous громадный; огромной важности *Syn: tremendous*

tilt (n)- наклон, наклонное положение (up) on the tilt — в наклонном положении

to give a) tilt (v) - наклонить; наклонять; опрокидывать; откидывать, поворачивать б) наклоняться; опрокидываться; откидываться, поворачиваться

unconformity (n) (геол.) - несогласное напластование

uplift (n) -подъём; to uplift (v)- поднимать

UNIT THREE

Text 3.1 Mineralogy

identification (n) – 1) идентификация; опознавание; распознавание; определение; выявление; 2) обозначение; маркировка

as follows 1) как изложено ниже; 2) следующее

crystallography (n) – кристаллография property(n) – 1) свойство; качество; 2) признак; характеристика ;

3) имущество

occurrence (n) – 1) событие; случай; 2) наличие; появление;

3) местонахождение, залегание (о нефти и газа)

rigid (adj) – 1) жёсткий; негибкий; неподатливый; 2) устойчивый; неподвижно закреплённый

sulfide (n) – сульфид (соль сероводородной кислоты)

antimony (n) – сурьма, Sb - crude antimony

silicate (n) – 1) силикат; 2) соль кремнёвой кислоты - aluminium silicate

hematite (n) – 1) гематит, красный железняк, 2) железный блеск (утяжелитель для буровых и цементных растворов)

apatite (n) – апатит

chlorine – 1) 1) хлор ; 2) Cl – хлорин

fluorine (n) – 1) фтор, F

galena (n) – галенит, свинцовый блеск (минерал, сульфид свинца с ярким серебряно-белым металлическим блеском)

sphalerite (n) – сфалерит, цинковая обманка

determined (adj) – 1) решительный, твёрдый; 2) непоколебимый, стойкий; непреклонный

inclusive (adj) – включающий, содержащий

Text 3.2 Mineralogist

to claim - требовать; предъявлять требования; заявлять о своих правах на что-л.

to draw conclusions - делать/сделать выводы

to be concerned about - беспокоиться, заботиться о чем-л.

identification - идентификация, отождествление, установление, выявление

ranging from ... to - ... изменяющийся от ... до...

site (n) - 1) место; местонахождение, местоположение; позиция,

2) сайт, узел размещения сервера в сети Интернет

3) базовый блок (сотового радиотелефона)

quantity and quality- количество и качество

Text 3.3 Charles Lyell

to educate (v) - воспитывать, обучать; давать образование

to educate in the sciences – обучать наукам; давать научное образование

expensive private school – дорогая частная школа

to make keen observations – вести точные наблюдения

radical new ideas – радикально (принципиально) новые мысли; идеи

to be a firm believer - быть твёрдым сторонником; приверженцем

to find (v) evidence – найти подтверждение; свидетельство

UNIT FOUR

Text 4.1 Geophysics

scope (n) – область, поле, сфера

outer-space (n) – открытый космос

manifestation (n) –манифестация, проявление; обнаружение

behavior (n) – 1) поведение, характер изменения 2) работа

subtle (adj) – 1) искусный 2) тонкий 3) хитроумный

scintillation (n) – 1) вспышка люминесценции 2) искорка

propagation (n) – 1) распространение (напр. волн, сигналов) 2) продвижение; прохождение; пропускание

geothermal (adj) – геотермический, геотермальный

Text 4.2 Geophysicist

bachelor's degree - степень бакалавра (ученая степень, присваивается после четырех лет обучения в высшем учебном заведении)

to collect data - собирать данные

to calibrate - калибровать; градуировать;

doctorate degree - докторская степень

master's degree - степень магистра (учёная степень, промежуточная между бакалавром и доктором)

to employ - нанимать, предоставлять (давать) работу; занимать

wide range of activities широкий спектр деятельности

Text 4.3 Amos Eaton

to be admitted to the state bar - принят в штат адвокатуры

forgery (n) - подлог, подделка документа (в том числе денежных документов:

банковских чеков

incarceration (n) - заключение в тюрьму

itinerant(n) - должностное лицо, объезжающее свой округ (судья, священник)

rote (n) - механическое запоминание; rote memory - механическая память; механическое запоминание

UNIT FIVE

Text 5.1 Marine Geology

environment (n) - 1) окружение; обстановка; окружающая среда; внешние условия, 2) режим (работы), 3) условия

sedimentology (n) - седиментология

stratigraphy (n) - стратиграфия (отдел геологии, изучающий геологические пласты)

unexplored (adj) - неисследованный, неизведанный

frontier (n) - 1) граница, 2) район освоения, осваиваемая территория

to subduct (v) - 1) изымать, забирать, удалять , 5) пододвигаться (о тектонической плите)

to collide (v) - 1) соударяться 2) сталкиваться

ridge (n) – 1) кромка на буровой стали, 2) бороздка на забое (прорезанная зубом), 3) горный кряж; складка

fault (n) – 1) недостаток; дефект; порок; изъян , 2) ошибка; погрешность, 3) выход из строя; повреждение; поломка

Text 5.2 Marine Geologist

to conduct (v) (laboratory) research - проводить (лабораторные) научные, и т.д. исследования

mapping - 1) нанесение на карту; вычерчивание карт; картография 2) топографическая съёмка

plate tectonics - тектоника плит

prevalence (n) - распространенность; широкое распространение

research institution - научно-исследовательский институт

sedimentology(n) - литология, седиментология (отрасль геологии, связанная с осадочными породами)

tracking - слежение; отслеживание

Text 5.3 Edmond Halley

prodigy (adj) - 1) одарённый человек (чаще о ребёнке) , prodigy violinist — замечательный скрипач , infant prodigy - чудо-ребёнок, вундеркинд, 2) чудо

to take readings - производить отсчёт

HMS (abbrev) - от His (Her) Majesty's Ship английский военный корабль

mariner (n) - матрос, моряк; солдат морской пехоты;

mariner's ring – астролябия

master mariner - капитан торгового судна

studious (*adj*) - 1) занятый наукой; любящий науку,2) прилежный, старательный, трудолюбивый, усердный

to unearth (v) - 1) выкапывать, раскапывать, извлекать, 2) выгонять (животное) из норы

transit (n) - прохождение

bold (adj) - 1) отважный, смелый, храбрый I make bold to say... — осмелюсь сказать... Syn: audacious , brave 1., courageous , daring , intrepid

to vex (v) - досаждать, раздражать; возмущать, сердить

UNIT SIX

Text 6.1 Environmental Geology

environmental (adj) – экологический, связанный с окружающей средой

application (n) – 1) использование, применение, практическое применение 2) приложение (силы)

applied (adj) – 1) прикладной 2) приложенный; нанесенный

engineering (adj) –1) прикладной (о науке) 2) технический, инженерный

engineering (n) – 1) инженерное дело; техника; 2) машиностроение; 3) конструирование

related (adj) – связанный ; to be closely related to smth/ smb - быть тесно связанным с чем-либо, кем-либо

foundation (n) – фундамент, основание,

abiotic (adj) – абиотический, неживой

edaphology (n) – почвоведение

to mitigate (v) –1) смягчать (воду) 2) уменьшать; подавлять

exposure (n) – 1) внешнее воздействие ; 2) незащищённость; подверженность (внешнему воздействию)

Text 6.2 Environmental Geologists

to consult (to smb) - советоваться; консультироваться (с кем- либо);

справляться (о чём-либо)

contaminant (n) - загрязняющее вещество

to be involved in - быть связанным (с чем-то, или кем-то); быть

вовлечённым (во что- либо, быть участником (чего- либо);

to be involved in a project - участвовать в проекте

impact (n) - 1) удар, толчок, столкновение 2) воздействие, влияние

3) to have an impact - оказывать воздействие

landfill (n) - 1) захоронение отходов 2) мусорная свалка

man-made (adj) - искусственный, созданный руками человека

policy recommendations - рекомендации по вопросам политики, стратегии

public official - должностное лицо

remediation(n) - исправление, процесс исправления

routine inspections - профилактические осмотры

Text 6.3 James Dana

AAS American Association for the Advancement of Science - Американская ассоциация содействия развитию науки

to appoint (v) - назначать, определять (на должность)

to assume (v) - принимать, брать на себя, начинать

influence (n) - влияние, воздействие

to influence (v) влиять, оказывать влияние,

воздействовать

to foster (v) - воспитывать, обучать, растить, проявлять родительскую заботу

(о ком-либо.)

midshipman (n) midshipmen pl - 1) корабельный гардемарин (звание, присваиваемое курсантам военно-морского училища после окончания второго курса) 2) мичман (ист.)

honoured (adj) (AE) honored - уважаемый; заслуженный; почтенный

UNIT SEVEN

Text 7.1 Prospecting Geology

prospecting (n) - 1) разведочные работы; старательство; рудоискательство 2) поиск; 3) изыскание; разведочная выработка; шурф

to fossick (v) - искать полезные ископаемые

viable (adj) - жизнеспособный

to sift (v) - просеивать; отсеивать

specimen (n) - образец (породы или грунта)

oscillation (n) - 1) колебание; колебания, осцилляция 2) вибрация

panning (n) - 1) намытое золото; 2) панорамирование ; 3) затвердение почвы

ore (n) - руда; минерал; металл

airborne - 1) установленный на воздушном судне; бортовой ; 2) находящийся в воздухе; воздушный 3) перевозимый по воздуху

to dissolve (v) - 1) растворять(ся); разжижать(ся); 2) разлагать(ся) (на составные части)

Text 7.2 Prospecting Geologist

data (n,pl.) - данные, факты, сведения; информация ; мн.ч. от datum (n, Lat.)

drilling (n) – 1) бурение; сверление; высверливание 2) выбуренная порода

drilling for gas — бурение на газ; drilling for oil — бурение на нефть; drilling for structure — картировочное бурение; drilling for water — бурение на воду;

extensive (adj) - 1) обширный 2) подробный 3) пространный.

extremely (adv) - чрезвычайно, крайне, в высшей степени; очень

prospecting (n) - поиски, разведка; ведение поиска, ведение разведки; изыскания; исследования ;prospecting (adj) - разведочный ..

topographical (adj) - топографический;

topographical effect - отклонение отвеса за рельеф

undetected (adj) - скрытый, необнаруженный (напр. о дефекте)

Text 7.3 Academician I.M.Gubkin

mapping (n) - 1) картирование, картографирование, составление карт
fellow (n) - 2) младший научный работник колледжа или университета (занимается исследованием в какой-либо области, преподаёт или совмещает научную работу с педагогической)
outstanding achievements in science — выдающиеся научные достижения
oil-and-gas bearing нефтегазоносный
to perfect (v) - совершенствовать, улучшать
to accept something without any reservation - принять без оговорок
to accept a proposal / a suggestion / an offer — принять предложение

UNIT EIGHT

Text 8.1 Geochemistry

application (n) - 1) применение, использование; 2) приложение; 3) field application *геолог*. применение в условиях бурения

enzymatic (adj) - ферментный; энзимный

realm (n) - область; сфера; пределы

to encompass (v) - 1) окружать; заключать; 2) выполнять, осуществлять

iron (n) - 1) железо; 2) металлические изделия; 3) *(техн)* паяльник

rudimentary (adj) -1) элементарный ; 2) зачаточный, недоразвитый, рудиментарный

to emerge (v) - 1) а) появляться; всплывать; выходить б) вставать, возникать (о вопросе) 2) выясняться

carcinogenicity (n) - онкогенность, канцерогенность, канцерогенное действие

trace-element (n) - химический элемент, присутствующий в незначительном количестве в хим. растворе или в гор. Породе

to irrigate (v) - 1) орошать; ирригировать ; 2) промывать, спринцевать; 3) смачивать

Text 8.2 Geochemist

amount(n) - величина, количество
to conduct research(v) - заниматься (научными) исследованиями

goal (n) - цель; целевая установка

hard data - достоверные данные, точные данные

interference (n) - 1) интерференция; вмешательство 2) взаимодействие

to repair damage - возмещать ущерб

Text 8.3 Maria Gordon

to aspire (v) - 1) (aspire to / after) стремиться к (достижению чего-л.);

2) подниматься высоко вверх

Alpine (adj) - альпийский

to enroll (v) -1) вносить в список; регистрировать 2) записывать (в члены)

to be under the eye of smb. – быть под наблюдением у кого-либо

DSc от Doctor of Science - доктор (естественных) наук

PhD от Doctor of Philosophy - 1) доктор философии (учёная степень; примерно соответствует степени кандидата наук в РФ; 2) доктор философии (человек с такой учёной степенью)

the Dolomites ; Highest peak: Marmolada, 3342 m (10 965 ft.) - название горной цепи в Италии (часть Альпийских гор). Наивысшая точка г.Мармалада

UNIT NINE

Text 9.1 Hydrogeology

subsurface (n) - 1) нижние горизонты глубинный; подземный; 2) недра - isotropic subsurface

to move (v) through – перемещаться; двигаться, передвигать, перемещать что-либо; кого-либо (e.g. birds move through the air)

aquifer (n) – *геолог.* водоносный слой, водоносный горизонт (почвы)

to uncouple (v) - отсоединять; развинчивать (трубы); отвинчивать; расцеплять

to draw down (v) - истощать, исчерпывать, израсходовать (запасы)

drawdown (n) – *геолог*. 1) депрессия подземных вод; снижение, опускание; понижение уровня грунтовых вод; 2) сработка водохранилища, понижение уровня воды в водохранилище; 3) глубина воронки депрессии (e.g. drawdown of well)

water table (n) - 1) водная поверхность ; 2) уровень грунтовых вод

subsidence (n) - 1) осадок; 2) осаждение; 3) оседание (e.g. compression subsidence of rocks)

moisture (n) - 1) влага; 2) влажность; 3) влагоёмкость (почвогрунта)

abundant (adj)- 1) обильный, имеющийся в избытке; 2) изобильный

percolation (n) – 1) просачивание; 2)гравитационная фильтрация (e.g. capillary percolation - water percolation)

intrusion (n) – 1) проникновение; 2) внедрение, интрузия (e.g. extraneous water intrusion)

arid (adj) - 1) сухой, засушливый; 2) безводный; аридный

karst (adj) – карст, карстовый

alluvial (adj) - *геолог.* аллювиальный, наносный (e.g. alluvial deposit - alluvial gold)

riparian (adj) - прибрежный, находящийся на берегу, syn: littoral , coastal

overdraft (n) – 1) интенсивное использование, интенсивная сработка (подземных вод); 2) интенсивно использовать (подземные воды)

Text 9.2 Hydrogeologist

hydrogeologist (n) - гидрогеолог - mining hydrogeologist

hydrologist (n) - гидролог

water reservoir - 1) резервуар; бассейн; водохранилище

artificial reservoir — искусственное водохранилище

natural reservoir — естественное водохранилище Syn: vessel, tank

underground water - грунтовая вода; подземная вода

pollution (n) - pollution загрязнение - environmental pollution - gas pollution .

well tapping strategies – технологии поиска водоносных скважин

Text 9.3 Nikolay Golovkinsky

to be in one's line - 1) быть в чьей-либо компетенции;

book-keeping is out of his line (idioms) — Нет, счетоводство не по его части

non-commissioned officer (n) - унтер-офицер

decoration (n) - награда, орден, знак отличия

to decorate - награждать медалями, орденами to be decorated for bravery in battle — получить награду за проявленную в бою храбрость

associate professor (AmEn)- адъюнкт-профессор; доцент

mansion (n) - жилой дом, особняк

peninsula (n) – полуостров

UNIT TEN

Text 10.1 Land and Resources of Russia

inhabited (adj) - заселённый, населённый

to purchase (v) - покупать, закупать (приобретать что-либо за деньги)

expansive (adj) – 1) громадный, обширный (о размере, территории); 2) способный расширяться; расширительный

copper (n) - copper медь (металл); медный, сделанный из меди; покрывать медью, обшивать медью

lead (n) – 1) свинец, свинцовый (прилаг.) ; 2) освинцовывать, покрывать свинцом 2) разделять шпонами

consumer (n) – потребитель

Text 10.2 Oil and Gas Engineering

logging - геофизические исследования в скважинах, каротаж

to deplete (v) - 1) истощать; исчерпывать (запасы) 2) хищнически эксплуатировать

reservoir simulation - моделирование коллектора

reservoir rock - порода-коллектор, коллекторская порода

artificial (adj) - искусственный; синтетический;

substance (n) - вещество chemical substance - химическое вещество hard substance - твёрдое вещество oily substance - маслянистое вещество pure substance -чистое вещество, вещество без примесей toxic substance - токсичное вещество hazardous substance - опасное вещество ozone-depleting substance – озоноразрушающее вещество

Text 10.3 Alfred Nobel

award (n) - 1) премия, награда, приз, поощрение, компенсация; 2) присуждение (награды)

to award (v) – 1) присуждать, назначать (награду, премию; 2) назначить наказание; 3) выносить решение, присуждать

to go bankrupt (v) – 1) обанкротиться; 2) прекратить платежи

to combine (v) – 1) объединять, сочетать; 2) соединяться, объединяться

to invent (v) -1) изобретать, создавать; 2) выдвигать что-либо новое; 3) выдумывать, сочинять, измышлять

inventor (n) - 1) изобретатель; 2) выдумщик; фантазёр

to improve (v) -1) улучшаться; совершенствоваться; поправляться, налаживатьс;2) улучшать; совершенствовать; поправлять, налаживать

land mine (n), landmine (n) - наземная мина, фугас

ordinary (adj.) - 1) обычный, обыкновенный; ординарный, простой; 2) заурядный, банальный, посредственный

KEYS

UNIT ONE

Text 1.1 The Science of Geology

EXERCISES

1.

1c Geology is the study of the planet earth, its rocky exterior, and its history. 2 – g Geologists study the changes that the earth has undergone as its physical, chemical, and biological systems have interacted during their long history.

3e Geology enables scientists to predict how our planet will behave in terms of living with natural disasters and using the earth's natural resources.

4b They study the history of these events as recorded in rocks and try to determine when the next eruption or earthquake will occur

5d They also study the geologic record of climate change in order to help predict future changes.

6f Geology is also used to study other planets and moons in our solar system.

7a Geologic history shows that the processes that shaped the earth are still acting on it and that change is normal.

2.

Noun	Verb	Adjective	Adverb	Pronoun	Preposition
geology system history biosphere planet asteroid flood	determine predict change examine include divide interact occur	solar rocky chemical major	extensively currently safely …	it these some	into through on of during around

Text 1.2 Geologist

EXERCISES

2. 1c; 2e; 3f; 4g; 5a; 6d; 7b

3.

1) A geologist is someone who studies the Earth and the processes which shape it.

2) People who like the sciences and enjoy being outdoors may find geology an interesting and rewarding career, especially if they are willing to apply themselves to a sometimes extensive field of study.

3) Employment prospects in this field vary, depending on the qualifications and interests of a geologist.

4) Geology is an incredibly large field.

5) Geologists look at all of the materials which make up the Earth, studying the ways in which they are formed and altered .

6) A geologist may also be familiar with chemistry, mathematics, physics, geography, engineering, hydrology, environmental studies, urban planning, paleontology, biology, and mineralogy.

7) A geologist learns more about the Earth and the ways in which it can be safely and _effectively utilized by humans.

8) Many geologists find employment in fields which are focused on extracting useful resources from the Earth.

9) Geologists are often sent to various sites around the world to assess their contents

10) They also work in the petroleum industry, assessing potential oil sites and assisting with their maintenance

4.

Base form	Past Simple	Past Participle	Present Participle

vary(1);
look at(2);
make up(2);
work(4);
be (5,6);
find(7)
	formed(3);
	evolved(3)
		altered(2);
		focused(7)
			studying(2);
			assessing(4);
			assisting(4);

Text 1.3 Alexander Karpinsky

EXERCISES

1.

1) Alexander Petrovich Karpinsky was born into a family of iron works engineers. **False**

2) Alexander Petrovich Karpinsky proved to become the most talented of the big miner's dynasty. **True**

3) Karpinsky participated in the drafting of geological map of Eurasia and the unification of graph **False**

4) The international recognition of the scientist came to him 1881 in Paris (Sorbonne). **False**

5) Works by A.P. Karpinski constitute the fund of the world science. **True**

6) Alexander Petrovich Karpinsky, a member of the Academy of Sciences of the USSR, was one of the founders and creators of petroleum geology as an independent branch of geological science in the world. **False**

7) Although A.P. Karpinski's papers were not voluminous, still they proved to give profound observations. **True**

UNIT TWO

Text 2.1 History of Geology

EXERCISES

1.

1d The science of geology came into service in the 18th century, but systematic knowledge of the earth has been collecting since the Stone Age.

2b Philosophers of the antique kept written records relating to geology

3i Mineralogy was studied and detailed geologic observations were made throughout the Medieval and Renaissance periods.

4e The publication of Charles Lyell's book ***Principles of Geology*** took place.

5c Two well known scientists wanted to establish geology as a rational scientific field, like chemistry or physics.

6g The English naturalist, Charles Darwin, well known for his theory of evolution, began his scientific career on the sea voyage around world, where he made many geological observations.

7a During this time, geologists developed the theories of continental drift, plate tectonics, and seafloor spreading.

8h A group of scientists conducted four surveys of the American West.

9f Laccoliths were first recognized (round igneous rock intrusions) in Range Province.

2.

Humans have been (1) collecting systematic knowledge of the earth since at least the Stone Age. Between the 4th century and 1st century BC, (2) ancient Greek and Roman philosophers began the task of keeping written records relating to geology. Throughout the medieval and Renaissance periods, people began to study mineralogy and made detailed geologic (3) observations. By the early 19th century, many people were studying geologic topics, (4) although the term geologist was not yet in general use. In the late 18th and the 19th centuries, naturalists on voyages of exploration began to make important (5) contributions to geology. Reports of (6) these naturalists about their travels influenced the worlds of science and art. At the end of the 19th century and into the 20th century, the field of geology expanded even more.

Text 2.2 Petroleum Geologist

EXERCISES

2. **1g; 2a; 3c; 4f; 5d; 6e; 7b**

Text 2.3 James Hutton

EXERCISES

2. *Only one of the sentences below is correct. Say which:*

A. Hutton's approach to studying the Earth was based on:

1. The seventeenth century scholarly analysis of the Bible by Archbishop James Ussher of Ireland

2. The observation of the world around him**.**

A**2 is correct**

B. Hutton came to believe that:

1. The Earth had come into creation only around six thousand years earlier (on October 22, 4004 B.C.)

2. … that fossils were the remains of animals that had perished during the Biblical flood

3. ... that the Earth was perpetually being formed;

B3 is correct

C. The Hutton Unconformity is:

1. … the name of one of the J.Hutton's books.

2. … the place name in the USA

3. … a steep high rock face in Scotland

4. … the contact surface between younger and older rocks representing a discontinuity in the geological record cited by J.Hutton as evidence in his research.

C4 is correct

D. The author of one of the most influential books ***Principles of Geology*** was:

1. Charles Darwin

2. Charles Lyell

3. James Hutton

D 2 Charles Lyell is correct

4. **3a ; 7b; 6c; 1d; 2e; 4f; 5g**

UNIT THREE

Text 3.1 Mineralogy

EXERCISES

1. 1e; 2g; 3c; 4f; 5a; 6d; 7b

2.

verb	noun	adjective	adverb
determine	determination	determined	determinedly
include	inclusion	inclusive	inclusively
recognize	recognition	recognized recognizable	---
be important have importance	importance	important	importantly
complexify	complexation	complex	complexly
compose	composition	composed	composedly

combine	combination	combinatory	---

determine include recognize important complex compose combine

Text 3.2 Mineralogist

EXERCISES

2. 1e; 2a; 3b; 4g; 5f; 6d; 7c

3.

1**)** A mineralogist is someone who studies minerals.

2) Experts on mineralogy can work in state laboratories which analyze mineral samples for the purpose of assay to private industry.

3) They determine the value of claimed land and mineral finds by looking at samples from the site.

4) A variety of techniques can be used to test and examine a mineral to find out what it is, including chemical analysis to study its chemical composition .

5) No matter where a professional mineralogist works his goal is accurate identification and classification of minerals.

6) The mineralogist's job is to determine whether or not diamonds are likely to be present at the site and conclusions may be drawn about the quantity and quality of such hard minerals.

7) The minerals formed at high temperatures can be found found deep below the Earth's crust and in volcanoes.

8) Many mineralogists work with professionals such as engineers and geologists, pooling their knowledge and resources.

9) To make the use of minerals more effective professional mineralogists develop and study new uses for minerals.

Text 3.3 Charles Lyell

EXERCISES

2. *TRUE or FALSE*

1. Charles Lyell was born in the United Kingdom. **True**
2. Charles Lyell was born in the United States. **False**
3. Charles Lyell was born in the United Arab Emirates. **False**

4. He spent vacations from school traveling and making keen observations of geological formations **True**
5. Lyell moved to London where he married Mary Horner and became a lecturer on Geology **False**

4. 3a; 5b; 4c;1d;2 e; 7f; 6g

5. *Past Simple Active* - 1) graduated; 2) moved; became 3) observed; wrote 5) included 7) did not finish 8) believed
Past Simple Passive - 4) were attributed 6) was seen 8) was not widely accepted 9) was buried.

UNIT FOUR

Text 4.1 Geophysics

EXERCISES

1. Geophysics is a branch of science that 1) applies physical principles 2) to the study of the earth. The 3) scope of geophysics includes outer-space phenomena that influence the earth, even in subtle ways; the 4) effects of the sun on the earth's magnetic field; and manifestations of cosmic radiation and the solar wind.

Geophysicists examine physical phenomena and 5) their relationships within the earth.

Solid earth physics involves 6) studying the behavior of earth materials from the crust down to the core. Generation of the magnetic field 7) seems to be related to the motion of fluid, electrically conducting material within the earth, so that the planet acts as a self-exciting dynamo. Gravity is the 8) attractive force exerted by the mass of the earth.

Geophysical exploration, commonly called 9) applied geophysics or geophysical prospecting, is conducted to locate economically significant accumulations of oil, natural gas, and 10) other minerals

2. 1) vertical direction 2) special tools 3) energy resources 4) natural gas 5) magnetic field 6) temperature variations 7) geophysical prospecting 8) electrical current 9) applied geophysics 10) geophysical exploration 11) radioactive properties 12) geologic features

Text 4. 2 Geophysicist

EXERCISES

2. 1g; 2c; 3a; 4d; 5b; 6f; 7e

3.

1. focus on 2. concentrate on 3. programs in 4. work for 5. led to 6. returned to 7. course of

Text 4.3 Amos Eaton

EXERCISES

2. *TRUE or FALSE.*

1. After graduating from Williams College in 1799 Amos Eaton undertook the more practical study of law in New York City. **True**
2. Despite an interest in the natural sciences, he practiced law and worked as a land agent and surveyor in Catskill, New York. **True**
3. It was when he worked as a land agent that Amos Eaton committed a serious crime and was put to prison. **False**
4. In prison Amos Eaton did a lot of scientific studies and after being released spent a year at Yale College. **True**
5. He then returned to Williams College where he introduced a very successful course of lectures on the history of Northern States. **False**.
6. He undertook geological surveys and his published survey reports earned him recognition in American geology. **True**

UNIT FIVE

Text 5.1 Marine Geology

EXERCISE

1. Marine geology has 1) strong ties to physical oceanography. Geophysical 2) evidence confirmed the lateral motion of continents and indicated the 3) young age of oceanic crust. Marine geologists may be specialists in 4) a number of fields, including petrology, sedimentology, stratigraphy, paleontology, geochemistry, geophysics, and volcanology and do paleontological 5) investigations of the ocean floor and coastal zone.

The deep ocean floor is the last essentially unexplored frontier and detailed 6) mapping in support of both military (submarine) objectives and economic (petroleum and metal mining) objectives 7) drives the research.

Drilling platforms and drilling ships 8) allow earth scientists to make more-detailed studies of the history of the oceans and the ocean floor. Scientists used paleomagnetism and seafloor spreading 9) to determine that the continents had moved relative to the magnetic poles and to each other.

Text 5.2 Marine Geologist

EXERCISES

2. 1c; 2e; 3d; 4g; 5a; 6b; 7f

3.

1) A marine geologist is a scientist who studies the different natural processes that occur on ocean floors and beaches.

2) Marine geology or geological oceanography involves geophysical, geochemical, sedimentological and paleontological investigations of the ocean floor and coastal margins.

3) The deep ocean floor is the last essentially unexplored frontier and detailed mapping contributes to petroleum and metal mining.

4) Marine geologists may be specialists in a number of fields, including stratigraphy, sedimentology, mineralogy, geochemistry and volcanology.

5) They may gather samples from the ocean while out at sea and try to determine their chemical composition in the laboratory.

6) Ocean experiments and findings are described in detailed scientific papers.

7) Marine geologists concentrate on varied tasks through studies of oceanic rocks and sediments.

8) After the World War II marine geological studies provided the convincing evidence for sea floor spreading and plate tectonics.

9) There are experts, marine geochemists who investigate the chemical properties of different rocks and sediments.

Text 5.3 Edmond Halley

EXERCISES

1.

1) Edmond Halley published three papers on astronomical subjects as soon as he graduated from the college. **False**

2) Halley was able to prove that all of the sky, not just the solar system, is an active, dynamic place. **True**

3) Although Newton's new laws of physics, and theory of gravitation were being widely scorned and disputed Halley saw his colleague greatness and published Newton's book Principia Mathematica in 1687 **True**

4) From the data he collected during his voyage aboard the HMS Beagle
Halley produced the first map showing the variation of the Earth's magnetic field in 1700. **False**

5) The benefit of the map produced by E. Halley was not only for navigation but it also made a profound contribution to studies of the deep Earth. **True**

6). Halley applied new physics to the problem of predicting which comets might strike the Earth. **False**

7) The scientific research cruises of today follow the model of Halley's first geophysical voyage. **True**

2.

1) Where would Newton **have** been without his colleague Edmond Halley, the father of geophysics?

2) Captain James Cook's first voyage in 1769 **was made** to observe a transit of Venus

3) Halley made the first map of the world's winds, **setting** the baseline for another great field of geophysics, atmospheric dynamics.

4) At first Newton's new mathematics of the calculus, laws of physics, and theory of gravitation **were being** widely scorned and disputed.

5) Edmond Halley **is** known as the father of geophysics.

6) In 1694 Halley suggested that comets **might** strike the Earth.

7) That cruise **was** the first voyage ever made for a purely scientific purpose.

3.

1. vexing problems 2. remote island 3. restless prodigy 4. lively place
5. ancient star catalogue 6. fluid medium 7. geomagnetic field 8. distinctive thing

Revision Units 1-5

EXERCISES

1.

a) Minerals are classified on the basis of chemical composition.

b) Scientists usually spend a great amount of time conducting field research.

c) Numerous universities around the world offer graduate programs in Geology.

d) What is the main purpose of the environmental geologist's job?

e) Most of the physical properties can be recognized at sight.

2.

Verbs	Nouns	Adjectives
achieve	achievement	achieved
estimate	estimation	estimated
explain	explanation	explained, explaining
generate	generation	generated
expand	expansion	expanded, expanding
locate	location	located
regulate	regulation	regulated, regulating

3.

1. There has been a lot of debate among scholars about the expanding universe (расширяющаяся вселенная).

2. The local community uses electricity generated by the wind turbines.

3. These birds must have a wonderful power of location.

4. There is no convincing explanation of the overall structure of the universe.

5. The results achieved in radiology stimulated progress in other fields of science.

6. Under the new regulations, all staff must have safety training.

7. The estimated cost of repairing the roof is $600.

4.

1. Geology is referred **to** as earth science and geoscience

2. Prospecting geologists are trained **in** earth sciences to find geological wonders.

3. **At the end** the 19th century and into the 20th century, the field of geology expanded even more.

4. **By** the early 19th century, many people were studying geologic topics.

5. **Throughout** the medieval and Renaissance periods, people began to study mineralogy and made detailed geologic observations.

6. Seismic energy is detected **on land** by using devices called geophones

7. They also study the geologic record of climate change **in order to** help predict future changes.

8. Seismic exploration is **divided into** refraction and reflection surveys

9. Reports **by** German natural historian Alexander von Humboldt about his travels influenced the worlds of science and art.

10. Amos Eaton spent a year at Yale College studying science **under** Benjamin Silliman and Eli Ives.

5.

1) *f)Gas Field* - The geographic area that is directly above an underground accumulation of natural gas that is commercially viable.

2) *a) Infiltration* - The movement of surface water into porous soil.

3) *e) Extractive Industries* - Industries involved in mineral resource exploration, acquisition, assessment, development or production.

4) *i) Magma* - Molten rock material that occurs below Earth's surface.

5) *g) Elevation* - The vertical distance between mean sea level and a point or object on, above or below Earth's surface.

6) *d) Geochronology* - A study of the time relationships of rock units; includes methods of both relative and absolute dating.

7) *h) Greenhouse Effect* - A warming of the atmosphere caused by carbon dioxide and water vapor in the lower portions of the atmosphere capturing heat that is radiated from and reflected by Earth's surface.

8) *c) Lava* Molten rock material on Earth's surface.

9 *b) Geomorphology* - The science of Earth's landforms, their description, classification, distribution, origin and significance.

10) *j) Exploration* - The work of identifying areas that may contain viable mineral resources. This work can include surface mapping, remote sensing, exploratory drilling, geophysical testing, geochemical testing and other activities.

UNIT SIX

Text 6.1 Environmental Geology

EXERCISES

1.

1d) Environmental geology is an applied science concerned with the practical application of the principles of geology in the solving of environmental problems.

2a) Environmental geology involves the protection of human health and safety through understanding geological processes.
3g) The study of geologic hazards, such as earthquakes and volcanic eruptions, can also be considered part of environmental geology.
4c) Economic geology is the use of geologic knowledge to find and recover materials that can be used profitably by humans, including fuels, ores, and building materials.
5f) Economic geologists commonly specialize in a particular aspect of economic geology, such as petroleum geology or mining geology.
6e) Engineering geology is the application of engineering principles to geologic problems.
7b) In other words environmental geology is the application of geological information to help better organize protection of nature and human health.

3.

Ecology a science which studies the relationship between all forms of life on our planet and the environment. This word came 1) **from** Greek "oikos" which means home. Ancient Greek philosophers such as Hippocrates and Aristotle laid the foundations of ecology 2) **in** their studies on natural history. Modern ecology transformed 3) **into** a more rigorous science in the late 19th century.

Ecology is the scientific analysis and study of interactions 4) **among** organisms and their environment - the interactions organisms have 5) **with** each other and with their abiotic (абиотический, неживой) environment. Topics of interest 6) **to** ecologists include the diversity, distribution, amount (biomass), number (population) of organisms, as well as competition between them 7) **within** and among ecosystems. Ecosystems are composed 8) **of** dynamically interacting parts including organisms, the communities they make 9) **up**, and the non-living components of their environment. Ecosystem processes regulate the flux of energy and matter 10) **through** an environment.

Text 6. 2 Environmental Geologist

EXERCISES

2. 1c; 2f; 3e; 4g; 5b; 6a; 7d

Text 6.3 James Dana

2. A.

1.Dana's science teacher was Fay Edgerton, a pioneer American geologist.

2. Fay Edgerton and J.Dana met at Yale College at New Haven.

3. American geologist Amos Eaton studied under the elder Benjamin Silllman

A 3 is correct

2. B

1. On graduating from Yale in 1833, Dana spent 15 months as a shipboard naturalist responsible for geology and mineralogy.

2. His first publication appeared in the American Journal of Science in 1835.

3. After the expedition during which he cruised the Mediterranean he was appointed a professor at Yale and started his teaching in 1849

B2 is correct

3.C

1. Dana's Manual of Mineralogy (1848), became the main introduction to mineralogy for generations of geology students.

2. His studies on volcanic phenomena became the most influential textbook.

3. Dana was elected Editor of the Geological Society of America.

C 1 is correct

4.

Present Perfect Active	Past Perfect Active	Past Simple Active	Past Simple Passive	Past Participle
have changed (1)	*had been (3); had supported(7)*	*became(4)*	*was appoinned (2) was fostered(3)*	*published, (4) suggested(5) , associated,(5) originated(6)*

UNIT SEVEN

Text 7.1 Prospecting Geology

EXERCISES

1. 1d, 2 a, 3e, 4c, 5 b, 6 f, 7g

2. 1. Seismic prospecting determines the structure of rock deposition.

2. Geological exploration remains one of the most effective means for increasing reserves.

3. The job of geoscientists is to find locations with abnormally low gravity.

4. Gravitational, magnetic, and seismic methods are used to survey the subsurface.

5. Echoes of seismic waves are detected by seismographs.

6. Geochemical methods for prospecting hydrocarbon deposits are based on studies of the chemical composition of underground water and the content of dissolved gases and organic matters in it.

7. Magnetic prospecting is based on different magnetic conductivity of rocks.

3. gas arc; three-dimensional ;water containing; long-term; oil-bearing

Text 7.2 Prospecting Geologist

EXERCISES

2.

1) Subject – (Prospecting) geologists; Predicate – are trained .

2) Subject – The English naturalist Charles Darwin; Predicate – began.

3) Subject – Finding and maintaining a clean water supply, and disposing safely of waste products; Predicate – requires.

4) Subject – People **who work in this branch of geology*; Predicate – spend.

5) Subject – Scientific teams; Predicate – include.

* *who work in this branch of geology - Defining Relative clause*

3. 1b; 2g; 3f; 4e ; 5c; 6d; 7a

4.

1) Prospecting geologists are scientifically **trained** in earth sciences to find geological wonders.

2) Geophysical instruments and devices help prospecting geologists to collect data and determine feasibility of **staking** and developing a claim.

3) The primary purpose of the prospecting geologist is to locate all **outcropping** mineralization within a given area.

4) Very often prospecting geologists have to determine if certain locations are able to be effectively **mined.**

5) When mining works in a particular area are in full swing a prospecting geologist may be assigned **to oversee** certain aspects of the mining operation.

6) Over the course of their careers prospecting geologists often develop a high level of **expertise** I in fulfilling their professional responsibilities.

7) It’s common practice that geologists **specialize in** a specific type of rock, mineral or precious metal.

8) In mining the work of quality control **advisors** is to ensure that mines p Ivan Mikhailovich Gubkin roduce quality ore.

Text 7.3 Academician I.M.Gubkin

EXERCISES

2. 3a; 6 b; 1 c; 7d ; 2e ;4f; 5g

4.

1) It was work on the genesis of the oil fields and mud volcanism that brought I.M. Gubkin **worldwide** fame.

2) Gubkin’s first **research** was examining the rocks of the northern shore of Lake Ladoga.

3) He **proposed** a new method for constructing maps of underground oil reservoirs relief.

4) In the summer of 1917 he **was** sent to the United States to study the American oil industry.

5) Another focus of his academic interests was the rational use of **hydrocarbon** resources.

6) He stated that petroleum geology should be **integrated** with physics, chemistry, biology, mathematics, and other sciences.

7) He insisted that a petroleum engineer should be an expert in deep drilling, exploitation, chemistry and technology of oil **as well as** in economics.

8) Apart from the research work I.M.Gubkin was engaged in **teaching**.

9) He introduced a special-purpose academic program designed to balance theory and practice, field and **laboratory** studies.

10) I.M.Gubkin put **forward** a new concept of teaching petroleum engineers.

UNIT EIGHT

Text 8.1 Geochemistry

EXERCISES

1.

Geochemistry is the geology and chemistry concerned 1) **with** the chemical composition and chemical reactions taking 2) **place** within, the earth's crust.

Geochemistry is the application of chemistry to the study of the earth, its materials, and the cycling of chemicals 3) **through** its systems.
The sphere of geochemistry extends 4) **beyond** the Earth, encompassing the entire Solar System and has made 5) i**mportant** contributions to the understanding of a number of processes including mantle convection, 6) the formation of **planets** and the origins of granite and basalt.

Among the various 7) **branches** of earth science, environmental geochemistry is unique in focusing directly 8)**on** public health issues related to the environment.

Biogeochemistry is an 9) **emerging** field that examines the chemical interactions between living and nonliving systems—for example, microorganisms that act in soil formation.

Text 8.2 Geochemist

EXERCISES

2. 1g; 2d; 3f; 4a; 5b; 6c; 7 e

Text 8.3 Maria Gordon

2.

1. superficial resemblance 2. important contribution 3. tectonic evolution 4. microscopic examination 5. profound interest 6. pastoral family 7. copious volumes 8. longstanding admirer

3.

1. Already in these early years she showed a **profound** interest in nature, so during holidays she enjoyed to explore the landscape of the Highlands accompanied by her elder brother.
2. Studying both in London and Edinburgh she obtained her **degree** in geology, botany and zoology in 1890.
3. Julius Pia **carried** out research in the Prags Dolomites.
4. She published **copious** volumes of the tectonic evolution of the Dolomites.
5. Dr. John Dr. John Gordon, Maria's husband **respected** and encouraged her passion for the Dolomites.
6. Maria Matilda Ogilvie Gordon succeeded against all odds and unequal **treatment** of women to study geology and achieve important results in this field.

UNIT NINE

Text 9.1 Hydrogeology

EXERCISES

1. 1c 2e 3g 4b 5f 6a 7d

2.

Most land areas on Earth have some form of aquifer underlying them, sometimes at 1) **significant** depths. In some cases, these aquifers are rapidly being depleted by the 2) human population.

Aquifers are critically 3) **important** in human habitation and agriculture. Deep aquifers in 4) **arid** areas have long been water sources for irrigation. 5) Many villages and even large cities draw their 5) **water** supply from wells in aquifers.

Municipal irrigation and 6) **industrial** water supplies are provided through large wells. 7) **Multiple** wells for one water supply source are termed "wellfields", which may withdraw water from confined or unconfined aquifers. Using ground water from 8) **deep**, confined aquifers provides more protection from surface water contamination. 9) **Some** wells, termed "collector wells," are specifically designed to induce infiltration of surface (usually river) water.

Aquifers that provide sustainable fresh groundwater to 10) **urban** areas and for agricultural irrigation are typically 11) **close** to the ground surface (within a couple of hundred metres) and have some recharge by fresh water. This recharge is typically from rivers or meteoric water (precipitation) that percolates into the aquifer through overlying 12) **unsaturated** materials.

Text 9.2 Hydrogeologist

EXERCISES

2. 1b; 2c; 3g; 4d; 5a; 6e; 7f

3.

1) Hydrogeology studies how waters are distributed in the earth and how the earth affects its properties.

2) A hydrogeologist is a scientist who researches groundwater systems.

3) Some people think that hydrology and hydrogeology study the same problems only their methods are different.

4) Groundwater hydrologeologists usually concentrate on how groundwater interacts with other surfaces like soil and air.

5) One of the hydrogeologists' tasks is to predict when water resources eventually be drained.

6) Field research is conducted to learn more about the hydrogeologic activity in a particular area.

7) Advanced computer programs and imaging technology can also be utilized to map groundwater reservoirs and simulate different drilling and well tapping strategies.

8) Very often hydrogeologists take part in cleanup efforts in areas that have become polluted by waste or oil spills.

9) To promote awareness of the dangers of pollution and the importance of evironmental sustainability educational websites and books are created.

Text 9.3 Nikolay Golovkinsky

EXERCISES

1.

1. Russian geologist N. A. Golovkinsky was born in a small town of Yaran in Kazan province.
2. In 1851 N.A. Golovkinsky entered Kazan Imperial University to study medicine.
3. Soon after the beginning of the Crimean war he was sent to Sevastopol.
4. In Kazan University N.A. Golovkinsky worked as a freelance associate professor.
5. When he retires he moves from Odessa to the Crimea.

2. True or False.

1. N.A. Golovkinsky spent 25 years working in the University of Kazan. ***False***.
2. In the Crimea Professor had a mansion near Alushta next to a beautiful waterfall. ***False***.
3. On having resigned from the military service N.A. Golovkinsky entered Kazan University. ***True***
4. His famous paper "On Permian formations in the central part of the Volga-Kama basin." brought him Doctor's degree and professorship. ***True***
5. His father received decoration – a bronze medal on Andrew's ribbon. ***False***.
6. Golovkinsky was one of those who organized the first "artesian observatory" as a model of hydro-geological station. ***True***
7. Only thanks to Professor Golovkinskiy first urban water supply appeared in Kazan. ***False***.

UNIT TEN

Text 10.1 Land and resources of Russia

1. 1b; 2i; 3d; 4a; 5j; 6c; 7f; 8h; 9g; 10e

Text 10.2 Oil and Gas Engineering

EXERCISES

2. 1g; 2c; 3d; 4a; 5f; 6b; 7e

3.

1) Two main oil and gas subsurface disciplines, are exploration by earth scientists and petroleum engineering.

2) Petroleum geology and geophysics accomplish a static description of the hydrocarbon reservoir rock

3) Petroleum engineering focuses on estimation of the recoverable volume of resource of oil, water or gas.

4 Oil and gas engineering involves the production of oil and gas in an economical and environmentally safe manner.

5) Subsequent development training for oil and gas engineers has usually been done within oil companies.

6) Specific to industry requirements, technical knowledge and hands-on experience will be gained in this program.

7) Oil and gas engineering experts are given global opportunities to work for various industry organizations and oil companies.

8) A degree in engineering might be a stepping-stone to graduate studies or various professional degrees.

9) Crude oil and natural gas should be efficiently extracted and refined into marketable products.

Text 3 Alfred Nobel

EXERCISES

1.

1) Alfred Nobel's father went bankrupt before the birth of Alfred. ***False***

2) Immanuel Nobel was quick to see industrial openings for his scientific inventions and build up over 80 companies in 20 different countries. ***False***

3) Alfred Nobel did not have a University degree. ***True***

4) Alfred Nobel knew science but was a poor linguist. ***False***

5) Throughout his life Alfred Nobel avoided publicity. ***True***

6) Alfred Nobel was more successful in business than his father. ***True***

7) Alfred Nobel died in Paris in 1896. ***False***

Revision Units 6-10

EXERCISES

1. 1) Hydrology 2) Marine studies 3) Determinative mineralogy 4) Descriptive mineralogy 5) Geochemistry 6) Geophysical exploration 7) Volcanologic studies 8) Magnetic prospecting 9) Environmental geology

2. Synonyms

1) Viable (adj) fruitful (adj)

2) riparian (adj) coastal (adj)

3) inventive(adj) – resourceful (adj)

4 prospective (adj) – potential

5) exploration geologist – prospector (adj)

6) production (n) - output (n)

7) investigations (n) - exploration (n)

8) deposit (n) – accumulation (n)

9) generate (v) – produce (v)

10).recovery (n) - extraction (n)

11) perform (v) – fulfill (v)

12) area (n) - territory (n)

13) concentrate (v) – focus on (v)

14) combustible (adj) – inflammable (adj)

15) application (n)-usage (n)

3.

Verbs	**Nouns**	**Adjectives**
to design	design	designed
to drill	drilling	drilled
to mine	mine	mining

to evaluate	evaluarion	evaluated
to provide	provision	provided
to percolate	percolation	percolating ?
to refine	refinement	refining

4. 1e; 2a; 3d; 4c; 5b

5.

1. Petroleum geologists are scientists who focus **on** the extraction and estimation of oil, gas and other combustible resources buried in the Earth. 2. Qualifications are useful but they are no substitute **for** experience. 3. Several schools are involved **in** the project. 4. He graduated **with** honors, with a Bachelor's of Art **in** Classics. 5. Refineries that process petrochemicals can be found all **over** the world. 6. The Black Sea is an inland sea bounded **by** Europe, Anatolia and the Caucasus. 7. The Black Sea was originally a land-locked fresh water lake and was flooded **with** salt water during the Holocene. 8. An asteroid is any of numerous small celestial bodies that move **around** the sun mainly **between** the orbits of Mars and Jupiter. 9. A degree **in** engineering is an academic award conferred **by** a university or college on successful completion of a course. 10. Groundwater hydrologists usually concentrate **on** how groundwater interacts with other surfaces like soil and air.

Additional Material

Geophysicist Quiz

1) c
2) b
3) d
4) b
5) a
6) d
7) c
8) d
9) b
10) c
11) a
12) d
13) a
14) c
15) b
16) c
17) b
18) d
19) b
20) b

Multiple Choice Quiz

Geophysics and Geology Knowledge

1) 1
2) 3
3) 4
4) 1
5) 1
6) 2
7) 1
8) 4
9) 1
10) 1
11) 4
12) 3
13) 4
14) 1
15) 1
16) 4
17) 2
18) 2
19) 1
20) 2

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