ПЕРВОЕ ВЫСШЕЕ ТЕХНИЧЕСКОЕ УЧЕБНОЕ ЗАВЕДЕНИЕ РОССИИ

МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ

РОССИЙСКОЙ ФЕДЕРАЦИИ

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САНКТ-ПЕТЕРБУРГСКИЙ ГОРНЫЙ УНИВЕРСИТЕТ

УТВЕРЖДАЮ

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Руководитель ОПОП ВО
профессор М.В. Двойников

МЕТОДИЧЕСКИЕ РЕКОМЕНДАЦИИ
ДЛЯ ПРАКТИЧЕСКИХ ЗАНЯТИЙ ПО ДИСЦИПЛИНЕ
ПРОФЕССИОНАЛЬНО ОРИЕНТИРОВАННЫЙ ИНОСТРАННЫЙ ЯЗЫК

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Составитель:	к.т.н., доц. И.Г. Герасимова, к.т.н., доц. Ю.Е. Мурзо

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ВВЕДЕНИЕ

Данные материалы предназначены для всех направлений подготовки кадров высшей квалификации и соответствуют программе по английскому языку для неязыковых вузов.

Целью методических указаний является формирование навыков и развитие умений работы с оригинальными научно-техническими текстами с последующим использованием информации в речевой практике. Особое внимание уделяется формированию активного словарного запаса, а также развитию устной монологической и диалогической речи.

Текстовый материал сопровождается разнообразными упражнениями, позволяющими активизировать познавательную деятельность.

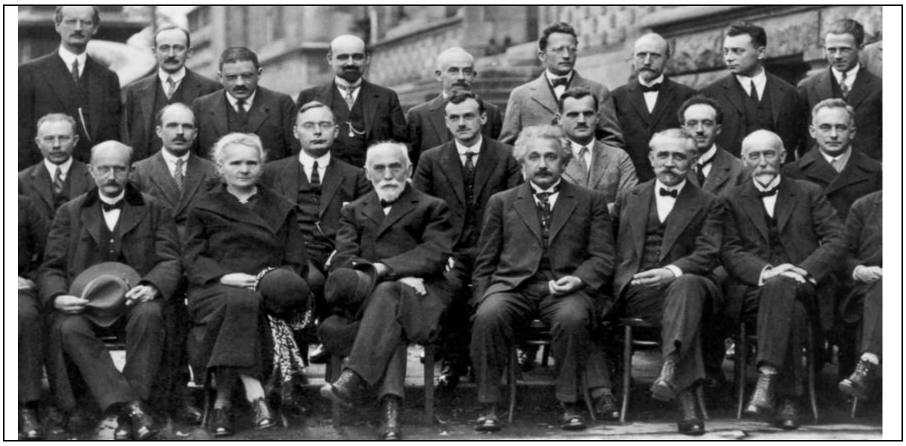
Для развития навыков устной речи по специальности предлагаются вопросно-ответные задания, дискуссии и работу в парах.

Методические указания можно использовать как на практических занятиях, так и для самостоятельной работы.

Text 1

HOW DID ENGLISH BECOME THE LANGUAGE OF SCIENCE?

Task 1. Look at the picture and read the description below. Can you recognize any scientists? What do you know about the Conference?



From the October 1927 Fifth Solvay International Conference on Electrons and Photons. Hendrik Lorentz, Leiden University, seated between Madame Curie and Einstein, chaired the conference.

Task 2. Read the words and expressions and memorize them.

to coin a term	создать новый термин
to publish	опубликовать
obvious	очевидный, ясный
up-and-coming	энергичный, многообещающий
universal means (of communication)	общемировые средства
medieval period	средневековый период
in the realm of	в области, в рамках
to govern	руководить, управлять
to decimate	сильно ударить, сократить
to kick in	вступать в силу, начинаться
to take over	идти на смену, захватывать

Task 3. Read and translate the text:

Permafrost, oxygen, hydrogen — it all looks like science to me. But these terms actually have origins in Russian, Greek and French. Today though, if a scientist is going to coin a new term, it's most likely in English. And if they are going to publish a new discovery, it is most definitely in English. Look no further than the Nobel prize awarded for physiology and medicine to Norwegian couple May-Britt and Edvard Moser (2014). Their research was written and published in English. This was not always so.

“If you look around the world in 1900, and someone told you, ‘Guess what the universal language of science will be in the year 2000?’ You would first of all laugh at them because it was obvious that no one language would be the language of science, but a mixture of French, German and English would be the right answer,” said Michael Gordin. Gordin is a Professor of the History of Science at Princeton and his book, Scientific Babel, explores the history of language and science. Gordin says that English was far from the dominant scientific language in 1900. The dominant language was German. “So the story of the 20th century is not so much the rise of English as the serial collapse of German as the up-and-coming language of scientific communication,” Gordin said.

You may think of Latin as the dominant language of science. And for many, many years it was the universal means of communication in Western Europe — from the late medieval period to the mid-17th century, and then it began to fracture. Latin became one of many languages in which science was done.

The first person to publish extensively in his native language, according to Gordin, was Galileo. Galileo wrote in Italian and was then translated to Latin so that more scientists might read his work.

Fast forward back to the 20th century, how did English come to dominate German in the realm of science? “The first major shock to the system of basically having a third of science published in English, a third in French, and a third in German — although it fluctuated based on field and Latin still held out in some places — was World War I, which had two major impacts,” Gordin said. After World War I, Belgian, French and British scientists organized a boycott of scientists from Germany and Austria. They were blocked from conferences and weren't able to publish in Western European journals. “Increasingly, you have two scientific communities, one German, which functions in the defeated [Central Powers] of Germany and Austria, and another that functions in Western Europe, which is mostly English and French,” Gordin explained.

It’s that moment in history, he added, when international organizations to govern science, like the International Union of Pure and Applied Chemistry, were established. And those newly established organizations begin to function in English and French. German, which was the dominant language of chemistry was written out.

The second effect of World War I took places across the Atlantic in the United States. Starting in 1917 when the US entered the war, there was a wave of anti-German hysteria that swept the country. “At this moment something that’s often hard to keep in mind is that large portions of the US still speak German,” Gordin said. In Ohio, Wisconsin and Minnesota there were many, many German speakers. World War I changed all that. “German is criminalized in 23 states. You’re not allowed to speak it in public, you’re not allowed to use it in the radio, you’re not allowed to teach it to a child under the age 10,” Gordin explained. The Supreme Court overturned those anti-German laws in 1923, but for years that was the law of the land. What that effectively did, according to Gordin, was decimate foreign language learning in the US. “In 1915, Americans were teaching foreign languages and learning foreign languages about the same level as Europeans were," Gordin said. "After these laws go into effect, foreign language education drops massively. Isolationism kicks in in the 1920s, even after the laws are overturned and that means people don’t think they need to pay attention to what happens in French or in German." This results in a generation of future scientists who come of age in the 1920s with limited exposure to foreign languages. That was also the moment, according to Gordin, when the American scientific establishment started to take over dominance in the world.

“And you have a set of people who don’t speak foreign languages,” said Gordin, “They’re comfortable in English, they read English, they can get by in English because the most exciting stuff in their mind is happening in English. So you end up with a very American-centric, and therefore very English-centric community of science after World War II.” You can see evidence of this world history embedded into scientific terms themselves, Gordin said. Take for example the word “oxygen.” The term was born in the 1770s as French chemists are developing a new theory of burning. In their scientific experiments, they needed a new term for a new notion of an element they were constructing. They pick the term ‘oxygen’ from Greek for ‘acid’ and ‘maker’ because they have a theory that oxygen is the substance that makes up acids. They’re wrong about that, but the word acid-maker is what they create and they create it from Greek. That tells you that French scientists and European scientists of that period would have a good classical education,” Gordin said. The English adopted the word “oxygen” wholesale from the French. But the Germans didn't, instead they made up their own version of the word by translating each part of the word into “Sauerstoff” or acid substance.

“So you can see how at a certain moments, certain words get formed and the tendency was for Germans, in particular, to take French and English terms and translate them. Now that’s not true. Now terms like online, transistor, microchip, that stuff is just brought over in English as a whole. So you see different fashions about how people feel about the productive capacity of their own language versus borrowing a term wholesale from another,” Gordin said.

Task 4. Match the words to form collocations/phrases/phrasal verbs used in the text:

1) scientific	a) language
2) universal	b) means
3) native	c) in
4) major	d) place
5) newly established	e) communication
6) to take	f) organisations
7) to take over	g) by
8) to kick	h) dominance
9) to get	i) impacts

Task 5. Discuss the questions in groups:

1) What languages were dominant in science from the late medieval period to 1990?
2) Who was the first person to publish extensively in his native language?
3) How did English become the language of science?
4) When and why did the American scientific establishment start to take over dominance in the world?

Task 6. Make a report about loan words from English in the Russian scientific vocabulary.

Text 2

ENGLISH AS THE UNIVERSAL LANGUAGE OF SCIENCE: OPPORTUNITIES AND CHALLENGES

Task 1. Read the words and find Russian equivalents.

exclusive, extraordinary, communication, universal, journal, minimize, population, manuscript, publication, community, grant

Task 2. Read the words and word combinations, translate and memorize them. Use dictionaries if necessary.

adoption, to gain access, to foster, to alleviate, subtle nuances, to look beyond, to endeavor, syntax, concise, harshly, to bear in mind, to advance progress, to eliminate obstacles, playing field

Task 3. Translate the adjectives:

scientific, single, nonnative, challenging, unclear, revised, lingering, aware, oral, essential, vast

Task 4. Form adverbs from the following adjectives:

Example: direct – directly

universal, true, exclusive, easy, ultimate, final, extensive

Task 5. Read and translate the text.

English is now used almost exclusively as the language of science. The adoption of a de facto universal language of science has had an extraordinary effect on scientific communication: by learning a single language, scientists around the world gain access to the vast scientific literature and can communicate with other scientists anywhere in the world. However, the use of English as the universal scientific language creates distinct challenges for those who are not native speakers of English. Here it is considered how researchers, manuscript reviewers, and journal editors can help minimize these challenges, thereby leveling the playing field and fostering international scientific communication.

It is estimated that less than 15% of the world's population speaks English, with just 5% being native speakers. This extraordinary imbalance emphasizes the importance of recognizing and alleviating the difficulties faced by nonnative speakers of English if we are to have a truly global community of scientists. For scientists whose first language is not English, writing manuscripts and grants, preparing oral presentations, and communicating directly with other scientists in English is much more challenging than it is for native speakers of English. Communicating subtle nuances, which can be done easily in one's native tongue, becomes difficult or impossible. A common complaint of nonnative speakers of English is that manuscript reviewers often focus on criticizing their English, rather than looking beyond the language to evaluate the scientific results and logic of a manuscript. This makes it difficult for their manuscripts to get a fair review and, ultimately, to be accepted for publication.

It is believed that the communications advantage realized by native speakers of English obligates them to acknowledge and to help alleviate the extra challenges faced by their fellow scientists from non-English-speaking countries. Native speakers of English should offer understanding, patience, and assistance when reviewing or editing manuscripts of nonnative speakers of English. At the same time, nonnative speakers of English must endeavor to produce manuscripts that are clearly written. The following guidelines are offered for writing and evaluating manuscripts in the context of the international community of scientists:

1. Nonnative speakers of English can write effective manuscripts, despite errors of grammar, syntax, and usage, if the manuscripts are clear, simple, logical, and concise.

2. When possible, reviewers and editors of manuscripts should look beyond errors in grammar, syntax, and usage, and evaluate the science.

3 It is inappropriate to reject or harshly criticize manuscripts from nonnative speakers of English based on errors of grammar, syntax, or usage alone. If there are language errors, reviewers and editors should provide constructive criticism, pointing out examples of passages that are unclear and suggesting improvements. Reviewers and editors may also suggest that authors seek the assistance of expert English speakers or professional editing services in preparing revised versions of manuscripts.

4. And finally, all involved should bear in mind that most journals employ copyeditors, whose job it is to correct any lingering errors in grammar, syntax, and usage before final publication of an article.

Nonnative speakers of English must be aware that reviewers, editors, and journal staff do not have the time or resources to extensively edit manuscripts for language and that reviewers and editors must be able to understand what is being reported. Thus, it is essential that nonnative speakers of English recognize that their ability to participate in the international scientific enterprise is directly related to their ability to produce manuscripts in English that are clear, simple, logical, and concise.

The fact that English is the de facto global language of science is not likely to change anytime soon. Optimizing communication among members of the international community of scientists, and thus advancing scientific progress, depends on elimination of obstacles faced by nonnative speakers of the English language. This ideal can best be achieved when all members of the scientific community work together.

Task 6. Choose the right word to fill in the gaps.

publication editing tongue employ obstacles constructive

a) journals………..copyeditors
b) ……….criticism
c) native …….
d) elimination of …….
e) be accepted for ………
f) professional …..services

Task 7. Complete the sentences according to the text:

a) A common complaint of nonnative speakers of English is __________
b) Nevertheless, the use of English as the universal scientific language ____________.
c) The guidelines are offered for____________
d) Optimizing communication depends on__________.
e) Copyeditor’s job is to _____________

Task 8. Answer the following questions:

a) What is the main effect of the English language on scientific communication?
b) Who does English create challenges for?
c) Why is it difficult for nonnative speakers to get a fair manuscript review?
d) What do nonnative speakers have to be aware of?
e) What is the main condition for optimizing communication in scientific community?

Task 9. Make 5 more questions of your own and ask them your partners.

Text 3

FROM ANCIENT FOSSILS TO FUTURE CARS

Task 1. Read the words and find Russian equivalents.

energy-efficient, lithium-ion, diatom, portable electronics, graphite, electrolyte, adoption

Task 2. Read the words and memorize them.

inexpensive	недорогой
silicon-based anode	кремниевый анод
fossilized remains	окаменелые останки
algae	морские водоросли
performance	производительность
limiting factor	ограничивающий фактор
carbothermic reduction	карботермическое восстановление
silicon-rich	богатый кремнием
frustule	панцирь

3. Form nouns for the following adjectives:

Example: natural – nature

electrical, mechanical, popular, intensive, porous, pure

Task 4. Read and translate the text.

Researchers at the University of California, Riverside's Bourns College of Engineering have developed an **inexpensive**, energy-efficient way to create **silicon-based anodes** for lithium-ion batteries from the **fossilized remains** of single-celled **algae** called diatoms. The research could lead to the development of ultra-high capacity lithium-ion batteries for electric vehicles and portable electronics.

Titled "Carbon-Coated, Diatomite-Derived Nanosilicon as a High Rate Capable Li-ion Battery Anode," a paper describing the research was published recently in the journal Scientific Reports. The research was led by Mihri Ozkan, professor of electrical engineering, and Cengiz Ozkan, professor of mechanical engineering. Brennan Campbell, a graduate student in materials science and engineering, was first author on the paper.

Lithium-ion batteries, the most popular rechargeable batteries in electric vehicles and personal electronics, have several major components including an anode, a cathode, and an electrolyte made of lithium salt dissolved in an organic solvent. While graphite is the material of choice for most anodes, its **performance** is a **limiting factor** in making better batteries and expanding their applications. Silicon, which can store about 10 times more energy, is being developed as an alternative anode material, but its production through the traditional method, called **carbothermic reduction** is expensive and energy-intensive.

To change that, the UCR team turned to a cheap source of silicon -- diatomaceous earth (DE) -- and a more efficient chemical process. DE is an abundant, **silicon-rich sedimentary rock** that is composed of the fossilized remains of diatoms deposited over millions of years. Using a process called magnesiothermic reduction, the group converted this low-cost source of Silicon Dioxide (SiO_2) to pure silicon nano-particles.

"A significant finding in our research was the preservation of the diatom cell walls -- structures known as frustules -- creating a highly porous anode that allows easy access for the electrolyte," Cengiz Ozkan said.

This research is the latest in a series of projects led by Mihri and Cengiz Ozkan to create lithium-ion battery anodes from environmentally friendly materials. Previous research has focused on developing and testing anodes from portabella mushrooms and beach sand.

"Batteries that power electric vehicles are expensive and need to be charged frequently, which causes anxiety for consumers and negatively impacts the sale of these vehicles. To improve the adoption of electric vehicles, we need much better batteries. We believe diatomaceous earth, which is abundant and inexpensive, could be another sustainable source of silicon for battery anodes," Mihri Ozkan said.

Task 5. Match the words in both columns to form collocations:

1) diatomaceous	a) nanoparticles
2) organic	b) access
3) chemical	c) vehicle
4) easy	d) earth
5) silicon	e) battery
6) rechargeable	f) solvent
7) electric	g) process

Task 6. Make a summary of the text.

Task 7. Make a report about ways of accumulating energy.

Text 4

WHAT IS CLOUD COMPUTING?

Task 1. Read the words and find Russian equivalents.

gigantic, server, synchronized, tablet, metaphor

Task 2. Read the words and memorize them.

hard drive	жесткий диск
flowchart	блок-схема
server-farm infrastructure	серверное хозяйство
network attached storage	сетевое хранилище данных
backup	резервирование
cloud computing service	служба облачных вычислений
blurry	неясный, туманный

desktop computer настольный компьютер

Task 3. Form adverbs from the following adjectives using suffix ly-:

Example: probable – probably

real, easy, individual, natural, essential, horizontal

Task 4. Read and translate the text.

The 'cloud' is a real buzzword, but what is it, how does it impact what you do, and is it anything really new?

What is the cloud? Where is the cloud? Are we in the cloud now? These are all questions you've probably heard or even asked yourself. The term "**cloud computing**" is everywhere.

In the simplest terms, cloud computing means storing and accessing data and programs over the Internet instead of your computer's **hard drive**. The cloud is just a metaphor for the Internet. It goes back to the days of **flowcharts** and presentations that would represent the gigantic **server-farm infrastructure** of the Internet as nothing but a puffy, white cumulonimbus cloud, accepting connections and doling out information as it floats.

What cloud computing is *not* about is your hard drive. When you store data on or run programs from the hard drive, that's called *local* storage and computing. Everything you need is physically close to you, which means accessing your data is fast and easy, for that one computer, or others on the local network.

The cloud is also *not* about having a **dedicated network attached storage** (NAS) hardware or server in residence. Storing data on a home or office network does not count as utilizing the cloud.

For it to be considered "cloud computing," you need to access your data or your programs over the Internet, or at the very least, have that data synchronized with other information over the Web. In a big business, you may know all there is to know about what's on the other side of the connection; as an individual user, you may never have any idea what kind of massive data-processing is happening on the other end. The end result is the same: with an online connection, cloud computing can be done anywhere, anytime.

Consumer vs. Business. Let's be clear here. We're talking about cloud computing as it impacts individual consumers—those of us who sit back at home or in small-to-medium offices and use the Internet on a regular basis.

There is an entirely different "cloud" when it comes to business. Some businesses choose to implement **Software-as-a-Service** (SaaS), where the business subscribes to an application it accesses over the Internet. There's also **Platform-as-a-Service** (PaaS), where a business can create its own custom applications for use by all in the company. And don't forget the mighty **Infrastructure-as-a-Service** (IaaS), where players like Amazon, Microsoft, Google, and Rackspace provide a backbone that can be "rented out" by other companies.

Common Cloud Examples. The lines between local computing and cloud computing sometimes get very, very blurry. That's because the cloud is part of almost everything on our computers these days. You can easily have a local piece of software (for instance, Microsoft Office 365) that utilizes a form of cloud computing for storage (Microsoft OneDrive).

That said, Microsoft also offers a set of Web apps, now called Office Online, that are **online-only versions** of Word, Excel, PowerPoint, and OneNote accessed via your Web browser without installing anything. That makes them a version of cloud computing (Web-based=cloud).

Some other major examples of cloud computing you're probably using:
Google Drive: This is a pure **cloud computing service**, with all the storage found online so it can work with the cloud apps: Google Docs, Google Sheets, and Google Slides. Drive is also available on more than just **desktop computers**; you can use it on tablets like the iPad$349.00 at Amazon or on smartphones, and there are separate apps for Docs and Sheets, as well. In fact, most of Google's services could be considered cloud computing: Gmail, Google Calendar, Google Maps, and so on.

Apple iCloud: Apple's cloud service is primarily used for online storage, **backup**, and synchronization of your mail, contacts, calendar, and more. All the data you need is available to you on your iOS, Mac OS, or Windows device (Windows users have to install the iCloud control panel). Naturally, Apple won't be outdone by rivals: it offers cloud-based versions of its word processor (Pages), spreadsheet (Numbers), and presentations (Keynote) for use by any iCloud subscriber. iCloud is also the place iPhone users go to utilize the Find My iPhone feature that's all important when the phone goes missing.

Amazon Cloud Drive: Storage at the big retailer is mainly for music, preferably MP3s that you purchase from Amazon, and images—if you have Amazon Prime, you get unlimited image storage. The Cloud Drive also holds anything you buy for the Kindle. It's essentially storage for anything digital you'd buy from Amazon, baked into all its products and services.

Task 5. Find synonyms to the following words:

a) to consider	
b) to purchase	
c) storage	
d) available	
e) to install	
f) primarily	

Task 6. Give answers to the following questions:

a) What is cloud computing?
b) What are examples of common cloud?
c) What Webapps does Microsoft offer?
d) What is local storage?
e) What are the most popular cloud drives?
f) What does SaaS stand for?

Task 7. What do the following abbreviations mean?

SaaS, IaaS, PaaS, NAS

Task 8.

Make a report on cloud technologies.

Text 5

SCIENTISTS FIND WAY TO MAKE MINERAL WHICH REMOVES CO2 FROM ATMOSPHERE

Task 1. Read the words and find Russian equivalents.

carbon dioxide, magnesite, tactics, province, microsphere

Task 2. Form all possible words from the following ones:

Example: nature-natural-naturally

energy easy chemical electric improve efficient climate

Task 3. Read and translate the text.

Scientists have suggested trapping carbon dioxide in rocks as one way to slow the rate of climate change. But they hadn't come up with an easy way to do it. All their proposed tactics appeared to be difficult, costly or require too much energy. Until now, anyway. Researchers in Canada have just proposed a new technology to collect and trap the greenhouse gas.

Limestone and other minerals already store a lot of carbon dioxide (CO_2) on Earth, notes Ian Power. He's a geoscientist at Trent University in Peterborough, Canada. The problem: This natural process is slow. It can take thousands or even millions of years. At present, he explains, "We're emitting so much CO_2 now that Earth can't keep up."

But Power's team has just reported a way to quickly do what nature does slowly. A mineral called magnesite (MAG-nuh-syte) locks up CO_2. A metric ton of this mineral (also known as magnesium carbonate) can store about half a metric ton of CO_2. The chemical normally takes thousands of years to form. But in their lab, Power's group made it happen in just a few months.

How the lab cooked up this CO_2 'sponge' so quickly
Ions are electrically charged atoms or molecules. Power's group combined positively charged magnesium *ions* and negatively charged carbonate ions. (Carbonate ions form when carbon dioxide mixes with water.)

Magnesite occurs naturally. But the process by which it forms on Earth's surface is very, very slow. Power and his team investigated how Mother Nature makes magnesite. And to do that, they went to one place where they knew this mineral forms near Earth's surface. It was a northern site in Canada's western province of British Columbia. At dry basins there known as playas (PLY-uhs), groundwater flows through rocks. Along the way, it picks up magnesium and carbonate ions. Over time, those ions react to make magnesite. The mineral slowly settles out of the water, creating rock.

"We knew it was slow," Power says of the natural process. "But no one had ever measured the rate." In British Columbia, the process began as far back as 11,000 years ago, he notes.

Scientists can combine rocks and CO_2 using lots of heat in the lab. That could make the mineral quickly — but only by using a lot of costly energy, Power says. And that's because water gets in the way. When magnesium ions are in water, the water molecules form a "shell" around the ions. This keeps the magnesium from bonding to carbonate ions. "It's difficult to strip away those water molecules," Power says. But unless you do, he adds, the magnesite will take a very long time to form.

To get around the problem, the researchers stripped water from the magnesium. To do this, they added thousands of little plastic balls, or microspheres. Each was about 20 micrometers (8 ten-thousandths of an inch) in diameter. Made out of polystyrene (Paal-ee-STY-reen), the tiny balls were coated with molecules that attract the water. As they tied up the water, the leftover magnesium ions now were free to bond with the carbonate.

Using the microballs, the researchers produced magnesite in 72 days, Power says. And the good news: The same microspheres could also be reused over and over, he says.

Still a long way to go

So far, the scientists have made only a tiny amount of magnesite in the lab. Their total — one microgram — is about one millionth the weight of a paper clip. So the process needs a lot of improvement before it can begin trapping the millions of tons of CO_2produced each year, Powers says.

But a big concern has been hurdled, he says. They've shown it is possible to do this at room temperature and pressure. Now the team can explore how to make the process more efficient.

Task 4. Match the words in both columns to form collocations:

1) ground	a) gas
2) electrically	b) balls
3) plastic	c) ions
4) greenhouse	d) Nature
5) carbonate	e) charged
6) Mother	f) water

Task 5. Decide if the following statements are true or false.

a) The technology of trapping greenhouse gas cannot be developed.
b) Ian Power is a biologist in South Korean University.
c) Magnesite takes thousands of years to form.
d) Ions are electrically charged molecules.
e) Plastic balls are used for filling rock basins.
f) Magnesite can be produced in 5 days.

Text 6

GEOLOGY IS GOING DIGITAL

Task 1. Read the words and find Russian equivalents.

planet, result, revolution, role, guru, geology, factor, cartographer, ocean, geothermal, analysis, seismography, interior, career

Task 2. Read the words and memorize them.

to derive	происходить
empowered	правомочный, возможный
have at fingertips	располагать, иметь под рукой
hence	таким образом, следовательно
technological advances	научно-технический прогресс
submersible	подводный аппарат
to harness	освоить
Bureau of Labor Statistics	Статистическое управление (США)
median annual wage	средняя ежегодная зарплата
contamination	загрязнение
strides in technology	развитие технологии
moldy	устарелый

Task 3. Read and translate the text.

Our food, water and energy is derived from the planet we walk on. And thanks to technology, we're learning how to derive this energy more sustainably and efficiently. And one of the most unexpected results of the digital revolution is the redefined and empowered role of the geologist as sustainability guru.

The transformation of Earth science and geology is an answer to the world's growing needs. For example, the age-old cartographer's tool, the paper map, has always been a limiting factor in geologists' studies. The paper map has never been able to accurately display the data geologists collected. Further, it wasn't that long ago that ocean floors were too far away to be explored, let alone mapped. Now new technologies geologists have at their fingertips have increased their ability to perform an exact science.

3-D Mapping
Geologists have technologies for 3-D modeling at their disposal. Two- dimensional mapping has often limited geology from being an exact science. Inferences had to be made with limiting

technology. However, recent developments in 3-D modeling have improved mapping of natural resources, hence improving our ability to understand and assess the resources of the earth.

Groundwater modeling, carbon storage capacity, and conventional and geothermal energy surveys are benefiting from 3-D mapping capabilities as well. The natural progression to 3-D mapping was made possible by information science– the processing and analysis of data.

Seismography

Seismographic monitoring helps detect and measure earthquakes, and monitor the building and testing of nuclear weapons. Technological advances in digital seismography allows a much greater range of motion over a wide range of frequencies to be detected. Modern global seismology has also furthered the study of the Earth's interior, replacing old ideas about our planet's interior.

Marine Geology

Marine geology has benefited significantly from technological advances. The undersea world is just as diverse and interesting as our above-water world. Piloted submersibles, remotely operated vehicles (ROVs) and programmable acoustic instruments attached to ships make exploration of the undersea world possible. New technologies in 3-D modeling allows for creation of maps and models of the seafloor. Advances in marine geology can help provide for basic needs as our society grows.

Career Exploration

Job prospects for geologists are growing alongside these developments in environmental science. As our world is constantly looking for new ways to harness or generate power, geologists are growing more invaluable.

According to the Bureau of Labor Statistics, a geoscientist with a bachelor's level degree earns a median annual wage of $82,500. Geoscientists study physical aspects of the Earth. Most geoscientists spend time in the field, the office, and the lab. Field work can involve extensive travel to remote areas and irregular working hours. Job growth for geoscientists is projected to rise twice as fast as all other occupations. The DOL offers a thorough breakdown of employment and wages.

Geological engineers design mines so that minerals can be safely removed. They can expect to make the same amount of money as geoscientists, but job growth is average. Hydrogeologists study how water moves through the soil and rock of the earth. Hydrogeologists ensure clean groundwater supplies. Job duties might include investigating ways to test water to guarantee safety, or overseeing cleanup of spills and contamination. Architectural engineers work in activities ranging from food farming to processing, to developing biofuels to improving conservation. Architectural engineers may spend time in the office or on job sites. With a bachelor's degree, a median annual salary is just under $72,000. Job growth is expected to be a little slower than average in the next 8 years, but for environmental areas, growth should be larger than average.

SeaGrant offers information about geological oceanographers, a valuable career that's seen great strides in technology, improving our ability to derive food, potable water, energy resources, waste disposal, and transportation from the ocean. Marine geologists in academics with advanced degrees (taking between 6 and 8 years) can expect to make around $55,000 starting salary, around $80,000 working for the government, and upwards of $90,000 with as an associate professor with a Ph.D. Profiles of marine geologists dive into more detail about job responsibilities and career outlook.

Natural resource managers oversee and implement conservation and sustainability plans that relate to our Earth, often times related to human activities that help or harm her. Conservation scientists and environmental scientists with at least bachelor's degrees can expect a median pay near $60,000 with work in an office, lab or the field.

Geology may seem like a slow moving science to the millions of students who are stuck studying the same Cold War-era earth science textbooks their parents used. But don't let those moldy textbooks fool you. In reality, geology is developing as quickly as technology. And with society's constant demands for food, clean water, and energy, the pace will only quicken.

Task 4. Match the words in both columns to form collocations:

1) ocean	a) capacity
2) waste	b) area
3) paper	c) geologist
4) remote	d) water
5) groundwater	e) map
6) marine	f) floor
7) storage	g) disposal
8) potable	h) supplies

Task 5. Choose the right word to fill in the gaps. Put it in the correct form.

efficient to transform constant to operate technology

a) The ________________of Earth's science is an answer to the world's growing needs.
b) ________________advances are applied in marine geology.
c) Our world is ______________looking for ways to generate power.
d) We need to learn how to derive this energy_____________.
e) Remotely _________vehicle make exploration in undersea world.

Task 6. Give answers to the following questions:

a) Which technologies do geologists have at their disposal?
b) What career possibilities and profits do geologists have nowadays?
c) What are responsibilities of different types of geologists?

Task 7. Make 5 more questions of your own and ask them to your partner.

Task 8. Make a report on application of modern technologies in geology.

Text 7

POTENTIAL APPLICATIONS OF UNDERGROUND CONSTRUCTION TECHNOLOGIES

Task 1. Read the words and find Russian equivalents.

concept, tunnel, plus, transit, serious, system, urban, type, canal, project, bulldozer, continent, atmospheric

Task 2. Read the words and memorize them.

improved mole	усовершенствованная горнопроходческая машина
concrete lining	бетонная облицовка
conveyance	транспортировка, перемещение
conceivably	гипотетически, в теории
exhaust air	отводимый воздух
vehicular	транспортный
interbasin water transfer	межбассейновое перераспределение воды
shallow	мелкий
immerced-tube method	метод опускных секций (для подводного тоннеля)
subaqueous	подводный, донный
chamber	камера, отсек
fissured rock	трещиноватая порода
cement grout	жидкий цементный раствор
favoured	предпочитаемый
Atomic Energy Commission	Комиссия по атомной энергии (США)

Task 3. Translate the adjectives. What verbs are they formed from?

Example: equipped – to equip

expected, improved, collected, needed, united, monitored, manned, immersed, involved, pioneered, reduced, prevented, developed, cooled

Task 4. Read and translate the text.

Future applications are expected to range from expansion of existing uses to the introduction of entirely new concepts. The largest increase is likely to be in rock tunneling: partly from the nature of the projects and partly from the expectation that improved moles will make rock tunneling more attractive than soil tunnels, with their usual requirement for continuous temporary support plus a permanent concrete lining.

Deep rock tunnels for rapid transit between cities are beginning to receive very serious consideration. These might include a 425-mile system to cover the nearly continuous urban area between Boston and Washington, D.C., probably with an entirely new type of conveyance at speeds of several hundred miles per hour. Urban highway tunnels conceivably may offer a convenient opportunity to reduce pollution by treating the exhaust air that has already been collected by the ventilating system essential for longer vehicular tunnels.

There is increasing recognition that many more interbasin water transfers will be needed, involving systems of tunnels and canals. Notable projects include the California Aqueduct, which transfers water from the northern mountains some 450 miles to the semiarid Los Angeles area; the Orange-Fish Project in South Africa, which includes a 50-mile tunnel; and studies for possible transfer of surplus Canadian water into the southwestern United States.

Shallower tunnels for subways are bound to increase beyond those expansions undertaken in recent years in many cities, including San Francisco, Washington, D.C., Boston, Chicago, New York, London, Paris, Budapest, Munich, and Mexico City. Multiple use is likely to receive further consideration as communication agencies begin to show interest in adding space within the structures for the several types of utilities.

The Japanese are experimenting with an underwater bulldozer, robot-manned and television-monitored. One innovative proposal for supplying additional water to southern California visualizes the immersed-tube method to construct a large pipeline for some 500 miles under the shallower ocean along the continental shelf. Subaqueous tunneling also is likely to be involved as procedures are developed for utilizing the vast continental-shelf areas of the world; concepts are already being studied for tunnels to service oil wells and for extensive undersea mining such as has been pioneered in Britain and eastern Canada.

Both Norway and Sweden have reduced the direct costs of fluid storage by storing petroleum products in underground chambers, thus eliminating the maintenance cost for frequent repainting of steel tanks in a surface facility. Locating these chambers below the permanent water table (and below any existing wells) ensures that seepage will be toward the chambers rather than outward; thus, the oil is prevented from leaking out of the chamber, and the lining may be omitted.

There are a number of underground installations for the storage of highly compressed gas cooled to a liquid state; these may increase once improved types of lining have been developed. Although the method involves only limited tunneling for access, the United States Atomic Energy Commission has developed an ingenious method for disposal of nuclear waste by injecting it into fissured rock within a cement grout so that hardening of the grout reconverts the nuclear minerals into a stable rocklike state.

The use of rock chambers for underground hydroplants seems certain to increase in most countries, particularly those in which until recently surface plants have been favoured because of their apparently lower cost. Scotland has been one of the first countries to recognize that extra construction cost can often be warranted to preserve the scenic environment, also recognized by choice of an underground location for recent U.S. pump-storage plants.

Sweden's use of the underground for plants treating sewage and water, for warehouses, and for light manufacturing is likely to find further application. The relatively small annual temperature range in the underground has made it a desirable environment for facilities requiring close atmospheric control.

Task 5. Match the words in both columns to form collocations.

1) nuclear	a) state
2) water	b) area
3) ventilating	c) use
4) oil	d) tunnel
5) multiple	e) shelf
6) soil	f) plant
7) urban	j) agencies
8) storage	h) well
9) liquid	i) waste
10) communication	j) table
11) continental	k) system

Task 6. Answer the following questions:

a) What is suggested in underground construction to reduce pollution?
b) How can compressed gas be stored?
c) What is applied in Norway and Sweden?
d) What concept is proposed for subaqueous tunneling?
e) What experiments are carried out in Japan?

Task 7. Make 5 more questions of your own and ask your partners to answer them.

Task 8. Discuss the following topic:

Innovations in underground construction.

Text 8

REMOTE CONTROL MINING

Task 1. Read the words and find the Russian equivalents.

official, automation, client, prototype, course, innovation, product, industry, climate, comfort, operator, barrier, battery, cabin, machine, personnel, magnet, crane, dichotomy, electricity

Task 2. Read the words and memorize them.

remote control mining	дистанционное ведение горных работ
mine site	место разработки, шахта, карьер
to originate	происходить, брать начало, появляться
training facility	учебное оборудование, тренировочный комплекс
customizable	приспосабливаемый, настраиваемый
to impart	передавать, делиться
sustainable	устойчивый, долгосрочный
to implement	внедрять
teleremote system	система телеуправления
boost	прирост, подъем
delivery truck	грузовик для доставки
to kit out	оборудовать, снаряжать, оснащать
coat of pain	окраска
stoping area	участок очистных работ
loader	погрузчик, навальщик
custom-built	выполненный на заказ
fatigue	утомление, усталость
amenities	блага, бытовые условия
control room ops	диспетчерское управление

Task 3. Translate the following groups of adjectives and participles. What verbs are they formed from?

a) riding, working, hitting, stunning,
b) upgraded, estimated, installed, transmitted, detected, crammed, benefiting, rigged, based

Task 4. Read and translate the text.

Canada is almost like the unofficial home base of remote control mining. While their mine sites are set up all over the world—from Africa, to China, to Papua New Guinea—many of the companies most skillfully riding the automation wave originated in Canada. The northern nation is also home to an underground training facility where mining clients can familiarise themselves with the latest machinery and where developers test out prototype models.

<u>The NORCAT underground training facility</u> has a unique offering of customisable training courses and its own innovation and product development department. It is both private and non-profit with a focus on imparting the knowledge and experience necessary to keep the global mining industry safe, productive and as sustainable as possible for the future.

A Canadian mining company in China (using Aussie technology)

China's first ever remote control mining system was implemented by Canadian company, Eldorado Gold. The teleremote system they used comes from Aussie company, RCT and has reportedly resulted in a significant boost to productivity and safety at the Eldorado's White Mountain mine site.

Rather than the old Line of Site (LOS) system, operators now conduct teleremoting from a delivery truck specially upgraded for the task. The truck has been kitted out with high tech video equipment, red lighting for eye protection, climate control for comfort, and a fresh coat of blue paint just because.

The truck goes to all the underground stoping areas but the human operators are now able to control the loader from within the safety of the laser barrier system. The loader is designed to have minimal setup time and the truck has a battery pack capable of giving it up to five days continuous charge. The loader also has semi-autonomous capabilities, able to steer itself with a LiDAR system and cruise at a max of 10km per hour.

RCT reported White Mountain's General Manager, Warren Uyen as saying:
"The perceived benefits in productivity were estimated between 25-30%, meaning the system would pay for itself in less than six months. However, actual data shows productivity gains of more than 35%."

With operators now working in the safety of their custom-built cabin, a good 500 metres from the stope area, safety gets an instant, undeniable boost. The vehicles ability to self-navigate and drive provides an extra layer of protection for both human and machine.

"The added and most important benefit was the removal and control of personnel from the work area. It reduces operator fatigue and virtually eliminates impact damage to the machine hitting the walls. Meanwhile machine data is transmitted back to the remote control station, so if any critical faults are detected, an alarm sounds and a message appears on the operator's screen, just as if they were in the cabin."

Remote control mining: Africa

While China may be the most mineral-rich region on Earth, Africa has enough of a share to make it a magnet for the world's mining companies. Billions of dollars flow in and out of the continent every year in the form of mining investments and gains. Yet, many of the people who call the mineral-rich land home live without the power and basic amenities we take for granted. According to David Forth, an Aussie crane operator who's spent the last couple of years working in a copper mine in Zambia,

"You see people living rough. Generations of family in mud huts within 15 meters of each other and all of them crammed in with each other at night time. Then just up the road, there's a big mine. Money, big companies benefitting, but the people not getting anything."

This strange dichotomy is made even stranger by the level of technology that's being installed in the mines. While the African workers are bringing portable battery chargers to work so they can power small devices at home where they have no connected electricity, in the very same facilities some of the most stunning autonomous and remote control machines are in use.

Companies like Mine Technology Services (MTS) are bringing in and distributing teleremote systems like the one rigged up in China, as well as radio remote and multi-machine automated setups. These can handle LOS work, control room ops, and proximity detection.

MTS operates in Africa but is based in the UK. However, the products they supply come from mining giant, Nautilus; who also happen to be Canadian. Seems like Canada is taking over the world's mines. At least on the automation front.

Task 5. Match the words in both columns to form collocations.

1) video	a) mine
2) eye	b) charge
3) prototype	c) development
4) portable	d) land
5) product	e) model
6) basic	f) operator
7) mineral-rich	g) protection
8) copper	h) equipment
9) battery	i) battery
10) crane	j) amenities

Task 6. Choose and underline the correct preposition.

a) ……with the focus *(at, on, in, from)* the knowledge and experience
b) Canada is home ….*(up, to, in , from)* underground training facility .
c) ……significant boost *(in, up, to, for)* productivity and safety.
d) Clients familiarize themselves …..*(for, about, to, with)* machinery.
e) We take basic amenities …..*(on, with, for, to)* granted.
f) Remote control machines are…..(*on, from, in, with*) use.
g) Canada is taking …..(*on, above, from, over*) the worlds mines.

Task 7. Discuss advantages of remote control mining technologies. Make a report on other examples of this technique.

Text 9

AUSTRALIA'S NEWEST MINE WORKERS

Task 1. Take a look at the truck in the picture below and think about the following questions:

- How big do you think this truck is?
- What kind of work is it used for? What can it do?
- How many people does it take to drive it?

Image from an original BBC Click programme. Click is a BBC television programme covering news and recent developments in the world of consumer technology.

Task 2. Compare your answers for Task 1 with this information:

- This truck is an amazing 7 metres tall, making it one of the biggest trucks in the world.
- It is used in Australia for **mining** – it can drill holes, **extract** copper and iron, and carry heavy loads.
- Zero! This is a **mechatronic** truck and it works automatically.

Task 3. Read and translate the text.

Think of Australia and you probably think of modern cities like Sydney and Melbourne, sunny weather, and the beach!

But Australia is one of the world's largest countries - and the world's biggest island. It has a huge **interior** with thousands of miles of beautiful, **uninhabited** space.

This huge space is also part of a problem for Australia. These vast areas are full of **rich pickings** – mainly minerals and metals – but there are few people who want to go and get them.

Mining companies used to rely on a few brave and adventurous workers who would come and live a thousand kilometres from the nearest town. However, now the Four Hope Iron Ore Mine in North-western Australia (which actually is 1,000km from the nearest town!) uses giant robots to do the jobs that people don't want to do.

Mine workers used to drill holes and operate machinery to crush rocks. They also used to drive the trucks and the trains that transported the iron ore to the coast. Now, automated machines do all the dirty and dangerous work.

The robot trucks are not only useful for the difficult jobs though. They are also very **efficient**. When the trucks had human drivers, they used to use a lot more fuel and chemicals to extract minerals. Miners also used to dig more holes but the automated trucks are much more **precise**.

The mining companies used to pay much more in energy bills – saving energy is very important when crushing rocks uses 5% of the world's energy! This extra efficiency means the companies can make millions of dollars in extra profit.

These machines do not mean there are no human mine workers. People still work in the mining industry, but they are doing different jobs.

Miners and engineers used to fly to the mines and work away from their families for weeks at a time but now they can work from home as **remote** operators. Employees at the mining companies used to be trained in **manual labour** but now they are trained in remote control and computer operation.

As well as remote operators, experts in mechatronics also work for the mining companies. Mechanics and maintenance staff also work at the mine to look after the equipment. However, there are only a few of them. There used to be hundreds of people working there.

Australia's robots, then, may provide an **insight** into life and work in the future. No matter where the work is, we can live anywhere - near the mines or on the coast - and let the machines do the heavy work.

Task 4. Translate the words in bold from the text. Make up your own sentences with these words.

БИБЛИОГРАФИЧЕСКИЙ СПИСОК

Электронные ресурсы:

https://www.onlinecollege.org/geology-going-digital/, свободный._Загл. с экрана.-Яз. англ.

http://www.bbc.co.uk/learningenglish/english/course/lower-intermediate/unit-17/session-3, свободный._Загл. с экрана.-Яз. англ.

https://www.machines4u.com.au/mag/around-world-remote-control-mining/, свободный._Загл. с экрана.-Яз. англ.

http://www.engineersjournal.ie/2016/06/14/future-trends-in-engineering-global-urbanisation-the-fourth-industrial-revolution/, свободный._Загл. с экрана.-Яз. англ.

https://science.howstuffworks.com/environmental/energy/5-innovations-oil-drilling.htm, свободный._Загл. с экрана.-Яз. англ.

https://www.mining-technology.com/features/mining-the-uk/, свободный._Загл. с экрана.-Яз. англ.

https://www.ielts-mentor.com/reading-sample/academic-reading/723-ielts-academic-reading-sample-73-the-birth-of-scientific-english, свободный._Загл. с экрана.-Яз. англ.

https://science.howstuffworks.com/engineering/structural/10-futuristic-construction-technologies.htm, свободный._Загл. с экрана.-Яз. англ.

https://www.britannica.com/technology/tunnel/Future-trends-in-underground-construction, свободный._Загл. с экрана.-Яз. англ.
https://www.pri.org/stories/2014-10-06/how-did-english-become-language-science, свободный._Загл. с экрана.-Яз. англ.
http://www.mining.com/web/benefits-pitfalls-mining-automation/, свободный._Загл. с экрана.-Яз. англ.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3341706, свободный._Загл. с экрана.-Яз. англ.

https://ucrtoday.ucr.edu/41025, свободный._Загл. с экрана.-Яз. англ.

https://www.pcmag.com/article2/0,2817,2372163,00.asp#, свободный._Загл. с экрана.-Яз. англ.

https://www.sciencenewsforstudents.org/article/scientists-find-easier-way-trap-carbon-dioxide-rock, свободный._Загл. с экрана.-Яз. англ.

https://www.mining-technology.com/mining-safety/future-of-mining-industry-predictions, свободный._Загл. с экрана.-Яз. англ.

СОДЕРЖАНИЕ