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СИБИРСКОГО
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УНИВЕРСИТЕТА

ПРОФЕССИОНАЛЬНЫЙ АНГЛИЙСКИЙ ЯЗЫК ДЛЯ СПЕЦИАЛИСТОВ ГОРНОГО ДЕЛА, ГЕОЛОГИИ И ГЕОЛОГОРАЗВЕДКИ

Министерство науки и высшего образования Российской Федерации
Сибирский федеральный университет

ПРОФЕССИОНАЛЬНЫЙ АНГЛИЙСКИЙ ЯЗЫК ДЛЯ СПЕЦИАЛИСТОВ ГОРНОГО ДЕЛА, ГЕОЛОГИИ И ГЕОЛОГОРАЗВЕДКИ

Допущено учебно-методическим советом Сибирского федерального университета в качестве учебника для студентов, обучающихся по специальностям 21.05.02 «Прикладная геология», 21.05.04 «Горное дело», 21.05.03 «Технология геологической разведки», протокол № 1 от 24 января 2022 года

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ВВЕДЕНИЕ

Настоящий учебник является основным учебным материалом, предназначенным для аудиторной и самостоятельной работы учащихся вторых курсов (очного и заочного отделений) Института горного дела, геологии и геотехнологий и Института нефти и газа Сибирского федерального университета, направлений специалитета: 21.05.02 «Прикладная геология», 21.05.04 «Горное дело» и 21.05.03 «Технология геологической разведки», специализаций 21.05.03.01 «Геофизические методы поисков и разведки месторождений полезных ископаемых» и 21.05.03.03 «Технология и техника разведки месторождений полезных ископаемых».

По учебным целям и содержанию учебник соответствует требованиям Федерального государственного образовательного стандарта высшего образования и рабочей программе дисциплины «Иностранный язык» в части «Модуль 3. Профессиональная сфера коммуникации» (4-й семестр).

Учебник направлен на формирование у выпускников программ специалитета универсальной компетенции (УК-4), а именно способности применять современные коммуникативные технологии, в том числе и на иностранном языке, для академического и профессионального взаимодействия.

В основу учебника положены принципы обучения, направленные на развитие интегративных умений использования диалогического общения для сотрудничества в академической коммуникации: слушать и пытаться понять суть идей других, даже если они противоречат собственным воззрениям; уважать высказывания других как в плане содержания, так и в плане формы; критиковать аргументировано и конструктивно, не задевая чувств других; адаптировать речь и язык жестов к ситуациям взаимодействия.

Цель учебника – расширение и закрепление навыков и умений ознакомительного, поискового и аналитического чтения, а также обучение студентов основам перевода литературы по тематике, близкой к их будущей специальности для извлечения и обработки информации из оригинальных источников. Подобранный тестовый материал служит основой для развития иноязычной профессиональной коммуникативной компетенции, позволяет конструировать высказывания монологического и диалогического характера по актуальным вопросам общетехнической и специальной направленности.

Учебник состоит из четырех разделов (Units): Introduction to Geology, the Earth's Crust and Useful Minerals, Sources of Energy, Prospecting and Exploration. Каждый из разделов включает по 3–4 темы, содержательное наполнение которых соответствует центральной тематике раздела и вводится планом изучения темы (Learning Objectives).

Материал учебника подобран из современной зарубежной научно-технической и научно-популярной литературы, а также аутентичных видео- и аудиозапи-

сей и снабжен гиперссылками для возможности более детального знакомства студентов с интересующими их темами.

Представленные в учебнике ссылки на видео- и аудиоресурсы по темам разделов и разработанные к ним задания помогают развитию у студентов умений применять современные коммуникативные технологии для будущего взаимодействия в профессиональной сфере; способности самостоятельно находить, оценивать и использовать необходимую информацию из различных источников, представлять ее в корректной письменной и устной форме.

Каждый основной раздел темы открывается словарем терминов с транскрипцией и переводом, за которыми следует основной учебный текст. В целях формирования иноязычной компетенции система послетекстовых заданий для каждой темы включает в себя комплекс упражнений, предусматривающих овладение всеми видами коммуникативной деятельности – чтением, говорением, аудированием, письмом, переводом, освоением профессионального словаря. Авторы также включили в темы блок упражнений, направленных на тренировку и закрепление наиболее типичных для профессиональной и академической сферы грамматических и лексических конструкций, а также словообразовательных паттернов, способствующих развитию коммуникативной компетенции и активизации речевых навыков. Все темы снабжены необходимым теоретическим минимумом, опорными фразами, примерами употребления грамматических структур и лексических конструкций с использованием новой общетехнической и общенаучной лексики, а также ее переводом на русский язык.

Кроме того, темы разделов содержат иллюстративный материал и творческие задания коммуникативного характера: участие в беседе на профессиональную тематику, дискуссии, мини-конференции, интервью.

Учебник содержит приложения по грамматическому материалу (Grammar Bank) со схемами, таблицами, примерами и объяснениями грамматических правил, глоссарий с эквивалентным русским переводом лексических единиц для каждого юнита (Glossary), планы разговорных тем (Speaking Topics), предусмотренных для итоговой аттестации по разделу, рекомендации и практикум для самостоятельной работы по внеаудиторному чтению профессиональной направленности (Home Reading Recommendations), рекомендации и практикум по презентациям (Tips for Effective Presentations).

Учебник может быть использован преподавателями и студентами технических вузов горно-геологических и геофизических направлений подготовки.

UNIT 1

INTRODUCTION TO GEOLOGY (CAREER, SKILLS, GENERAL RESPONSIBILITIES)

UNIT 1A. MINING

Learning objectives

In this unit you will:

- ▶ acquire the vocabulary connected to mining operations and methodology;
- ▶ listen about the most popular mining jobs;
- ▶ study and practice patterns IN ORDER TO and SO THAT to explain purpose;
- ▶ learn how to talk about skills and responsibilities of a miner;
- ▶ review basic grammar tenses.

Reading

Before you read:

Exercise 1. Practice to pronounce of the following words and word combinations correctly:

Extract	[ɪk'strækt]	Извлекать
Mine	[maɪn]	Добывать
Designate	['deɪzɪneɪt]	Обозначать
Occur	[ə'kɜːr]	Возникать, появляться

Surface	['sɜːfɪs]	Поверхность
Inorganic substance	[,ɪnɔː'gæɪnɪk] ['sʌbstəns]	Неорганическое вещество

Organic substance	[ˌɪnəːˈɡænik] [ˈsʌbstəns]	Органическое вещество
Chemical composition	[ˈkemɪkəl] [kəmˈpəʊzɪʃən]	Химический состав
Distinctive property	[dɪˈstɪŋktɪv] [ˈprɒpəti]	Отличительное свойство
Molecular structure	[məˈleɪkjə.lər] [ˈstrʌktʃər]	Молекулярная структура
Exploration	[ˌekspləˈreɪʃn]	Разведка

Deposit	[dɪˈpɒz.ɪt]	Месторождение
Coal	[kəʊl]	Уголь
Ore	[ɔːr]	Руда
Metalliferous minerals	[ˌmetəˈlɪfərəs] [ˈmɪnərəl]	Рудоносные минералы
Gangue	[ɡaŋ]	Жильная, пустая порода
Aggregated rock	[ˈægrɪgeɪtɪd] [rɒk]	Раздробленная порода
Associated rock	[əˈsəʊʃɪeɪtɪd] [rɒk]	Сопутствующая порода

Exercise 2. Read the text.

Mining is the process of extracting useful minerals from the surface of the Earth, including the seas and oceans. A mineral, with a few exceptions, is an inorganic substance occurring in nature that has a definite chemical composition and distinctive physical properties or molecular structure. One organic substance, coal, is often discussed as a mineral as well. Ore is a metalliferous mineral, or an aggregate of metalliferous minerals and gangue (associated rock of no economic value), that can be mined at a profit. Mineral deposit designates a natural occurrence of a useful mineral, while ore deposit denotes a mineral deposit of sufficient extent and concentration to invite exploitation.

(abridged from: <https://www.britannica.com/technology/mining/Prospecting-and-exploration>)

Exercise 3. Decide if the following statements are true or false. Correct the false ones.

1. Mining also includes extraction of minerals at a seafloor.
2. A deposit is a place where minerals are extracted.
3. Coal is inorganic substance.
4. Ore is gangue or associated rock of no economic value.
5. According to the text there are three types of minerals: metalliferous minerals, an aggregate of metalliferous minerals and gangue.
6. Exploration could be only invited when a deposit is denoted as an ore deposit.

Vocabulary

Exercise 4. Match the words and their definitions.

1. The process or industry of extracting coal or other minerals from a mine.
2. A naturally occurring solid material from which a metal or valuable mineral can be extracted profitably.
3. (of chemical substances) being or coming from living plants and animals.
4. A combustible black or dark brown rock consisting of carbonized plant matter, found mainly in underground seams and used as fuel.
5. A layer that has formed under the ground, especially over a long period.
6. To take something out.
7. (of chemical substances) containing no carbon or only small amounts of carbon.

- a) Inorganic substance
- b) Ore
- c) Coal
- d) Organic substance
- e) Deposit
- f) To extract
- g) Mining

NB!:

combustible – горючий

consist of – состоять из

underground seams – подземные пласты

fuel – топливо

(abridged from: <https://www.lexico.com/en/definition/>)

Speaking

Exercise 5. Read a short extract taken from the website page of Siberian Federal University and answer the following questions:

1. What School do you study at?
2. What is your field of study?
3. What is your major?
4. What types of workers does your School prepare?
5. What are the companies you'll be able to work at after graduating from the university?
6. What are the usual activities for people in mining industry?

“Main fields of study and majors of our School are connected to applied geology, mining engineering and technology of geological exploration. School of Mining, Geology and Geotechnology prepares engineers and research and teaching staff for

companies working in geological exploration or mining and smelting which deal with a wide range of activities from survey and exploration to mining and processing of mineral resources”.

(abridged from: <http://www.sfu-kras.ru/en/about/igd>)

Listening

Exercise 6. Watch the video about mining career opportunities at Unskilled & Entry Level Mining Jobs and answer the about career opportunities in mining industry in Australia.

1. What are the entry level mining jobs?
2. What kinds of courses in mining are needed to start a career?
3. What is the best way to get the job if you are an unexperienced applicant?
4. What qualities do you need to develop in order to start working in mining industry and why?
5. What kinds of tests do you need to pass before getting a job?
6. What does the word “ticket” mean in mining slang? What do you need a “ticket” for?
7. What is the most popular job for women in mining industry? Why?
8. Why having a look at www.miningresumes.com is the good decision to write the best resume?

(abridged from: https://www.youtube.com/watch?v=tY9MZhaS_RY&t=195s)

Grammar

Revision “to be” forms

Глагол “to be” может переводиться глаголами «быть», «являться», «находиться», «существовать».

See Appendix A: Grammar (The verb “to be”), табл. 1.1.

Study the following examples:

1. Geological exploration **is** one of the fields of study at School of Mining, Geology and Geotechnology. Геологоразведка – одно из направлений обучения в Школе горного дела, геологии и геотехнологии.
2. He **will be** a geologist soon. Он скоро станет геологом.
3. According to the survey, mining engineering and geology **were** the most popular fields of study in 2014. Согласно исследованию, в 2014 году наиболее популярными направлениями исследований были горное дело и геология.

Exercise 7. Put “to be” forms into the gaps, the ask questions to the words in bold.

1. The mining courses (...) only about **4 weeks long**, but they (...) fairly expensive.
2. If **you** (...) inexperienced and unqualified you need to be fit and ready for physical labor.

3. The work (...) be **very repetitive and routine** based with long 12 hour days.
4. A lot of the **work** (...) **unskilled** and doesn't last very long, so it (...) great for backpackers who want to keep on travelling.
5. There (...) **lots of different types of tickets** depending on what type of work you're going to do.
6. For example, **a popular job for women on mining sites** (...) driving a dump truck because research has shown that women (...) easier on the multi-million dollar equipment.

Reading

Before you read

Exercise 8. Do the matching task and translate the following collocations.

- | | |
|-------------|---|
| 1. Complete | a) safety standards |
| 2. Shipping | b) land |
| 3. Mining | c) large groups of ore |
| 4. Access | d) the structure of an underground tunnel |
| 5. Maintain | e) underground projects |
| 6. Use | f) needed resources |
| 7. Improve | g) machinery and tools |
| 8. Collect | h) area |
| 9. Break up | i) site |

MINING (SOFT AND HARD SKILLS)

Miners spend a lot of their workday outdoors or underground. Miners can expect the following work environment characteristics:

- ▶ a lot of time spent on their feet in difficult climates;
- ▶ exposure to risk and danger;
- ▶ use of machinery and tools;
- ▶ long work hours in a remote and loud location;
- ▶ frequent travel to new mining sites.

The work environment for a miner can be physical and laborious. Because miners often have to relocate to the job site. Additionally, miners will often move from one location to another as the project needs change. The specific job tasks of a miner may change from day to day. One day, a miner may use tools to break up large groups of ore and transport it to the shipping area. Another day may be spent working on a project that improves the structure of an underground tunnel.

There are a few hard and soft skills that are important to the success of a miner, including:

Problem-solving: Problem-solving skills are crucial as a miner. The ability to identify a problem and take the necessary steps to overcome it is not only important for the job, but also for staying safe when completing underground projects. Miners are

often tasked with a project to evaluate and fix a problem, whether it is finding a way to a new underground area or choosing equipment that is able to collect the needed resources.

Teamwork: Miners will often work in teams and must have strong teamwork skills. Teamwork is important for maintaining safety standards, solving problems and completing projects. Miners will learn to develop collaboration and interpersonal skills that help them succeed in the mining teamwork environment.

Communication: Developed communication skills are also important when working as a miner. Miners will communicate with team leaders and other team members to complete projects. Strong verbal and nonverbal communication skills are necessary for this role.

Technical: Modern-day miners are beginning to rely on technology to assess land and determine next steps. Miners will need advanced technical skills to use industry-specific programs.

(abridged from: <https://www.indeed.com/career-advice/careers/what-does-a-miner-do>)

Exercise 9. Classify all the skills and abilities mentioned in the text into soft and hard ones.

Soft skills (non-technical abilities)	Hard skills (teachable and learnable abilities through books, training materials, job)

Exercise 10. Put the words into the right order.

- tools / to break up / to the shipping / may use / to transport it / large groups / area / **A miner** / of ore / and.
- when completing / take the necessary / **The ability** / is / for staying safe / to identify a problem / underground projects / and / to overcome / steps / important.
- Miners** / to evaluate / are / and / often / with a project / fix the problem / tasked.
- to collect / a way to / should be / **Miners** / and also / to find / to choose / new underground area / able / equipment / the needed resources.
- interpersonal / teamwork / succeed / **Collaboration and** / help / in the mining / environment / miners / skills / to.
- technical / to use / need / **Miners** / industry-specific programs / skills / advanced.
- to another / often / change / as the project / **Miners** / one location / needs / move from.
- are / technology / to assess / and determine / **Modern-day miners** / to rely on / land / next steps / beginning.

Listening and Use of English

Structures “in order that” and “so that” to express purpose

Союзы “in order that” и “so that” «для того чтобы» используются в предложении для того, чтобы объяснить, с какой целью совершается действие. Союз “in order that” является более формальным. Чаще всего данные союзы употребляются с модальными глаголами (can/would/will).

Study the following examples:

1. I'll go by car **so that** I can take more luggage. Я поеду на машине, **чтобы** я **смог** взять побольше багажа.
2. We left a message with his neighbour **so that** he would know we'd called. Мы оставили сообщение его соседу, **чтобы он знал**, что мы звонили.
3. **In order that** you can sign the form, please print it out and mail it to this address. **Чтобы вы могли** подписать форму, распечатайте ее и отправьте по этому адресу.

(abridged from: <https://dictionary.cambridge.org/ru/>)

Exercise 11. Listen to the recording and continue the sentences using “so that” and “in order to” structures.

1. A mining engineer develops a safe efficient operating plan_____
2. You need a Bachelor of Science in civil engineering_____
3. You need mechanical engineering_____
4. You need electrical engineering_____
5. Once we have a plan, we schedule the equipment_____
6. We use GPS, Global positioning system and satellites_____
7. We use biotechnologies_____
8. We use computer applications_____

(abridged from: <https://youtu.be/xva5q9L8PxI>)

Speaking

Exercise 12. In pairs, look at the following responsibilities and decide which soft and hard skills should a miner possess in order to work successfully in the mining industry.

- ▶ Mine ore, coal and rocks in an underground setting.
- ▶ Design and build supportive entryways.
- ▶ Operate explosives.
- ▶ Drive underground mining equipment.
- ▶ Transport ore, coal and rocks to designated shipping destinations above ground.
- ▶ Working in a crew on collaborative projects.

Example:

*Miners **should possess** technical skills and knowledge of machinery and tools **so that they can** mine ore, coal and rocks in an underground setting.*

Grammar

Active Voice Revision: Present Tenses

Изменяя форму глагола для описания действий в настоящем времени, мы можем делать акцент на:

- ▶ регулярности действия;
- ▶ обыденности действия;
- ▶ процессуальной составляющей действия;
- ▶ том, что текущее действие выражает планы говорящего;
- ▶ результатах действия в настоящем времени.

See Appendix A: Grammar (Present Tenses), табл. 1.2–1.4.

Study the examples:

1. Underground mining geologists **usually oversee** the underground mine geology departments and team. *Горные инженеры-геологи обычно контролируют отделы и команду геологии при выполнении подземных горных разработок.*
2. Out product manager **is visiting customers** to present the latest products and hosting factory visits **on Monday**. *В понедельник наш менеджер по продукции посещает клиентов, чтобы представить новейшие продукты и организовать посещение завода.*
3. The miners **have not excavated** the site **yet**. *Шахтеры еще не разрабатывали этот участок.*

Exercise 13. Correct the conversation between two miners using Present Simple or Present Progressive forms of the verb.

A: Hi, James! Nice to see you again!

B: Tom! What a surprise! Where **(1) (you / fly)** to?

A: I am on my way to Mirny mine which is located in Siberia, Russia.

B: Really? So far from home, isn't it? **(2) (I / go)** to Bingham Canyon mine.

A: Oh, **(3) (you / work)** in the United States?

B: Yes. I work as a crane operator and I'm responsible for machinery and tools.

A: OK. Do you have a set schedule or you are on call?

B: **(4) (we / have)** a set schedule but we reschedule twice a month. What about you?

A: I've just got this job as a project manager, so **(5) (I / have)** a meeting at the main headquarter in Mirny. **(6) (you / know)** Salt Lake City? Your mine is located there if I am not mistaken.

B: Not very well. My brother lives there. **(7) (I / not / go)** there very often. What your first project will be?

A: Don't know all the details. At the moment, **(8) (I / work)** on a project that improves the structure of an underground tunnel in Mirny. I know that Bingham Canyon is one of the largest mine in the world. **(9) (you / operate)** a crane in such a loud location? How can you work such long hours on a site? My job is mostly at the office.

B: **(10) (things / go / well)** if you follow some safety precautions and as I said we have some shifts.

A: I see. **(11) (my plane / board)** and I've got to go. Bye.

Grammar

Active Voice Revision: Past Tenses

Изменяя форму глагола для описания действий в прошедшем времени, мы можем делать акцент на:

- ▶ законченности действия в прошлом;
- ▶ процессуальной составляющей действия в прошлом;
- ▶ том, что действию в прошлом предшествовало другое действие.

See Appendix A: Grammar (Past Tenses), табл. 1.5, 1.6.

Study the examples:

1. **Last year** I participated in Product Quality Reviews and Issue Resolution meetings. I **didn't give** presentations at the local industry conferences. *В прошлом году я участвовал в обзорах качества продукции и встречах по разрешению проблем. Я не выступал на местных отраслевых конференциях.*
2. **Were** you carrying coal to a dewatering plant **when** our boss phoned? *Несли ли вы уголь на установку обезвоживания, когда звонил наш босс?*
3. **Before** we extracted the precious minerals, we **had conducted** a geological survey. *Перед тем, как добыть драгоценные полезные ископаемые, мы провели геологическое изучение.*

Exercise 14. Meet Simone Hensher: Mining Engineer, Safety Ambassador, Diversity Champion. Match the main events in her life with the correct background situations.

1. In September 2010 – Simone's children went to elementary school (full time) and she had applied for a scholarship with Glencore Canada's Sudbury and received it.
 2. In 2015 – Simone transferred to Nickel Rim South Mine and worked as an underground front line supervisor from 2016 to 2017.
 3. In October 2018 – Simone became part of Glencore Canada's Sudbury Integrated Nickel Operations (INO).
 4. In March 2018 – The Workplace Safety North provided Simone with supervision in the field of safety.
 5. In June 2018 – Simone took home the award for top technician in The Workplace Safety North (WSN) 69th Annual Ontario Mine Rescue Competition.
- a) She was studying books and having extensive hands-on training at a workplace.
 - b) She was participating in the competition amongst technicians and got a tremendous result for a first-timer.
 - c) She was studying geological engineering at the university.

- d) She was developing and training employees to standards for safe and efficient equipment operation.
- e) She was working as an underground front line supervisor in INO.

Exercise 15. Ask Simone Hensher about her (responsibilities, career, activities in mining, experiences). Use Past Simple, Past Progressive or Past forms of to be.

Interviewer: _____

Simone: There would be nothing worse than standing back and watching something happen and not having the capacity to do something. So having the ability to be able to do what you need to do to save a life is pretty empowering.

Interviewer: _____

Simone: My training for the competition involved both book studying and extensive hands-on training.

Interviewer: _____

Simone: Overall, I think that the experience was a very positive one in my life.

Interviewer: _____

Simone: Yes, I really enjoyed my mine rescuer status. I believe that it is a tremendous, and it is another step closer to safer mines and safer work.

Interviewer: _____

Simone: My employer gave me unique path into the industry, which gave me a different perspective and set of skills.

Interviewer: _____

Simone: I wanted to encourage more women to go into mining, because we're still very underrepresented in the industry and I thought that it would be great.

(abridged from: the text for the tasks https://www.glencore.ca/en/Media-and-insights/Insights/meet-simone-hensher-mining-engineer-safety-ambassador-diversity-champion?fbclid=IwAR3zbNCi42_SS6BP3zgZeHBuiNEXxoWQ8d0NQcNUYAA5lsmv3MhAeDCut2c)

Grammar

Active Voice Revision: Future tenses and “to be going to”

Изменяя форму глагола для описания действий в будущем времени, мы можем делать акцент на:

- ▶ прогнозах на будущее;
- ▶ спонтанных решениях;
- ▶ выражении надежды, обещания или опасения;
- ▶ отдаленных планах и намерениях.

See Appendix A: Grammar (Future Tenses and “to be going to”), табл. 1.7, 1.8.

Study the examples:

1. Will you **be able to perform** long-range planning duties as well as short-range engineering after your graduation? *Сможете ли вы выполнять обязанности*

по долгосрочному планированию, а также краткосрочному проектированию после окончания учебы?

2. She **is going to** become an underground mining engineer. *Она собирается стать горным инженером по подземным работам.*
3. I **promise I'll come** to the meeting with engineering and geology teams. *Я обещаю, я приду на встречу с инженерно-геологическими командами.*

Exercise 16. Match the questions to answers. Pay attention to different future forms. More than one answer is possible.

1. How are you getting there?
2. What's happening?
3. Where are you going?
4. What will you do there?
5. What are you doing?
6. What your workplace will be like?

- a) He is loading ore into trucks and cars.
- b) I am going to Bingham Canyon mine.
- c) They are loading ore into trucks and cars.
- d) We are going by a crew bus.
- e) I am transporting the broken coal from the face in wheelbarrows.
- f) I think, I will build new shafts and develop new drives, rises, crib rooms and air vents.
- g) Probably, it will be one of rural and remote locations.

Speaking

Plans

Exercise 17. What will you be doing in 10 years' time?

I will be working in _____

I will be probably working for _____

I will have _____

I won't be _____

Exercise 18. Work in pairs. Look at these hazardous situations and explain what you will do.

1. Mines are noisy places, with the constant of drilling and heavy machinery, and the potential for hearing damage is quite serious.

*What **will** you do, if you hear loud noise?*

2. Mines are very hot and humid. A common health risk that miners face is thermal – or heat – stress.

*What **will** you do if you feel hot?*

3. There are a lot of harmful chemicals in mines. Risks include chemical burns, respiratory problems.

*What **will** you do if you go down the mine without any protection?*

4. In mines located in Australia ultraviolet rays can put you at risk of skin cancer and can cause damage to your eyes.

*What **will** you do if you at surface **mines (outdoors)**?*

5. Mines are very deep. A miner could experience some problems affecting their bones, muscles, blood vessels and nerves during due to a trip, fall or heavy lift.

*What **will** you do if you feel bad while going down the mine.*

Some ideas to use:

- ▶ Apply safe handling and proper disposal.
- ▶ Put on personal hearing protection.
- ▶ Put on protective eye wear.
- ▶ Use using an oxygen self-rescuer.
- ▶ Apply sunscreen.
- ▶ Put on some respiratory protective equipment and clothing with cooling systems or breathable fabrics.
- ▶ Call mines rescue team.

(abridged from: <https://www.miningreview.com/health-and-safety/mining-health-safety-7-common-risks-to-protect-yourself-against/>)

UNIT 1B. APPLIED GEOLOGY

Learning objectives

In this unit you will:

- ▶ acquire the vocabulary connected to applied geology and its methodology;
- ▶ learn how to talk about skills and responsibilities of an applied geologist;
- ▶ study and practice patterns IN ORDER TO and SO THAT to explain purpose;
- ▶ review basic grammar tenses.

Reading

Before you read:

Exercise 1. Practice to pronounce of the following words and word combinations correctly:

Interior surface	[ɪn'tɪrɪər] ['sɜːrfɪs]	Внутренняя поверхность
Exterior surface	[ɪk'stɪrɪər] ['sɜːrfɪs]	Наружная поверхность, внешняя поверхность
Geological time	[ˌdʒiːə'lɑːdʒɪkl] [taɪm]	Геологический возраст

Anticipate changes	[æn'tɪsɪpeɪt] [tʃeɪndʒ]	Предвидеть изменения
Deductive reasoning	[dɪ'dʌktɪv] ['riːzənɪŋ]	Дедуктивное рассуждение
Geological rates	[ˌdʒiːə'lɑːdʒɪkl] [reɪts]	Геологические показатели темпа изменений
Environmental implications	[ɪnˌvaɪrən'mentl] [ɪmplə'keɪfənz]	Последствия для окружающей среды; экологические последствия
Mitigate the hazards	['mɪtɪgeɪt] ['hæzərd]	Уменьшить опасность
Earthquakes	['ɜːθˌkweks]	Землетрясения
Slope failures	[sləʊp] ['feɪljə]	Откосное разрушение; сползание откоса; оползание откоса
Volcanic eruptions	[vɒl'kænɪk] [ɪ'rʌpʃn]	Извержения вулканов

(abridged from: <https://courses.lumenlearning.com/wmopen-geology/chapter/outcome-what-is-geology/>)

Exercise 2. Read the text.

In its broadest sense, geology is the study of Earth – its interior and its exterior surface, the rocks and other materials that are around us, the processes that have resulted in the formation of those materials, the water that flows over the surface and lies underground, the changes that have taken place over the vastness of geological time, and the changes that we can anticipate will take place in the near future. Geology is a science: we use deductive reasoning and scientific methods to understand geological problems.

Geology is arguably the most integrated of all of the sciences because it involves the understanding and application of all of the other sciences: physics, chemistry, biology, mathematics, astronomy, and others. But unlike most of the other sciences, geology has an extra dimension, that of time – billions of years of it. Geologists study the evidence that they see around them, but in most cases, they are observing the results of processes that happened thousands, millions, and even billions of years in the past. Those were processes that took place at incredibly slow rates – millimeters per year to centimeters per year – but because of the amount of time available, they produced massive results.

Geology is also about understanding the evolution of life on Earth; about discovering resources such as metals and energy; about recognizing and minimizing the environmental implications of our use of those resources; and about learning how to mitigate the hazards related to earthquakes, volcanic eruptions, and slope failures.

(abridged from: <https://courses.lumenlearning.com/wmopen-geology/chapter/outcome-what-is-geology/>)

Exercise 3. Decide if the following statements are true or false. Correct the false ones.

1. Geology uses inductive reasoning and to understand geological problems.

2. Geology doesn't involve the understanding and application of different branches of science.
3. Geology studies the processes that take place at incredibly high rates.
4. Slope equations can't be mitigated with the help of geological studies.
5. Geologists study only the evidence that they see around them.
6. Geology doesn't involve understanding the evolution of life on Earth.

Vocabulary

Exercise 4. Match the words and their definitions.

1. Long period of time occupied by the earth's geologic history.
2. A measurable extent of a particular kind, such as length, breadth, depth, or height.
3. Velocities at which geologic processes occur range from imperceptibly slow to exceptionally fast.
4. Make (something bad) less severe, serious, or painful.
5. Matter, found mainly in underground seams and used as fuel.
6. The downward and outward movement of rock or unconsolidated material as a unit or as a series of units.
7. A danger or risk.
8. Expect or predict.

NB!:

predict – предсказывать

velocity – скорость

downward / upward – по направлению вниз / вверх

extent – степень

- a) Anticipate
- b) Hazards
- c) Mitigate
- d) Geological time
- e) Slope failures
- f) Extra dimension
- g) Geological rates

(abridged from: https://courses.lumenlearning.com/wmopen_geology/chapter/outcome-what-is-geology/; https://www.mindat.org/glossary/slope_failure; <https://www.merriam-webster.com/>)

Speaking

Exercise 5. Read a short extract taken from the website page of Siberian Federal University and answer the following questions:

1. What School do you study at?
2. What is your field of study?

3. What is your major?
4. What types of workers does your School prepare?
5. What are the companies you'll be able to work at after graduating from the university?
6. What are the usual activities for people in mining industry?

“Main fields of study and majors of our School are connected to applied geology, mining engineering and technology of geological exploration. School of Mining, Geology and Geotechnology prepares engineers and research and teaching staff for companies working in geological exploration or mining and smelting which deal with a wide range of activities from survey and exploration to mining and processing of mineral resources”.

“Institute of Petroleum and Natural Gas Engineering created as part of SFU, effectively implements the modules of the competencies of graduates and modernization of educational standards in areas of training of bachelors, specialists and masters demanded in oil companies, as well as develops and supports the implementation of modular elective courses and electives student learning, providing personnel resources of scientific research and innovative development of the enterprises of fuel-energy complex.

An effective system of engineering personnel training for the oil industry is based on the balance of interests of education, science and business, which can successfully solve current and future problems of the educational process, as well as quickly change its content, methods and organizational forms in accordance with production needs and situation on the labour market.

Graduates of the Institute of Petroleum and Natural Gas Engineering possess skills of management, engineering and operational and research activity”.

(abridged from: <http://www.sfu-kras.ru/en/about/igd/>; <http://inig.sfu-kras.ru/en/about-spg/>)

Listening

Before you listen

- | | |
|---------------------------|--------------------|
| 1. Petroleum | a) a new model |
| 2. Collect | b) core samples |
| 3. Build up | c) new data |
| 4. Core samples' | d) geologist |
| 5. Identify | e) images |
| 6. Get and apply | f) rock properties |
| 7. Send geophysical tools | g) down the hole |
| 8. Drill for | h) facility |
| 9. Take | i) oil and gas |

Exercise 6. Watch the video about the career as petroleum geologist and answer the following questions:

1. What will you do as a petroleum geologist?
2. What are geologists sometimes called “treasure hunters”?
3. What types of data do geologists interpret analyzing geological log measurements?
4. What is the porosity of rocks?
5. Does the job involves working in the office or in the field?
6. Do geologists work individually or collaborate with other specialists?
7. What types of procedure with samples do geologists usually perform?
8. What are the educational requirements for the job?
9. What does it mean to think in “three dimensional ways”?

(abridged from: https://www.youtube.com/watch?v=RRZr_d2d3YQ&ab_channel=alisWebsite)

Grammar

Revision “to be” forms

Глагол “to be” может переводиться глаголами «быть», «являться», «находиться», «существовать».

See Appendix A: Grammar (The verb “to be”), табл. 1.1.

Study the following examples:

1. Geological exploration **is** one of the fields of study at School of Mining, Geology and Geotechnology. *Геологоразведка – одно из направлений обучения в Школе горного дела, геологии и геотехнологии.*
2. He **will be** a geologist soon. *Он скоро станет геологом.*
3. According to the survey, mining engineering and geology **were** the most popular fields of study in 2014. *Согласно исследованию, в 2014 году наиболее популярными направлениями исследований были горное дело и геология.*

Exercise 7. Put “to be” forms into the gaps, the ask questions to the words in bold.

1. If you (...) down-to-earth kind of **person** with skills at certain sciences and technologies, consider becoming a petroleum geologist;
2. Petroleum geologists explore oil and gas that (...) **beneath the surface**;
3. With the help of logs, we can identify rock properties including the type of rock it (...), the type of liquid that (...) there, or how tight the rock (...);
4. A lot of the work that I do (...) actually **in the computer**;
5. I took a **class** in geology and it (...) really all about rocks;
6. The work (...) be **very repetitive and routine** based with long 12 hour days.

(abridged from: https://www.youtube.com/watch?v=RRZr_d2d3YQ&ab_channel=alisWebsite)

Reading

Before you read

Exercise 8. Do the matching task and translate the following collocations.

- | | |
|-------------------------|--------------------------------|
| 1. Challengeable | a) features |
| 2. Geographical | b) environments and conditions |
| 3. Ore | c) information systems |
| 4. Undertake | d) the fieldwork |
| 5. Geological | e) software |
| 6. Field | f) internationally |
| 7. Drawing and modeling | g) deposits |
| 8. Operate | h) large amounts of work |
| 9. Complete | i) equipment |

GEOLOGY (SOFT AND HARD SKILLS)

- a) Languages
- b) Effective written communication
- c) Technical and IT skills
- d) Field skills
- e) Effective oral communication

1. _____

You must be able to convey your ideas and your reasoning effectively but concisely to reach robust conclusions. This means your work must be interesting, logical and easy to read.

2. _____

Being able to present or lecture to an audience is one of the most important skills you can acquire during a degree. There will be assignments in which you present to your lecturers and peers.

It is imperative to learn to engage with your audience so they are interested in what you are talking about.

3. _____

All professions nowadays require basic IT skills, such as word processing, database analysis and data management. These are rarely a problem for those who have completed an undergraduate degree. However, gaining other IT skills in geographical information systems, drawing and modelling software is becoming increasingly important.

All professional geologists will use specialist software, regardless of the sector they work in, and having a basic understanding of the functionality of some of these is highly desirable to employers.

Many specialist software (modelling) packages permit 3-D and 4-D visualisation of geological features and processes. Understanding how these relate to the real world and their limitations is very important.

Computer generated 3D model of an ore deposit.

4. _____

Foreign language skills are more important than ever in geology. Although English is the global language of science, having an ability in foreign languages can be extremely desirable to employers as so many organisations now operate internationally.

Most universities offer foreign language courses for a range of abilities as extra-curricular classes (i.e. on top of normal lectures and work). They usually charge a small fee, but this can sometimes be claimed back from departments.

Spanish, French, Portuguese and Russian are the most useful European languages to learn. Arabic and Cantonese/Mandarin Chinese could also be of use.

5. _____

Fieldwork you have undertaken is always of interest to employers in geological industries. It is more directly useful for some sectors than others, but doing well in fieldwork demonstrates that you can complete large amounts of work in sometimes challenging environments and conditions.

Additionally, it shows you can use field equipment and that you have seen a variety of different geological features.

(abridged from: <https://www.geolsoc.org.uk/Geology-Career-Pathways/University/During-your-degree/Useful-Skills-During-your-Degree>)

Exercise 9. Classify all the skills and abilities mentioned in the text into soft and hard ones.

Soft skills (non-technical abilities)	Hard skills (teachable and learnable abilities through books, training materials, job)

Exercise 10. Put the words into the right order.

1. An aptitude / and research / in data / include / **Geologist** / analysis / skills /
2. comfortable with / should be / , as well as / and / geologic modeling / **Geologists** / technological tools / data /
3. water pipe / should be / such as oil / **Geologists** / and / events / plan geology / field sampling / projects / able / extraction, / construction /
4. **Geologists** / examine / and specimens / usually / of samples / the compositions /
5. / investigation of / **The job of a geologist** / resource / and / natural / deposits / involves / evaluation and /
6. / survey sites / using GIS / **Geologists** / and create / have to / and maps / logs (e.g. borehole) /

7. may / **For example**, / at a university or, / agency / geologists / for an environmental / might / teach / work / they /
8. **Geologists** / company / where / well performance / they / oil / will / production / be evaluating /
9. **Geologists** / and test fossils, / with / should / the proper instruments (e.g. X-rays) / ores / rock, / and other material / be able / soil, /

(abridged from: <https://resources.workable.com/geologist-job-description#>)

Listening and Use of English

Structures “in order that” and “so that” to express purpose

Союзы “in order that” и “so that” (для того чтобы) используются в предложении для того, чтобы объяснить, с какой целью совершается действие. Союз “in order that” является более формальным. Чаще всего данные союзы употребляются с модальными глаголами (can / would / will).

Study the following examples:

1. I'll go by car **so that** I can take more luggage. *Я поеду на машине, чтобы я смог взять побольше багажа.*
2. We left a message with his neighbour **so that** he would know we'd called. *Мы оставили сообщение его соседу, чтобы он знал, что мы звонили.*
3. **In order that** you can sign the form, please print it out and mail it to this address. *Чтобы вы могли подписать форму, распечатайте ее и отправьте по этому адресу.*

(abridged from: <https://dictionary.cambridge.org/ru/>)

Exercise 11. Listen to the recording and continue the sentences using “so that” and “in order to” structures.

1. We could look at the porosity _____
2. You need to understand the rocks _____
3. We can use the extracted rocks _____
4. We use microscopes _____
5. We need to predict the subsurface _____

(abridged from: https://www.youtube.com/watch?v=8FR9Ukex7S0&ab_channel=FaculteitCiTG)

Speaking

Exercise 12. In pairs, look at the following responsibilities and decide which soft and hard skills should a miner possess in order to work successfully in the oil and gas industry.

- ▶ Interpret geophysical information;
- ▶ analyse project data;
- ▶ estimate fuel amounts;

- ▶ interpret and implement drilling strategies for extraction;
- ▶ utilize a variety of techniques to discover this information, including geochemical analysis, ground-based sonar;
- ▶ discover reservoirs or satellite mapping;
- ▶ understand the origin of the fuel;
- ▶ determine the location and amount of combustible fuel in sediments on land or in the ocean;
- ▶ investigate the structure and evolution of the earth and its natural resources;
- ▶ plan programmes for exploration of sites for oil, gas, water, minerals;
- ▶ survey and map geologically promising sites;
- ▶ collect and record samples and data from test sites.

Example:

*Petroleum geologists should **possess** technical computer skills and knowledge of natural reserves on both land and sea **so that they can** gauge how much combustible fuel can be extracted.*

(abridged from: https://study.com/articles/Petroleum_Geologist_Job_Description_Duties_and_Requirements.html, <https://targetjobs.co.uk/careers-advice/job-descriptions/279515-exploration-geologist-job-description#:~:text=investigating%20the%20structure%20and%20evolution,and%20data%20from%20test%20sites>)

Grammar

Active Voice Revision: Present Tenses

Изменяя форму глагола для описания действий в настоящем времени, мы можем делать акцент на:

- ▶ регулярности действия;
- ▶ обыденности действия;
- ▶ процессуальной составляющей действия;
- ▶ том, что текущее действие выражает планы говорящего;
- ▶ результатах действия в настоящем времени.

See Appendix A: Grammar (Present Tenses), табл. 1.2–1.4.

Study the examples:

1. Underground mining geologists **usually oversee** the underground mine geology departments and team. *Горные инженеры-геологи обычно контролируют отделы и команду геологии при выполнении подземных горных разработок.*
2. Out product manager **is visiting customers** to present the latest products and hosting factory visits **on Monday**. *В понедельник наш менеджер по продукции посещает клиентов, чтобы представить новейшие продукты и организовать посещение завода.*

3. The miners **have not excavated** the site **yet**. *Шахтеры еще не разрабатывали этот участок.*

Exercise 13. Correct the conversation between two miners using Present Simple or Present Progressive forms of the verb.

A: Hi, James! Nice to see you again!

B: Tom! What a surprise! Where **(1) (you / fly)** to?

A: I am on my way to the company which is located in Australia. I'll be working for Mining People International.

B: Really? So far from home, isn't it? **(2) (I / go)** to Bingham Canyon mine.

A: Oh, **(3) (you / work)** in the United States?

B: Yes. I work as an exploration geologist and I'm responsible for mapping, geochemical, structural and geophysical surveys.

A: OK. Do you have a set schedule or you are on call?

B: **(4) (we / have)** a set schedule but we reschedule twice a month. What about you?

A: I've just got this job as a petroleum geologist, so **(5) (I / have)** a meeting at the main headquarter. **(6) (you / know)** Salt Lake City? Your company is located there if I am not mistaken.

B: Not very well. My brother lives there. **(7) (I / not / go)** there very often. What your first project will be?

A: Don't know all the details. At the moment, **(8) (I / work)** on a project that designs and management of Brownfields and Greenfields exploration drilling programs. **(9) (you/ interpret)** cross-sections? How can you work such long hours in the field? My job is mostly at the office.

B: **(10) (things / go / well)** if you follow some safety precautions and as I said we have some shifts.

A: I see. **(11) (my plane / board)** and I've got to go. Bye.

(abridged from: <https://www.careermine.com/job/1978435/project-exploration-geologist/>)

Grammar

Active Voice Revision: Past Tenses

Изменяя форму глагола для описания действий в прошедшем времени, мы можем делать акцент на:

- ▶ законченности действия в прошлом;
- ▶ процессуальной составляющей действия в прошлом;
- ▶ том, что действию в прошлом предшествовало другое действие.

See Appendix A: Grammar (Past Tenses), табл. 1.5, 1.6.

Study the examples:

1. **Last year** I participated in Product Quality Reviews and Issue Resolution meetings. I **didn't give** presentations at the local industry conferences. *В прошлом году я участвовал в обзорах качества продукции и встречах по решению проблем. Я не выступал на местных отраслевых конференциях.*
2. **Were you carrying** coal to a dewatering plant **when** our boss phoned? *Несли ли вы уголь на установку обезвоживания, когда звонил наш босс?*
3. **Before** we extracted the precious minerals, we **had conducted** a geological survey. *Перед тем, как добыть драгоценные полезные ископаемые, мы провели геологическое изучение.*

Exercise 14. Meet Simone Hensher: Mining Engineer, Safety Ambassador, Diversity Champion. Match the main events in her life with the correct background situations.

1. In September 2010 – Simone's children went to elementary school (full time) and she had applied for a scholarship with Glencore Canada's Sudbury and received it.
 2. In 2015 – Simone transferred to Nickel Rim South Mine and worked as an underground front line supervisor from 2016 to 2017.
 3. In October 2018 – Simone became part of Glencore Canada's Sudbury Integrated Nickel Operations (INO).
 4. In March 2018 – The Workplace Safety North provided Simone with supervision in the field of safety.
 5. In June 2018 – Simone took home the award for top technician in The Workplace Safety North (WSN) 69th Annual Ontario Mine Rescue Competition.
- a) She was studying books and having extensive hands-on training at a workplace.
 - b) She was participating in the competition amongst technicians and got a tremendous result for a first-timer.
 - c) She was studying geological engineering at the university.
 - d) She was developing and training employees to standards for safe and efficient equipment operation.
 - e) She was working as an underground front line supervisor in INO.

Exercise 15. Read a conversation between an interview and a famous geologist Tom Neumann about collecting and analysing rocks split out from the base of the glacier of the Greenland Ice Sheet. Ask Tom about his (responsibilities, career, activities and experiences).

Use Past Simple, Past Progressive or Past forms of to be.

Interviewer: _____

Tom: Everything is going great! This is our third site, so we collected rocks on Filchner Ice Shelf, so we had two beautiful days there, we got about a 115.

Interviewer:

Tom: Yesterday, we were doing ice sampling, we were looking around on the edge of an ice sheet for places where the rocks were coming out. We chopped rocks out of ice. Paul was sampling the rocks that had been recently exposed.

Interviewer:

Tom: Actually, we did measures of beryllium concentrations. It tells us about how long the rock has been espoused to the air and the sky, and how long it has been buried for.

Interviewer:

Tom: What we were hoping to find from rocks from this ice sheet was to learn about what was the last time the ice sheet was smaller. Was it smaller than today?

Interviewer:

Tom: That was out last day offline. That was great. We had 21 samples.

(abridged from: <https://www.exploratorium.edu/video/interview-geologist-tom-neumann>)

Grammar

Active Voice Revision: Future tenses and “to be going to”

Изменяя форму глагола для описания действий в будущем времени, мы можем делать акцент на:

- ▶ прогнозах на будущее;
- ▶ спонтанных решениях;
- ▶ выражении надежды, обещания или опасения;
- ▶ отдаленных планах и намерениях.

See Appendix A: Grammar (Future Tenses and “to be going to”), табл. 1.7, 1.8.

Study the examples:

1. Will you **be able to perform** long-range planning duties as well as short-range engineering after your graduation? *Сможете ли вы выполнять обязанности по долгосрочному планированию, а также краткосрочному проектированию после окончания учебы?*
2. She **is going to** become an underground mining engineer. *Она собирается стать горным инженером по подземным работам.*
3. I **promise I'll come** to the meeting with engineering and geology teams. *Я обещаю, я приду на встречу с инженерно-геологическими командами.*

Exercise 16. Match the questions to answers. Pay attention to different future forms. More than one answer is possible.

1. How are you getting there?

2. What's happening?
 3. Where are you going?
 4. What will you do there?
 5. What are you doing?
 6. What your workplace will be like?
- a) He is loading ore into trucks and cars.
 - b) I am going to Bingham Canyon mine.
 - c) They are loading ore into trucks and cars.
 - d) We are going by a crew bus.
 - e) I am planning programmes for exploration of sites for oil, gas, water, minerals.
 - f) I think, I will survey and map geologically promising sites.
 - g) Probably, it will be one of rural and remote locations.

Speaking

Plans

Exercise 17. What will you be doing in 10 years' time?

I will be working in _____
 I will be probably working for _____
 I will have _____
 I won't be _____

Exercise 18. Work in pairs. Look at these hazardous situations and explain what you will do.

1. While working you can face falls of ground underground or collapse of trenches.

*What **will** you do, if you see collapse of trenches?*

2. It's hot and humid in the field. A common health risk that geologists face is thermal – or heat – stress, dehydration.

*What **will** you do if you feel hot?*

3. Much of the vehicle work is true off-road, with no tracks at all, picking a way through the scrub.

*What **will** you do if your vehicle breaks?*

4. Geologists might have exposure, ultraviolet rays can put you at risk of skin cancer and can cause damage to your eyes.

*What **will** you do if you are **outdoors**?*

5. Geologists also might disturb animals by careless actions.

*What **will** you do if you see a wild animal?*

- ▶ Apply safe handling and proper disposal;
- ▶ put on personal hearing protection;
- ▶ put on protective eye wear;
- ▶ stand close to the team, weave hands, shout together, and don't run away;

- ▶ use using an oxygen self-rescuer;
- ▶ apply sunscreen;
- ▶ put on some respiratory protective equipment and clothing with cooling systems or breathable fabrics;
- ▶ call rescue team.

(abridged from: <https://www.miningreview.com/health-and-safety/mining-health-safety-7-common-risks-to-protect-yourself-against/>; https://www.researchgate.net/publication/296601283_Hazards_faced_by_geologists)

UNIT 1C. GEOPHYSICAL EXPLORATION

Learning objectives

In this unit you will:

- ▶ acquire the vocabulary connected to geophysics and its methodology;
- ▶ learn how to talk about skills and responsibilities of a geophysicist;
- ▶ study and practice patterns IN ORDER TO and SO THAT to explain purpose;
- ▶ review basic grammar tenses.

Reading

Before you read:

Exercise 1. Practice to pronounce of the following words and word combinations correctly:

Exploration geophysics	[ˌeksplə'reɪʃn] [ˌdʒi:əʊ'fɪzɪks]	Разведочная геофизика
Petroleum exploration	[pə'trɒliəm] [ˌeksplə'reɪʃn]	Разведка месторождений нефти
Mineral exploration	[ˈmɪn(ə)r(ə)l] [ˌeksplə'reɪʃn]	Разведка полезных ископаемых поиск полезных ископаемых
Physical properties	[ˈfɪzɪkl] [pra:pərtɪz]	Физические свойства
Density	[ˈdensəti]	Плотность
Velocity	[və'la:səti]	Скорость
Susceptibility	[sə'septə'bɪləti]	Восприимчивость к импульсным помехам, давлению и пр. воздействиям
Resistivity	[ˌrɪzɪ'stɪvɪti]	Удельное сопротивление
Geological configurations	[ˌdʒi:ə'la:dʒɪkl] [kən'fɪgjə'reɪʃn]	Структурная конфигурация / структурная форма залегания горных пород
Hydrocarbons	[ˌhaɪdrə'kɑ:rbənz]	Углеводороды
Groundwater	[ˈgraʊndwɔ:tər]	Грунтовая / почвенная вода

Exercise 2. Read the text.

Exploration geophysics plays a major role in the areas of mineral and petroleum exploration, marine geology, groundwater exploration, and engineering construction, wherein its primary aim is to add an extra dimension to geological information. In its basic essentials it is a method of geological exploration, using instruments whose function is to record changes in the physical properties of rocks in the subsurface. It therefore involves the application of principles of several physical sciences and relates to the measurement of rock properties such as density, velocity, susceptibility, and resistivity and involves the drawing of deductions about the rock types and their geological configurations. There is also some prediction involved in terms of inferring the probability of the presence of mineral deposits, hydrocarbons, and groundwater.

(abridged from: https://link.springer.com/referenceworkentry/10.1007%2F0-387-30844-X_27)

Exercise 3. Decide if the following statements are true or false. Correct the false ones.

1. Geophysicists don't measure susceptibility of rocks.
2. Geophysicists often give predictions where the mineral deposits are.
3. Geophysical methods are similar to the geological ones.
4. Geophysicists are interested only in rock properties.
5. Geophysical surveys contribute to geology.
6. The method of geological exploration can be transformed by IT technologies.

Vocabulary

Exercise 4. Match the words and their definitions.

1. An arrangement of parts or elements in a particular form, figure, or combination.
 2. Resistance of a conductor of unit cross-sectional area and unit length.
 3. The stratum or strata below the earth's surface.
 4. Is the water present beneath Earth's surface in rock and soil pore spaces and in the fractures of rock formations.
 5. The action of putting something into operation.
 6. A forecast.
 7. Place (something) somewhere for safekeeping.
-
- a) Prediction.
 - b) Deposits.
 - c) Resistivity.
 - d) Groundwater.
 - e) Configurations.
 - f) Subsurface.
 - g) Application.

NB!:

soil pore – поры в почве

fractures of rock formations – трещины в формации горной породы

the stratum or strata – слой или напластование

arrangement – расположение

(abridged from: <https://languages.oup.com/google-dictionary-en/>)

Speaking

Exercise 5. Read a short extract taken from the website page of Siberian Federal University and answer the following questions:

1. What School do you study at?
2. What is your field of study?
3. What is your major?
4. What types of workers does your School prepare?
5. What are the companies you'll be able to work at after graduating from the university?
6. What are the usual activities for people in mining industry?

“Main fields of study and majors of our School are connected to applied geology, mining engineering and technology of geological exploration. School of Mining, Geology and Geotechnology prepares engineers and research and teaching staff for companies working in geological exploration or mining and smelting which deal with a wide range of activities from survey and exploration to mining and processing of mineral resources”.

Institute of Petroleum and Natural Gas Engineering created as part of SFU, effectively implements the modules of the competencies of graduates and modernization of educational standards in areas of training of bachelors, specialists and masters demanded in oil companies, as well as develops and supports the implementation of modular elective courses and electives student learning, providing personnel resources of scientific research and innovative development of the enterprises of fuel-energy complex.

An effective system of engineering personnel training for the oil industry is based on the balance of interests of education, science and business, which can successfully solve current and future problems of the educational process, as well as quickly change its content, methods and organizational forms in accordance with production needs and situation on the labour market.

Graduates of the Institute of Petroleum and Natural Gas Engineering possess skills of management, engineering and operational and research activity.

(abridged from: <http://www.sfu-kras.ru/en/about/igd>; <http://inig.sfu-kras.ru/en/about-spg/>)

Listening**Before you listen**

- | | |
|----------------|------------------------------|
| 1. Drill | a) through |
| 2. Work out | b) the rock ages |
| 3. Do | c) a lot of training courses |
| 4. Exploration | d) fossils |
| 5. Microscopic | e) geologists |

Exercise 6. Watch the video about geophysical career opportunities and job routines and answer the following questions:

1. What does a job of a stratigrapher involve?
2. What education and level of knowledge are required for the job?
3. Who does a stratigrapher work with?
4. What are the career opportunities?
5. Do you need additional training for the job?
6. What outdoors activities geologist could enjoy being in the field?

(abridged from: <https://youtu.be/BRnYQ9t2oCA>)

Grammar

Revision “to be” forms

Глагол “to be” может переводиться глаголами «быть», «являться», «находиться», «существовать».

See Appendix A: Grammar (The verb “to be”), табл. 1.1.

Study the following examples:

1. Geological exploration **is** one of the fields of study at School of Mining, Geology and Geotechnology.
2. He **will be** a geologist soon.
3. According to the survey, mining engineering and geology **were** the most popular fields of study in 2014.

Exercise 7. Put “to be” forms into the gaps, the ask questions to the words in bold.

1. The surface of the Earth (...) broken up **into big blocks or plates**.
2. The first place where we went to (...) US Geological Survey which give us information about where the earthquake (...) and how large it (...).
3. When the earthquake occurs we (...) able to **provide similar information**.
4. I think that earthquakes (...) **devastating, dangerous** and can cause a lot of damage.
5. Surveying (...) **the most wonderful thing** to me.
6. When I (...) I actually thought that I would be a journalist not **a geophysicist**.

(abridged from: <https://youtu.be/OVKCqvyE5ZE>)

Reading

Before you read

Exercise 8. Do the matching task and translate the following collocations

- | | |
|----------------|--------------------------|
| 1. Data | a) locations |
| 2. Problem- | b) collection techniques |
| 3. Remote | c) stamina |
| 4. Conduct | d) fieldwork |
| 5. Physical | e) solving skills |
| 6. Geophysical | f) characterization |
| 7. Reservoir | g) data |
| 8. Automatic | h) picking site |

GEOPHISICS (SOFT AND HARD SKILLS)

We calculated that 18 % of Geophysicists are proficient in Data Collection, Geophysical Data, and C++. They're also known for soft skills such as Problem-solving skills, Communication skills, and Physical stamina.

We break down the percentage of Geophysicists that have these skills listed on their resume here:

- ▶ Data Collection, 18 %;
- ▶ Geophysical Data, 10 %;
- ▶ C++, 10 %;
- ▶ Data Analysis, 6 %;
- ▶ Reservoir Characterization, 5 %;
- ▶ Fortran, 4 %.

Some of the skills we found on geophysicist resumes included “Data collection”, “Geophysical data”, and “C++”. We have detailed the most important geophysicist responsibilities below.

The most important skills for a geophysicist to have in this position are problem-solving skills. In this excerpt that we gathered from a geophysicist resume, you'll understand why: “geoscientists work on complex projects filled with challenges”. According to resumes we found, problem-solving skills can be used by a geophysicist in order to “worked on water column statics, their effect in data quality, solution, automatic picking and correction”.

Another commonly found skill for being able to perform geophysicist duties is the following: communication skills. According to a geophysicist resume, “geoscientists write reports and research papers. Check out this example of how geophysicists use communication skills: “handle communication with specialized co-workers in order to optimize algorithm parameter settings for best data quality available”.

Physical stamina is also an important skill for geophysicists to have. This example of how geophysicists use this skill comes from a geophysicist resume, “geoscientists may need to hike to remote locations while carrying testing and sampling equipment

when they conduct fieldwork”. Read this excerpt from a resume to understand how vital it is to their everyday roles and responsibilities, “experimented with geophysical data collection techniques”.

(abridged from: <https://www.zippia.com/geophysicist-jobs/what-does-a-geophysicist-do/>)

Exercise 9. Classify all the skills and abilities mentioned in the text into soft and hard ones.

Soft skills (non-technical abilities)	Hard skills (teachable and learnable abilities through books, training materials, job)

Exercise 10. Put the words into the right order.

1. examine, / the physical properties / **Geophysicists** / of earth / and explore / measure.
2. done / field work / **Most of the work** / , with / in the lab / some / is.
3. **amount / of out** – / **Geophysicists** / the most / take / of-work / home / reading.
4. phenomena (such as tidal waves and electromagnetic fields) / **Daily duties** / measurement equipment / writing reports / studying of / examining natural / include.
5. enjoy / systems / **Professionals** / how / interrelate / tend to / geological.
6. flux / systems / **Geologists** / static / systems in / examine / ; geophysicist / analyse.
7. and try / seismic / **a seismologist** / earthquakes / study / reading / to predict.
8. plates / **A tectonophysicist** / studies / of tectonic / the movement.

(abridged from: <https://www.princetonreview.com/careers/73/geophysicist>)

Listening and Use of English

Structures “in order that” and “so that” to express purpose

Союзы “in order that” и “so that” (для того чтобы) используются в предложении для того, чтобы объяснить, с какой целью совершается действие. Союз “in order that” является более формальным. Чаще всего данные союзы употребляются с модальными глаголами (can / would / will).

Study the following examples:

1. I’ll go by car **so that** I can take more luggage. *Я поеду на машине, чтобы я смог взять побольше багажа.*
2. We left a message with his neighbour **so that** he would know we’d called. *Мы оставили сообщение его соседу, чтобы он знал, что мы звонили.*
3. **In order that** you can sign the form, please print it out and mail it to this address. *Чтобы вы могли подписать форму, распечатайте ее и отправьте по этому адресу.*

(abridged from: <https://dictionary.cambridge.org/ru/>)

Exercise 11. Listen to the recording and continue the sentences using “so that” and “in order to” structures.

We need seismic survey _____
Geophysicist should follow strict guidelines and safety precautions _____
During operations visual and acoustic monitoring is used _____
Geophysicists used compressed air released into the water _____
3D dimensional maps are needed _____
Geophysicists need sound sensors _____

(abridged from: <https://youtu.be/FN8lAb0rG9A>)

Speaking

Exercise 12. In pairs, look at the following responsibilities and decide which soft and hard skills should a miner possess in order to work successfully in the mining industry.

- ▶ Study the physical aspects of the earth.
- ▶ Examine the effects of the atmosphere on radio and satellite communications.
- ▶ Examine the size and shape of land masses.
- ▶ Study magnetic fields within and around the Earth.
- ▶ Surveys an oil concession on the shore.
- ▶ Study bodies of water and amounts of rainfall.
- ▶ Use radar, dynamite, computers, and maps.
- ▶ Use equipment includes magnetometers.
- ▶ Studying magnetic fields.
- ▶ Use gravimeters for studying the earth's gravitational pull.

(abridged from: <https://careers.stateuniversity.com/pages/64/Geophysicist.html#:~:text=To%20become%20a%20professional%20geophysicist,in%20a%20branch%20of%20geophysics>)

Example:

*Miners **should possess** technical skills and knowledge of machinery and tools **so that they can** mine ore, coal and rocks in an underground setting.*

Grammar

Active Voice Revision: Present Tenses

Изменяя форму глагола для описания действий в настоящем времени, мы можем делать акцент на:

- ▶ регулярности действия;
- ▶ обыденности действия;
- ▶ процессуальной составляющей действия;

- ▶ том, что текущее действие выражает планы говорящего;
- ▶ результатах действия в настоящем времени.

See Appendix A: Grammar (Present Tenses), табл. 1.2–1.4.

Study the examples:

1. Underground mining geologists **usually oversee** the underground mine geology departments and team. *Горные инженеры-геологи обычно контролируют отделы и команду геологии при выполнении подземных горных разработок.*
2. Out product manager **is visiting customers** to present the latest products and hosting factory visits **on Monday**. *В понедельник наш менеджер по продукции посещает клиентов, чтобы представить новейшие продукты и организовать посещение завода.*
3. The miners **have not excavated** the site **yet**. *Шахтеры еще не разрабатывали этот участок.*

Exercise 13. Correct the conversation between two miners using Present Simple or Present Progressive forms of the verb.

A: Hi, James! Nice to see you again!

B: Tom! What a surprise! Where **(1) (you / fly)** to?

A: I am on my way to the company which is located in Australia. I'll be working for Mining People International.

B: Really? So far from home, isn't it? **(2) (I / go)** to Bingham Canyon mine.

A: Oh, **(3) (you / work)** in the United States?

B: Yes. I work as an exploration geologist and I'm responsible for mapping, geochemical, structural and geophysical surveys.

A: OK. Do you have a set schedule or you are on call?

B: **(4) (we / have)** a set schedule but we reschedule twice a month. What about you?

A: I've just got this job as a petroleum geologist, so **(5) (I / have)** a meeting at the main headquarter. **(6) (you / know)** Salt Lake City? Your company is located there if I am not mistaken.

B: Not very well. My brother lives there. **(7) (I / not / go)** there very often. What your first project will be?

A: Don't know all the details. At the moment, **(8) (I / work)** on a project that designs and management of Brownfields and Greenfields exploration drilling programs. **(9) (you / interpret)** cross-sections? How can you work such long hours in the field? My job is mostly at the office.

B: **(10) (things / go / well)** if you follow some safety precautions and as I said we have some shifts.

A: I see. **(11) (my plane / board)** and I've got to go. Bye.

(abridged from: <https://www.careermine.com/job/1978435/project-exploration-geologist/>)

Grammar

Active Voice Revision: Past Tenses

Изменяя форму глагола для описания действий в прошедшем времени, мы можем делать акцент на:

- ▶ законченности действия в прошлом;
- ▶ процессуальной составляющей действия в прошлом;
- ▶ том, что действию в прошлом предшествовало другое действие.

See Appendix A: Grammar (Past Tenses), табл. 1.5, 1.6.

Study the examples:

1. **Last year** I participated in Product Quality Reviews and Issue Resolution meetings. I **didn't give** presentations at the local industry conferences. *В прошлом году я участвовал в обзорах качества продукции и встречах по разрешению проблем. Я не выступал на местных отраслевых конференциях.*
2. **Were you carrying** coal to a dewatering plant **when** our boss phoned? *Несли ли вы уголь на установку обезвоживания, когда звонил наш босс?*
3. **Before** we extracted the precious minerals, we **had conducted** a geological survey. *Перед тем, как добыть драгоценные полезные ископаемые, мы провели геологическое изучение.*

Exercise 14. Meet Simone Hensher: Mining Engineer, Safety Ambassador, Diversity Champion. Match the main events in her life with the correct background situations.

1. In September 2010 – Simone's children went to elementary school (full time) and she had applied for a scholarship with Glencore Canada's Sudbury and received it.
 2. In 2015 – Simone transferred to Nickel Rim South Mine and worked as an underground front line supervisor from 2016 to 2017.
 3. In October 2018 – Simone became part of Glencore Canada's Sudbury Integrated Nickel Operations (INO).
 4. In March 2018 – The Workplace Safety North provided Simone with supervision in the field of safety.
 5. In June 2018 – Simone took home the award for top technician in The Workplace Safety North (WSN) 69th Annual Ontario Mine Rescue Competition.
- a) She was studying books and having extensive hands-on training at a workplace.
 - b) She was participating in the competition amongst technicians and got a tremendous result for a first-timer.
 - c) She was studying geological engineering at the university.

- d) She was developing and training employees to standards for safe and efficient equipment operation.
- e) She was working as an underground front line supervisor in INO.

Exercise 15. Listen to Schlumberger Career profile. Ask Elena about her (responsibilities, career, activities in mining, experiences). Use Past Simple, Past Progressive or Past forms of to be.

Interviewer: _____

Elena: Schlumberge had one of the best training programmes.

Interviewer: _____

Elena: Similar to doctors made a medical imaging, I used imaging techniques from outside and I made a picture of what a subsurface looked like in order to find oil and gas.

Interviewer: _____

Elena: The culture. It's so diverse! I met different people at my job and they are really, really supportive.

Interviewer: _____

Elena: We went to a course called "Oil field surveys" that was a kind of an introductory course, we had a week of just meeting with professionals.

Interviewer: _____

Elena: They talked to as about the benefits, they answer any of our questions.

(abridged from: <https://youtu.be/7Zas-2S2SBg>)

Grammar

Active Voice Revision: Future tenses and "to be going to"

Изменяя форму глагола для описания действий в будущем времени, мы можем делать акцент на:

- ▶ прогнозах на будущее;
- ▶ спонтанных решениях;
- ▶ выражении надежды, обещания или опасения;
- ▶ отдаленных планах и намерениях.

See Appendix A: Grammar (Future Tenses and "to be going to"), табл. 1.7, 1.8.

Study the examples:

1. Will you **be able to perform** long-range planning duties as well as short-range engineering after your graduation? *Сможете ли вы выполнять обязанности по долгосрочному планированию, а также краткосрочному проектированию после окончания учебы?*
2. She **is going to** become an underground mining engineer. *Она собирается стать горным инженером по подземным работам.*

3. I **promise I'll come** to the meeting with engineering and geology teams. *Я обещаю, я приду на встречу с инженерно-геологическими командами.*

Exercise 16. Match the questions to answers. Pay attention to different future forms. More than one answer is possible.

1. How are you getting there?
 2. What's happening?
 3. Where are you going?
 4. What will you do there?
 5. What are you doing?
 6. What your workplace will be like?
-
- a) He is examining the shape of a land masses.
 - b) I am going to the Lab to analyse data from the reflected sound waves.
 - c) They are studying magnetic field.
 - d) We are going by a crew bus.
 - e) I am applying gravimeters for studying the earth's gravitational pull.
 - f) I think, survey an oil concession on the shore.
 - g) Probably, it will be one of rural and remote locations.

Speaking

Plans

Exercise 17. What will you be doing in 10 years' time?

I will be working in _____
I will be probably working for _____
I will have _____
I won't be _____

Exercise 18. Work in pairs. Look at these hazardous situations and explain what you will do.

1. While working you can face falls of ground underground or collapse of trenches.
*What **will** you do, if you see collapse of trenches?*
2. It's hot and humid in the field. A common health risk that geologists face is thermal – or heat – stress, dehydration.
*What **will** you do if you feel hot?*
3. Much of the vehicle work is true off-road, with no tracks at all, picking a way through the scrub.
*What **will** you do if you your vehicle breaks?*
4. Geophysicist might have exposure, ultraviolet rays can put you at risk of skin cancer and can cause damage to your eyes.
*What **will** you do if you are **outdoors**?*

5. Geophysicist also might disturb animals by careless actions.

*What **will** you do if you see a wild animal?*

- ▶ Apply safe handling and proper disposal;
- ▶ put on personal hearing protection;
- ▶ put on protective eye wear;
- ▶ stand close to the team, weave hands, shout together, and don't run away;
- ▶ use using an oxygen self-rescuer;
- ▶ apply sunscreen;
- ▶ put on some respiratory protective equipment and clothing with cooling systems or breathable fabrics;
- ▶ call rescue team.

(abridged from: <https://www.miningreview.com/health-and-safety/mining-health-safety-7-common-risks-to-protect-yourself-against/>; https://www.researchgate.net/publication/296601283_Hazards_faced_by_geologists)

UNIT 2

THE EARTH'S CRUST AND USEFUL MINERALS

UNIT 2A. SEDIMENTARY ROCKS

Learning objectives

In this part you will:

- ▶ acquire the vocabulary connected to the properties of sedimentary rocks;
- ▶ study WORD-FORMATION patterns relevant to describe the formation and size of rock grains;
- ▶ listen about size of rocks;
- ▶ read about the rock cycle;
- ▶ speak on the composition, location and geological formation processes of sedimentary rocks;
- ▶ review passive voice;
- ▶ do a professional test on sedimentary rocks.

Before you read

Sedimentary rocks are one of three main types of rocks, along with igneous and metamorphic. They are formed on or near the Earth's surface from the compression of ocean sediments or other processes.

(abridged from: <https://www.rainbowresource.com/product/023467/Sedimentary-Rock-Bag---Set-of-6-Rocks.html>)

Exercise 1. Practice to pronounce of the following words and word combinations correctly:

Erosion	[ɪˈrəʊ.ʒən]	Эрозия
Weathering	[ˈweð.ər.ɪŋ]	Выветривание

Dissolution	[dɪs.əˈluː.ʃən]	Растворение
Precipitation	[prɪˌsɪp.ɪˈteɪ.ʃən]	Осадки Осаждение
Lithification	[ˌlɪθɪfɪˈkeɪʃ(ə)n]	Литификация (окаменение)
Accumulation	[əˌkjuː.mjəˈleɪ.ʃən]	Накопление
Boulder	[ˈbəʊl.dər]	Валун
Raw material	[ˌrɔː məˈtɪə.ri.əl]	Исходный материал
Mud	[mʌd]	Ил
Stone	[stəʊn]	Камень
Deposit	[dɪˈpɒz.ɪt]	Месторождение
Clay	[kleɪ]	Глина
Bottom of the ocean	[ˈbɒt.əm] [əv /ðiː] [ˈəʊ.ʃən]	Дно океана
Body of water	[bɒd.i] [əv] [ˈwɔː.tər]	Водный источник / водное пространство / водоем
Overlying sediments	[ˌəʊvəˈlaɪnɪŋ] [ˌəʊvəˈlaɪnɪŋ]	Перекрывающая осадочная порода
Detrital rock	[dɪˈtraɪt(ə)l] [rɒk]	Обломочная горная порода
Detritus	[dɪˈtraɪtəs]	Детрит
Debris	[dəˈbriː]	Обломки пород
Decay	[dɪˈkeɪ]	Слой разложившихся останков животных и растений
Clastic rock	[ˈklastɪk] [rɒk]	Крупнообломочная / грубообломочная порода
Sandstone	[ˈsændstəʊn]	Песчаник
Caves	[ˈkeɪvz]	Пещеры
Shells	[ˈʃelz]	Ракушки
Limestone	[ˈlaɪmstəʊn]	Известняк
Cave formations	[ˈkeɪv][fɔːrˈmeɪʃn]	Вторичные минеральные отложения
Stalagmites	[ˈstæləɡmaɪts]	Сталагмиты
Stalactites	[ˈstæləktaɪts]	Сталактиты
Bedrock	[ˈbedrɔːk]	Коренная подстилающая порода
The floor of the cave	[ðiː] [flɔːr] [əv] [ˈkeɪv]	Дно пещеры
Acidic	[əˈsɪdɪk]	Кислотный
Sandy	[ˈsændɪ]	Песчаный
Chemical-rich	[ˈkemɪkl]-[rɪtʃ]	Богатый химическими элементами

Break down	[breɪk] [daʊn]	Разлагать
Wear away	[weə] [ə'wei]	Исчезать
Dry up	[draɪ]	Высушивать
Be compacted into	[kəm'pækt] ['ɪn.tu:]	Быть плотно уложенным
Break up	['breɪk ʌp]	Разламывать
Pick up	['pɪk ʌp]	Подхватывать
Evaporate	[ɪ'væpəreɪt]	Испаряться

FORMATION OF SEDIMENTARY ROCKS

Sedimentary rocks are formed on or near the Earth's surface, in contrast to metamorphic and igneous rocks, which are formed deep within the Earth. The most important geological processes that lead to the creation of sedimentary rocks are erosion, weathering, dissolution, precipitation, and lithification.

Erosion and weathering include the effects of wind and rain, which slowly break down large rocks into smaller ones. Erosion and weathering transform boulders and even mountains into sediments, such as sand or mud. Dissolution is a form of weathering – chemical weathering. With this process, water that is slightly acidic slowly wears away stone. These three processes create the raw materials for new, sedimentary rocks.

Precipitation and lithification are processes that build new rocks or minerals. Precipitation is the formation of rocks and minerals from chemicals that precipitate from water. For example, as a lake dries up over many thousands of years, it leaves behind mineral deposits; this is what happened in California's Death Valley. Finally, lithification is the process by which clay, sand, and other sediments on the bottom of the ocean or other bodies of water are slowly compacted into rocks from the weight of overlying sediments.

Sedimentary rocks can be organized into two categories. The first is detrital rock, which comes from the erosion and accumulation of rock fragments, sediment, or other materials – categorized in total as detritus, or debris. The other is chemical rock, produced from the dissolution and precipitation of minerals.

Detritus can be either organic or inorganic. Organic detrital rocks form when parts of plants and animals decay in the ground, leaving behind biological material that is compressed and becomes rock. Coal is a sedimentary rock formed over millions of years from compressed plants. Inorganic detrital rocks, on the other hand, are formed from broken up pieces of other rocks, not from living things. These rocks are often called clastic sedimentary rocks. One of the best-known clastic sedimentary rocks is sandstone. Sandstone is formed from layers of sandy sediment that is compacted and lithified.

Chemical sedimentary rocks can be found in many places, from the ocean to deserts to caves. For instance, most limestone forms at the bottom of the ocean from

the precipitation of calcium carbonate and the remains of marine animals with shells. If limestone is found on land, it can be assumed that the area used to be under water. Cave formations are also sedimentary rocks, but they are produced very differently. Stalagmites and stalactites form when water passes through bedrock and picks up calcium and carbonate ions. When the chemical-rich water makes its way into a cave, the water evaporates and leaves behind calcium carbonate on the ceiling, forming a stalactite, or on the floor of the cave, creating a stalagmite.

(abridged from: <https://www.nationalgeographic.org/encyclopedia/sedimentary-rock/>)

Exercise 2. Decide if the following statements are true or false. Correct the false ones.

1. The most important geological processes that lead to the creation of sedimentary rocks is precipitation.
2. One of the best-known clastic sedimentary rocks is sandstone.
3. If limestone is found on land, it can be assumed that the area used to be under water.
4. Erosion and lithification transform boulders and even mountains into sediments, such as sand or mud.
5. Coal is a sedimentary rock formed over millions of years from compressed plants.
6. The first is chemical rock, which comes from the erosion and accumulation of rock fragments, sediment, or other materials – categorized in total as detritus, or debris.
7. Organic detrital rocks are formed from broken up pieces of other rocks, not from living things.

Exercise 3. Read the text again and fill in the table.

Sedimentary rock	Host rock / source material	Formation process	Description of the process	Typical location

Use can use the following information:

Formation processes:

erosion, weathering, dissolution, precipitation, and lithification, cementation, compaction.

Sedimentary rocks:

detrital rock / clastic rock: coal, sandstone; chemical rock: limestone, stalagmites, stalactite.

Location:

on the bottom of different bodies of water (oceans, lakes), on land, deserts, on the floor of the caves, on the ceiling of the cave.

Sources:

boulders, sand, mud, stone, raw minerals, parts of plants and animals decay, pieces, of other rocks, shells, calcium and carbonate ions, marine animals.

Short description of the process:

break down large rocks into smaller ones, biological material that is compressed and becomes rock, transform boulders and even mountains into sediments, acid wears stone away, water passes through bedrock and picks up calcium and carbonate ions, precipitation leaves behind mineral deposits, the water evaporates and leaves behind calcium carbonate on the ceiling, sediments are compacted into rocks, from the weight of overlying sediments, layers are formed from broken up pieces of other rocks.

Exercise 4. Match the words with their definitions.

1. Lithification.
2. Cementation.
3. Precipitation.
4. Erosion.
5. Weathering.
6. Compaction.
7. Transportation.
8. Deposition.
9. Sedimentation.

- a) the process of consolidating fine-grained sediments into rock;
- b) when the river reaches a lake or the sea, its load of transported rocks settles to the bottom;
- c) being gradually damaged and removed by the waves, rain, or wind;
- d) falling products of condensation in the atmosphere, as rain, snow, or hail;
- e) a river carries, or transports, pieces of broken rock as it flows along;
- f) the deposited rocks build up in layers, called sediments;
- g) the process by which clastic sediments become lithified or consolidated into hard, compact rocks, usually through deposition or precipitation of minerals;
- h) the processes by which rock is broken into smaller pieces by the action of the weather;
- i) the conversion of loose sediment into solid sedimentary rock.

Put the processes in the correct order:

Stage 1. Weathering

Stage 2. _____

Stage 3. _____

Stage 4. _____

Stage 5. _____

Stage 6. _____

Stage 7. _____

Stage 8. _____

Stage 9. _____

Stage 10. Sedimentary rock**Exercise 5. Match the verbs and prepositions and translate the collocations.**

- | | |
|------------------|------------|
| 1. Find | a) behind |
| 2. Dry | b) up |
| 3. Pick | c) from |
| 4. Be organized | d) down |
| 5. Make its way | e) into |
| 6. Pass | f) in / on |
| 7. Break | g) into |
| 8. Leave | h) up |
| 9. Transform | i) through |
| 10. Precipitate | j) from |
| 11. Be produced | k) away |
| 12. Be compacted | l) from |
| 13. Be formed | m) into |
| 14. Wear | n) into |

Exercise 6. Fill the gaps with the correct phrasal verbs (consult the text if necessary). Translate the sentences into Russian.

1. Stalagmites and stalactites form when water passes through bedrock and _____ calcium and carbonate ions.
2. Sedimentary rocks can be _____ two categories.
3. For example, as a lake _____ over many thousands of years, it _____ mineral deposits; this is what happened in California's Death Valley.
4. The other is chemical rock, _____ the dissolution and precipitation of minerals.
5. Other sediments on the bottom of the ocean or other bodies of water are slowly _____ rocks from the weight of overlying sediments.
6. Precipitation is the formation of rocks and minerals from chemicals that _____ water.
7. When the chemical-rich water _____ its way _____ a cave, the water evaporates and leaves behind calcium carbonate on the ceiling.
8. With this process, water that is slightly acidic slowly _____ stone.
9. Erosion and weathering include the effects of wind and rain, which slowly _____ large rocks into smaller ones.

10. For instance, most limestone _____ the bottom of the ocean from the precipitation of calcium carbonate and the remains of marine animals with shells.

Sedimentary rocks _____ or near the Earth's surface, in contrast to metamorphic and igneous rocks, which are formed deep within the Earth.

Exercise 7. Complete the table using the different forms of each word. Most of them can be found in the previous text.

Verb	Adjective / Past Participle	Noun
		Acid
	Deposited	
Form		
Penetrate		
	Compacted	
Precipitate		
		Erosion
Dissolve		
	Transported	
		Evaporation
	Accumulative	
Transform		
		Condensation
	Sedimentary	
Compress		Weathering
		Lithification
Cement		
		Category
Organize		
	Converted	
		Fragments
Extract		
Settle		

Exercise 8. Fill the blanks with the right word from each group of words given in the table.

1. Breccia is a clastic sedimentary rock that is _____ **of** large (over two-millimeter diameter) angular fragments.
2. The spaces between the large fragments can be filled with a matrix of smaller particles or a mineral _____ which binds the rock together.
3. Sedimentary rocks are formed by the _____ **of** sediments in the Earth's Crust.
4. Chemical sedimentary rocks, such as rock salt, iron ore, chert, flint, some dolomites, and some limestones, form when _____ materials precipitate from solution.
5. Coal is an organic sedimentary rock that forms mainly from plant _____.
6. The plant debris usually _____ **in** a swamp environment.
7. The weight of the sediments press the layers of the deposited sediments at the bottom. This is called _____.
8. Iron Ore is a chemical sedimentary rock that forms when iron and oxygen (and sometimes other substances) combine in solution and _____ as a sediment.
9. Liquid and gaseous hydrocarbons can be _____ **from** the oil shale, but the rock must be heated and/or treated with solvents.
10. The water is squeezed out from between the pieces of rock and crystals of different salts form. The crystals stick the pieces of rock together. This process is called _____.
11. Rock Salt is a chemical sedimentary rock that forms from the _____ **of** ocean or saline lake waters.
12. The deposited rocks build up in layers, called sedimentary rock. This process is called _____.
13. A river carries, or _____, pieces of broken rock as it flows along. When the river reaches a lake or the sea, its load of transported rocks _____ **to** the bottom.

(abridged from: <https://geology.com/rocks/sedimentary-rocks.shtml>; <https://www.bbc.co.uk/bitesize/guides/zgb9kqt/revision/3>)

Listening

Before you listen

Study the following patterns to describe size of rocks:

Sedimentary rocks are classified not only according to their composition but also according to the size of the particles or grains.

Crystalline and biocrystalline rocks are composed of *crystals or compacted shell fragments or plant remains*. It's called *crystal texture* (кристаллическая структура).

Clastic rocks are composed of *grains of different types*. It's called *grain texture* (зернистая структура).

Clay	-sized particles	Размером с зерно глины	Мелкозернистая землистая структура	Глиноподобные известняки
Silt		Размером с частицу ила	Мелкозернистая землистая структура	Глиноподобные известняки
Sand		Размером с частицу песка	Мелкозернистая землистая структура	Глиноподобные известняки
Pebble		Размером с гальку	Мелкозернистая структура	Мелкообломочные известняки
Cobble		Размером с булыжник	Крупнозернистая структура	Грубообломочные известняки
Boulder		Размером с валун	Крупнозернистая структура	Грубообломочные известняки

You can also use adjectives + particles / grains / fragments / shell fragments / remains:

- ▶ angular (угловатый);
- ▶ sub-angular (с притупленными углами или без углов);
- ▶ rounded (округлый);
- ▶ sub-rounded (полуокруглый);
- ▶ well-rounded (обтекаемый, окатный);
- ▶ coarse (крупнозернистый);
- ▶ very coarse (очень крупнозернистый);
- ▶ fine (мелкозернистый);
- ▶ very fine (очень мелкозернистый);
- ▶ medium (среднего размера);
- ▶ microscopic (микроскопический).

Exercise 9. Match the names of sedimentary rocks with their translations.

- | | |
|---------------------|-------------------|
| 1. Conglomerate | a) доломит |
| 2. Breccia | b) гипс |
| 3. Sandstone | c) известняк |
| 4. Siltstone | d) сланец |
| 5. Shale | e) конгломерат |
| 6. Rock salt | f) каменная соль |
| 7. Rock gypsum | g) каменный уголь |
| 8. Dolostone | h) алевролит |
| 9. Limestone | i) песчаник |
| 10. Bituminous coal | j) брекчия |

Exercise 10. Classify all the sediments into the following groups:

Clastic (fragmental) – обломочные горные породы

- 1) _____ rounded fragments.

- 2) _____ angular fragments.
- 3) _____ fine to coarse.
- 4) _____ very fine grain.
- 5) _____ compact, may split easily.

Crystalline rock – crystals that form chemical precipitates and evaporates (кристаллические горные породы)

- 1) _____.
- 2) _____.
- 3) _____.

Crystalline or Bioclastic (кристаллическая или биокластическая порода)

- 1) _____ precipitates of biological origin or cemented shell fragments.
- 2) _____ compacted plants remains.

Exercise 11. Label the pictures of some sedimentary rocks. Two of the pictures are not related to the sedimentary rocks.

Conglomerate, Breccia, Sandstone, Siltstone, Shale, Rock salt, Rock gypsum, Dolostone, Limestone, Bituminous coal.



1 _____



2 _____



3 _____



4 _____



5 _____



6 _____



7 _____



8 _____



9 _____



10 _____



11 _____



12 _____

Speaking

Exercise 12. Choose one of the pictures above and tell the class about the composition, location, geological formation processes, and size of grains of the rock.

It's located on _____

It's found in _____

It's composed of _____

It's made of compacted / cemented into grains / crystals / fragments of _____

It's precipitated from _____

It's deposited at _____

It includes _____ sized (grains / crystals / fragments)

It has _____

It was formed from _____

Exercise 13. Watch the video about the composition of sediments and fill the gaps.

1. Conglomerate is composed of all different size sediments compacted and cemented together. So you have big 1) _____, 2) _____, maybe even 3) _____ compacted with small sand, silt and clay. Notice that the sediments in a conglomerate are 4) _____.
2. Very similar to a conglomerate is a breccia. Breccia is made of different size sediments compacted and cemented together. The sediments in a breccia are not 5) _____. They are more 6) _____, 7) _____ and 8) _____.
3. Then we get to the sandstone. As you can imagine, sandstone is made of compacted 9) _____. Siltstone made of compacted 10) _____, and shale made of compacted 11) _____.
4. For the crystalline we have things called evaporates and precipitates. And for the organic rocks we have 12) _____ or bioclastic rocks.
5. Rock salt forms from 13) _____ which, of course, has salt dissolved in it. When that water 14) _____, all salt stays behind in form of 15) _____. Those crystals are rock salts. This is why it's called an 16) _____.
6. We also get other rocks like rock gypsum and 17) _____ are forming similar ways. A 18) _____ forms when a water sample is completely filled with a dissolved mineral so much so a dissolved mineral falls out of being dissolved in crystalizes in the bottom of a body of water.
7. We already know some examples of bioclastic compacted organic matter which include coal compacted of 19) _____.
8. One more key aspect of sedimentary rock is that is the only rocks that may contain 20) _____, or evidence of the past life.

(abridged from: <https://youtu.be/Etu9BWbuDIY>)

Grammar**The Passive Voice**

В страдательном залоге ПОДЛЕЖАЩЕЕ (существительное или местоимение) выражает ЛИЦО (или ПРЕДМЕТ), НА КОТОРОЕ НАПРАВЛЕНО ДЕЙСТВИЕ, выраженное глаголом-сказуемым. Действие производит лицо или предмет, выраженный существительным или местоимением в функции дополнения с предлогом by (кем).

See Appendix A: Grammar (The Passive Voice), табл. 2.1.

1. Study the flowing examples:
2. Many metals **are recycled**. Многие металлы перерабатываются.
3. The metal **is being heated**. Металл (сейчас) плавят.
4. The new method **was called** bronze. Этот новый металл называли бронзой.
5. While the copper **was being heated**, the tin was mixed in. Олово добавляли в то время, как плавил медь.
6. These methods **have been used** for years. Данные методы использовали годами.
7. Bronze **had already been discovered**. Уже тогда бронза была обнаружена.
8. The metals **will not be replaced**. Данный металл не будет замещен.
9. It's **going to be replaced**. Его не заменят.
10. Metals **can be made** better and stronger. Металл можно изготовить лучше и прочнее.
11. Bronze **may have been discovered** by accident. Возможно, бронза была обнаружена случайно.

(abridged from: Cambridge Active grammar B2 Level. Davis Fiona, Rimmer Wayne. 2011:143)

Exercise 14. Fill the gaps with the correct Passive form of the verb.

1. Today many of our energy minerals of major economic importance _____ (**provide**) with sedimentary rocks.
2. Sedimentary rocks _____ therefore _____ (**can, compose**) of grains of various sizes, shapes and compositions that _____, _____, _____ (**already, cemented, compressed, recrystallized**).
3. Salt deposits _____ also _____ (**find**) in the Maritime provinces and also in western Canada.
4. Other sedimentary rocks _____ (**can, form**) from deposits secreted by chemical solutions (chemical precipitates), or from deposits made up from the remains of dead organisms (both animals and plants).
5. Chalk _____ originally _____ (**be formed**) as seafloor ooze, and made up with the remains of trillions of foraminifera organisms known as coccoliths.
6. Beds of marls containing gypsum and rock salt _____ originally _____ (**be deposited**) in areas with high evaporation that were flooded by marine waters.

7. As their name suggests, sedimentary rocks _____ (**derive**) from pre-existing sediments.
8. The liberated grains _____ (**carry**) or _____ (**transport**) by various mechanisms to a place where they accumulate in sequences of sediments.
9. When these grains _____ (**be cemented**) by silica a different name is given – quartzite (see image to the right of sandstone).
10. New reserves from orebodies that _____ not previously _____ (**can, be mined**), and lower environmental footprint through selective mining and operations scaled to the orebody.
11. Post-depositional change from sediment to sedimentary rock _____ (**call**) diagenesis, and the end result is usually lithification, where the former unconsolidated sediment _____ (**turn**) to rock.
12. Dolostones _____ (**can, see**) close to Waterloo in certain rock sequences along the outcrop of the Niagara Escarpment.
13. In warm tropical waters abundant calcium in solution in seawater subject to strong current movements _____ (**may, precipitate**) around minute shell fragments.
14. If the sediment continues _____ (**transport**) the grain size is still further reduced and silt is formed.

(abridged from: <https://uwaterloo.ca/wat-on-earth/news/sedimentary-rocks>)

Exercise 15. Translate the following sentences into English.

1. Осадочные породы образуются в результате переотложения продуктов выветривания и разрушения различных горных пород, химического и механического выпадения осадка из воды.
2. Сейчас активно изучается период массового вымирания живых организмов около 374 млн лет назад.
3. Обломочные породы разделяются по степени цементации на два параллельных ряда: рыхлые и уплотненные.
4. На практических занятиях по геологии изучаются главнейшие типы горных пород.
5. В полимиктовых породах обломки могут быть представлены не только различными минералами, но и горными породами.
6. Разрезы на территории Кузбасса и Горного Алтая будут исследованы в ближайшем будущем.
7. По происхождению горные породы делятся на три группы: магматические (изверженные), осадочные и метаморфические.
8. В глубоких частях земной коры магма охлаждается медленно, хорошо раскристаллизовывается, и из неё формируются кристаллические зернистые породы (граниты).

9. Метаморфические горные породы образуются в толще земной коры в результате изменения (метаморфизма) осадочных или магматических горных пород.
10. Поры могут быть частично заполнены жидкостью, поэтому свойства горной породы зависят одновременно от свойств твёрдой, газообразной и жидкой фаз и их взаимного соотношения.

(abridged from: <https://www.booksite.ru/fulltext/1/001/008/011/871.htm>)

Scientific Corner Archives

Exercise 16. Put the words in the correct order to make sentences and do the test on Sedimentary rocks.

1. fizzes / which one of / with dilute / the following / hydrochloric acid? / sedimentary rocks
 - a) Limestone.
 - b) Sandstone.
 - c) Mudstone.
2. for making / which / is used / of the following / bricks? / rocks
 - a) Limestone.
 - b) Sandstone.
 - c) Mudstone.
3. rocks / to make / which / of the following / is used / cement?
 - a) Sandstone.
 - b) Limestone.
 - c) Conglomerate.
4. are good / because / many sedimentary / building / rocks / stones
 - a) They contain several different minerals.
 - b) They often contain fossils.
 - c) They can be cut and carved to make large blocks.
5. with limestone / crop / that type / would be / type of soils / treated / yields / what?
 - a) Acid soils.
 - b) Neutral soils.
 - c) Alkaline soils.

(abridged from: <https://www.geolsoc.org.uk/ks3/gsl/education/resources/rockcycle/page3646.html>)

UNIT 2B. WEATHERING OF ROCKS

Learning objectives

In this part you will:

- read about types of weathering;

- ▶ study lexical patterns with INTO to describe weathering processes;
- ▶ listen to people talking about a day at a modern mine;
- ▶ review grammar on CAUSE and EFFECT language;
- ▶ translate sentences into English using cause and effect language;
- ▶ learn how to describe pictures and speak on weathering effects;
- ▶ do a professional test on weathering.

Reading

Before you read

Exercise 1. Try to guess the words judging from the context:

1. Weathering is the alteration of rocks to more stable material from their exposure to the **a _ _ _ _ s** of air, water, and organic fluids.
2. Carbonic acid **d _ _ _ _ ves** away minerals in rock, especially the carbonate minerals that make up limestone and marble.
3. Other agents of chemical weathering are **g _ _ _ s** and **a _ _ _ s**.
4. Any process that exerts a **s _ _ _ ss** on a rock that eventually causes it to break into smaller fragments is a type of mechanical weathering.
5. Continued cycles of **f _ _ _ ing** and thawing in rocks containing water will cause them to fragment into smaller pieces.
6. Air **p _ _ _ tion** that contributes to weathering of rock generally contains weak **c _ _ _ _ _ _ _ tions** of strong acids such as sulfuric and nitric acid.
7. Rocks under pressure might form **c _ _ _ _ s** parallel to the surface when the overburden is removed by erosion, and the rocks expand from this pressure release. These **j _ _ _ _ s** are called exfoliation cracks.

Exercise 2. Match 1–9 to a–i to make collocations.

- | | |
|------------------|---------------|
| 1. Exposure to | a) mine sites |
| 2. Removed from | b) surface |
| 3. Frost | c) the site |
| 4. Occupying | d) products |
| 5. Sea | e) limestone |
| 6. Pockmarked | f) the agents |
| 7. Abandoned | g) a crack |
| 8. Water-soluble | h) wedging |
| 9. Make up | i) mist |

Exercise 3. Read the following text and headline the paragraphs.

1. How mechanical weathering occurs.
2. Weathering effects.
3. Weathering and the exposed rocks.
4. Mechanical and chemical weathering: definitions.

5. Weathering rates.
6. How chemical weathering occurs.

WEATHERING EFFECTS

A) _____

Weathering is the alteration of rocks to more stable material from their exposure to the agents of air, water, and organic fluids. No rock is stable or immune to weathering. Many pathways and agents are involved in weathering, but most can be grouped into two main processes: mechanical and chemical weathering.

B) _____

Mechanical weathering includes processes that fragment and disintegrate rocks into smaller pieces without changing the rock's mineral composition. Chemical weathering is the alteration of the rock into new minerals. Both pathways constitute weathering, but one process may dominate over the other.

The two processes can be demonstrated with a piece of paper. It can be torn into smaller pieces, which is analogous to mechanical weathering. It also can be burned into carbon dioxide and water, which is analogous to chemical weathering.

A rock that is weathered into new minerals but still looks somewhat like the parent rock is called a saprolite. If the saprolite fragments are subsequently removed from the site by water, wind, gravity, or ice, erosion has taken place.

C) _____

Any process that exerts a stress on a rock that eventually causes it to break into smaller fragments is a type of mechanical weathering. The process of water freezing in rocks is probably one of the most important forms of mechanical weathering. On freezing, water expands 9 percent. If it is occupying a crack completely, the crack will grow. Continued cycles of freezing and thawing in rocks containing water will cause them to fragment into smaller pieces. This is called frost wedging.

The absorption of water by swelling clays, called smectites, causes rocks to split. Plant roots also wedge themselves into cracks in rocks and break them up. Forest fires cause the outsides of rocks to expand, crack parallel to the surface, and eventually “spall” off. Salt crystals might form in pores of rocks from the evaporation of sea mist and cause the pores to break apart. Rocks under pressure from an overburden of rocks and sediment might form cracks parallel to the surface when the overburden is removed by erosion, and the rocks expand from this pressure release. These joints are called exfoliation cracks.

Each of these is an example of mechanical weathering: The rocks have shattered, but their minerals have remained the same. Examples of mechanical weathering are dominant in cold climates, where chemical weathering occurs at such slow rates that the fragmentation processes are obvious.

D) _____

The process of chemical weathering generally occurs in the soil where water and minerals are in constant contact. Agents of weathering are oxygen, air pollution, water,

carbonic acid, and strong acids. They combine with the minerals in rocks to form clays, iron oxides, and salts, which are the endpoints of chemical weathering.

This photograph shows differential weathering of a fractured rock surface. Water has preferentially gained access to the large fractures running from upper left to lower right and has weathered these areas faster than the rock face. The pockmarked surface represents an intensely fractured part of the rock that was later filled with silica. Silica is harder than the original rock, so as the rock weathers away, the silica, marking the fracture lines, stands out in bold relief.

This photograph shows differential weathering of a fractured rock surface. Water has preferentially gained access to the large fractures running from upper left to lower right and has weathered these areas faster than the rock face. The pockmarked surface represents an intensely fractured part of the rock that was later filled with silica. Silica is harder than the original rock, so as the rock weathers away, the silica, marking the fracture lines, stands out in bold relief.

Water plays a very important role in chemical weathering in three different ways. First, it combines with carbon dioxide in the soil to form a weak acid called carbonic acid. Microbe respiration generates abundant soil carbon dioxide, and rainwater (also containing atmospheric carbon dioxide) percolating through the soil provides the water. Carbonic acid slowly dissolves away minerals in rock, especially the carbonate minerals that make up limestone and marble. The weak acid decomposes the insoluble rock into water-soluble products that move into the groundwater. In high concentrations, these dissolved minerals can cause the water to be considered “hard”.

Second, water can hydrate minerals by being adsorbed onto the mineral lattice. The conversion of anhydrite into gypsum is an example.

Finally, the water can break up minerals through hydrolysis. The most common group of minerals, the silicates, is decomposed by this process. Reactive hydrogen ions that are liberated from the water attack the crystal lattice, and the mineral decomposes.

Other agents of chemical weathering are gases and acids. Oxygen combines with the metals in minerals to form oxides such as hematite, limonite, and goethite. They are just like the rust that forms on metal exposed to rain or moisture. Air pollution that contributes to weathering of rock generally contains weak concentrations of strong acids such as sulfuric and nitric acid. Strong acids escaping from steam vents around volcanoes and abandoned mine sites can also contribute to increased weathering of nearby rocks.

E) _____

What would happen to an outcrop of granite that was exposed to the agents of weathering in a humid, warm environment over millions of years? The quartz grains would be liberated as sand grains. They are very resistant to chemical weathering and stay in the system to make up streambeds, beaches, and dunes. The feldspar minerals would be converted into clays and salts. The biotite and amphibole minerals would become iron oxides and clays.

If no erosion occurred at the site, there would be a soil of clay and iron oxides with some sand grains. Most of the salt would have been removed by groundwater. The large concentration of salts in the oceans is a result of chemical weathering of rocks on land, with the weathered constituents being washed into the seas. Clays are very stable and make up the majority of the most abundant sedimentary rocks – shale.

F) _____

First, the more water in the system, the faster the weathering. Second, the higher the temperature, the faster the weathering. So, the fastest rates of chemical weathering tend to occur in the hot, humid tropics. Third, the more mineral surface area exposed in the rock by joints, the faster the weathering. The increased number of cracks in the rock will allow the agents of water and oxygen to interact more intensely with the minerals.

Finally, the type of minerals in the rock will also dictate rates. For example, rocks with less quartz and more calcium feldspars (mafic igneous rocks) will weather faster than rocks with more quartz and sodium feldspars (felsic igneous rocks).

(abridged form: <http://www.waterencyclopedia.com/Tw-Z/Weathering-of-Rocks.html#ixzz6ltd2ysTx>)

Exercises 4. Read the text again and answer the following questions using key words from the text:

1. What are the types of weathering agents?
2. How many types of weathering were mentioned in the text?
3. How are the weathering expects usually demonstrated?
4. In what way air pollution can influence the rocks composition?
5. What is the reason for the increased number of cracks in the rocks?
6. How are streambeds, beaches, and dunes made?
7. Is there any difference among weathering rates?
8. In what way animals can influence rock structure?

Exercise 5. Match the words to their definitions.

1. Streambeds
2. Exposed to the agents
3. Parent rock
4. Exfoliation crack
5. Abandoned mine sites
6. Frost wedging
7. Overburden of rocks
8. Pockmarked surface
9. Decompose mineral

- a) (waist or spoil) that lies above an area that lends itself to economical exploitation.
- b) Break-up of rock by the pressure of water freezing in cracks.

- c) Having no protection from bad weather or not covered.
- d) That tends to be uniform and lack fractures.
- e) To break something or to decay into smaller parts.
- f) Marked with traces left after spots / pores.
- g) The original *rock* from which something else was formed long, narrow, sloping depression on land that is shaped by flowing water.
- h) No longer being used or cared.

(abridged from: <https://dictionary.cambridge.org/ru/>)

Exercise 6. Match 1–11 to a–k to make collocations.

INTO – used to show when a person or thing is changing from one form or condition to another.

Предлог into используется в значении «проникнуть внутрь», «превращать / превращаться», «разделаться на», «направление действия внутрь чего-либо (куда?)».

1. The feldspar minerals would be converted
2. Alteration of the rock
3. Be torn
4. Move
5. Be burned
6. Break
7. Be grouped
8. Be weathered
9. Wedge (itself)
10. The conversion of anhydrite
11. Decompose the insoluble rock

- a) into smaller split fragments
- b) into the groundwater
- c) into two main processes
- d) into gypsum
- e) into clays and salts
- f) into water-soluble products
- g) into cracks in rocks
- h) into carbon dioxide and water
- i) into new mineral
- j) into new minerals
- k) into smaller pieces

(abridged from: <http://www.waterencyclopedia.com/Tw-Z/Weathering-of-Rocks.html>)

Speaking

Picture Description

Описывая иллюстрации, необходимо ответить на следующие вопросы:

- ▶ что находится на иллюстрации;
- ▶ где находится объект;
- ▶ что происходит (имеет ли место какой-либо процесс).

Study the following examples:

1. **In the picture**, I can see the plant.
2. It's **in the middle of** the picture.
3. **It looks like** it's wedging itself into a stone.
4. It **might** lead to cracks in the stone.

Exercise 7. Classify the following language constructions into 4 columns:

What's in the picture	What is happening	Where is the picture	If something is not clear

It's snowing / The picture demonstrates / There is / there are / On the left / right of the picture / It looks like a ... / At the top / bottom of the picture / The picture shows / The man is ...ing / It might be a ... / The people are ...in / _____ is shown / it could be ...ing / In the picture, I can see ... / Maybe it's a ... / In the middle of the picture.

(abridged from: <https://learnenglishteens.britishcouncil.org/exams/speaking-exams/describe-photo-or-picture>)

Exercise 8. Look at pictures and describe phases of weathering processes. Two of the pictures doesn't show the weathering processes.



1 _____



2 _____



3 _____



4 _____



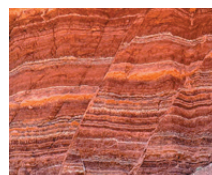
5 _____



6 _____



7 _____



8 _____

Grammar

Cause and Effect Language (язык для описания причины и следствия)

Для описания причины и следствия в английском языке могут быть использованы существительные, глаголы / слова связки со значением причины:

- ▶ result of / reason of / source of / cause of;
- ▶ to cause / to lead to / to affect / to result in;
- ▶ because of / due to / as a result of.

See Appendix A: Grammar (Cause and Effect Language), табл. 2.2.

Study the following examples:

1. The large concentration of salts in the oceans is **a result of** chemical weathering of rocks on land. *Высокая концентрация солей в океанах является результатом химического выветривания горных пород на суше.*
2. Cracks in the rocks **are usually caused by** freezing water occupying and braking rocks into smaller fragments. *Трещины в горных породах обычно возникают из-за того, что замерзающая вода захватывает и разбивает камни на более мелкие фрагменты.*
3. The water attack on the crystal lattice of minerals and the silicates **results in** their decomposition through hydrolysis. *Воздействие воды на кристаллическую решетку минералов и силикатов приводит к их разложению в результате гидролиза.*

Exercise 9. Translate the sentences into English using the cause and effect language.

1. Биогенное выветривание приводит к механическому разрушению пород. Причиной разрушения становятся корни растений, расширяющие трещины в породе, а также роющие организмы (черви, муравьи, термиты, суслики).
2. Охлаждение и нагревание приводит к изменению объема горных пород и минералов.
3. Различие температур в частях массива приводит к образованию трещин, направленных параллельно его поверхности. Вследствие этого происходит отслаивание пород.
4. В результате физического выветривания образуются особые формы ландшафта. Если выветривание происходит в горной области, где имеются плоские горизонтальные поверхности, то продукты выветривания накапливаются на них в виде глыб мелкого дресвяного материала.
5. Процессы химического разложения приводят к разрушению кристаллических решёток минералов.

6. Причинами физического выветривания являются изменение температуры, замерзание – оттаивание воды и действия роющих животных, а также корневая система растений.

(abridged from: <https://www.geolib.net/lithology/vyvetrivanie.html#i-4>; <https://www.geolib.net/lithology/vyvetrivanie.html#i-4>; http://popovgeo.sfedu.ru/lecture_5#Vivetrivanie)

Listening

Part 1. Revision

Exercise 10. Listen to the talk about weathering and do the test on weathering processes.

- Weathering breaks small rocks down into soil, sand or even tiny particles called _____.
 - Sediments
 - Precipitants
 - Row minerals
 - Stalagmites
- Temperature, water, wind, or even plants are the causes or _____ of weathering:
 - Agents
 - Powers
 - Movers
 - Actors
- When water freezes in cracks in the rocks it _____.
 - Expend
 - Contracts
 - Dissolves
 - Solidifies
- The force of water can _____ rocks.
 - Split rocks apart
 - Move
 - Deposit
 - Squeeze
- The flowing action of water slowly _____ of rocks away.
 - Wears the surface
 - Wears the inner part
 - Squeeze the inner part
 - Dissolve the surface
- When water flows over rocks it can not only cause a physical change, it can cause a change _____ to the different chemical materials.
 - Inside the rock

- b) Outside the rock
 - c) Around the rock
 - d) In cracks of the rock
7. Water cause a chemical change. It was able to _____ some of the materials inside the rock.
- a) Dissolve
 - b) Precipitate
 - c) Transform
 - d) Erode
8. Just like that sand blaster overtime wind can weather away the surface of land forms changing_____
- a) The way they look
 - b) Their composition
 - c) Their deposition
 - d) Formation
9. It's getting warmer now, and some of the materials in the rock are _____ with the heat.
- a) Compressing
 - b) Settling down
 - c) Expanding
 - d) Precipitating
10. Some of the materials in the rock are expending slowly. When the Sun goes down, they _____ at different speeds too.
- a) Contract
 - b) Compress
 - c) Cement

(abridged from: <https://youtu.be/BxmAJMjJ5Nk>)

Listening

Exercise 11. Listen to the recording for details. Listen and complete the facts about a day at a modern mine.

- 1. We produce _____ of diamonds every day.
- 2. Every day when we start out shift, we start with out _____.
- 3. _____ are waiting for us outside.
- 4. We've been running for over _____ years as an open pit.
- 5. We have _____ pits that we have primary been mining.
- 6. By _____ undergoing we extending the life of our mine.
- 7. Not all rock is the same, we drill _____ meters into the face at _____ degrees to the horizontal in an approved blast pattern.
- 8. We take safety very seriously. Here we are in a refuge chamber (шахтно-спасательная камера) which can accommodate _____ people.

9. The both shafts will be _____ deep when completed.

10. _____ is used in mining operations to break rock.

(abridged from: https://www.youtube.com/watch?v=pa6q5MPqKao&ab_channel=angloamerican)

Exercise 12. Listen to Stephan Hlohowskyj talking about the basics of Geology and answer the following questions:

1. What is a project: the high definition earth viewing experiment?
2. How exactly do we study the earth?
3. Why is it important for geologists to study the rocks?
4. What is a basic concept in geology ?
5. How do you explain the “rock cycle”?
6. Why understanding of Igneous rocks will give us a good foundation in geology and mining?
7. How can you describe the method of formation and characteristics of igneous rock?

(abridged from: <https://www.youtube.com/watch?v=rAYiBSO3JKY>)

Scientific Corner Archives

Exercise 13. Put the words in the correct order to make sentences and do the test on weathering processes.

1. it: / to split / it / water / because / rocks / has the power / freezes / when /
 - a) Contracts.
 - b) Evaporates.
 - c) Expands.
2. is commonly / rocks / by solution / which of the following / weathered / sedimentary
 - a) Limestone.
 - b) Sandstone.
 - c) Mudstone.
3. weathering / is most likely / that are: / in environments / to take place / chemical
 - a) Cold.
 - b) Wet.
 - c) Dry.
4. to observe / would you / in which type / be most likely / biological / to observe / of environment / weathering
 - a) A hot desert.
 - b) A high mountain.
 - c) A rocky sea-shore.
5. group / by chemical (hydrolysis) / a common / weathering is: / mineral / produced by

- a) Clay.
- b) Mica.
- c) Feldspar.

(abridged from: <https://www.geolsoc.org.uk/ks3/gsl/education/resources/rockcycle/page3639.html>)

UNIT 2C. IGNEOUS ROCKS

Learning objectives

In this part you will:

- ▶ read about the composition of igneous rocks;
- ▶ review grammar on participles;
- ▶ translate sentences into English using participles;
- ▶ listen to scientists talking about the types of igneous rocks;
- ▶ revise the passive voice;
- ▶ revise prepositions of location and movement;
- ▶ write a short process description;
- ▶ do a professional test on igneous rocks.

FORMATION OF IGNEOUS ROCKS AND FORMS OF IGNEOUS BODIES

Exercise 1. Do the matching task and translate the words and their definitions.

1. Cooling
2. Intrusive rocks
3. Igneous rocks
4. Solidification
5. Extrusive rocks
6. Melted minerals

a) Resulted from the process when magma force itself through a crack or fault in the rock at the Earth's surface.

b) Formed from magma forced into older *rocks* at depths within the Earth's crust, which then slowly solidifies below the Earth's surface.

c) Having turned soft or into a liquid.

d) Having the temperature lower.

e) The act or process of changing from being a liquid or gas to a solid form (of rocks) formed from magma (= very hot liquid rock that has cooled).

Exercise 2. Fill the gaps with Passive forms of the verb. Watch the video “What are igneous rocks” and check the answers <https://youtu.be/PrN7jygu4cQ>.

Earth's crust 1) _____ (make up) of different types of rocks the rocks which make up the maximum *volume* of the Earth's crust 2) _____ (call) igneous rocks. The word igneous 3) _____ (derive from) the Latin word “Ignace” which means fire. These rocks 4) _____ (associate with) volcanic eruptions.

Let's study more about *igneous rocks* and how they 5) _____ (form). The liquid rock matter that we see coming out from volcanoes 6) _____ (call) magma. It is a hot liquid made of melted minerals. When this *magma* reaches the Earth's surface 7) _____ (know as) lava. The cooling and the solidification of lava at the Earth's surface result in the formation of extrusive igneous rocks which are also known as volcanic rocks.

Due to rapid cooling their crystals are fine-grained. However, some of the magma can't come out and settles inside the surface. The magma cools slowly beneath the Earth's surface as it is completely 8) _____ (surround by) the soil and rock presented there. The cooling and the solidification of magma at a depth within the Earth's crust result in the formation of rocks having large crystals known as intrusive igneous rocks.

We have learned that igneous rocks are of two types extrusive igneous rocks and intrusive igneous rocks. It is interesting to know that igneous rocks were the first to be formed and are also known as primary rocks. Pumice and obsidian are extrusive igneous rocks. *Pumice* 9) _____ (use in) making lightweight concrete and obsidian is used in ornaments.

Granite and diorite are intrusive igneous rocks both they used as building material. To summarize, igneous rocks are of two types extrusive igneous rocks and intrusive igneous rocks. The cooling and the solidification of lava at the Earth's surface result in the formation of *extrusive igneous rocks*. They 10) _____ also _____ (know as) volcanic rocks. The cooling and the solidification of magma at a depth within the Earth's crust result in the formation of intrusive igneous rocks.

(abridged from: <https://youtu.be/PrN7jygu4cQ>)

Exercise 3. Answer the following questions to make sure that you've understood the text:

1. What are the two types of igneous rocks?
2. What is magma?
3. What is lava?
4. What is special about igneous rocks in geology?
5. How are igneous rocks formed?
6. What is the difference between intrusive and extrusive rocks?
7. What are the two types of extrusive igneous rocks?
8. What are the two types of intrusive igneous rocks?
9. Where extrusive and intrusive rocks can be used?

Exercise 4. Match geological bodies with their definitions and label the picture below.

NB! **Geological body** – пласт (букв. «геологическое тело»), форма залегания горной породы / структура залегания горной породы.

Четко ограниченная часть земной коры, сложенная одной горной породой или комплексом пород одного происхождения и близкого возраста.

Ср.: igneous body / ore body / sedimentary bodies.

(abridged form: *www. Glossary.ru*)

1. Volcanic neck (жерловина, столообразное тело)
2. Sill (силь; пластовая интрузия)
3. Dike (дайка)
4. Stock (шток)
5. Batholith (батолит)
6. Laccolith (лакколит)

a) an igneous intrusion that has a surface exposure of less than 100 square kilometres (40 sq mi), differing from batholiths only in being smaller.

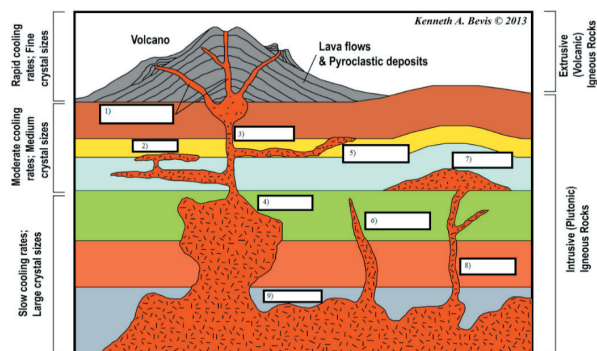
b) is a vertical or near vertical intrusive igneous rock body that cuts across rock beds. They frequently form from explosive eruptions that crack the area around a volcano with the magma filling the cracks.

c) a dome shaped intrusive body that has intruded between layers of sedimentary rock. The rising magma forces the overlying layers to rise up into a dome.

d) is similar to a dike with the exception that they run parallel to the existing rock bed instead of cutting through it.

e) the largest of the intrusive bodies. They are larger than 100 square kilometers and usually form granite cores cooled magma deep in the Earth's crust.

f) a column of igneous rock that is formed by congelation of lava or the consolidation of volcanic breccia in the conduit of a volcano.



(abridged from: <https://www.pinterest.ru/pin/445786063116019998/> ; <http://volcano.oregonstate.edu/book/export/html/1055>)

Exercise 5. Classify all the bodies listed above into two types of intrusive bodies:

<i>Discordant</i> – грибообразная несогласная интрузия	<i>Concordant</i> – согласная (конкордантная) интрузия
The one that cuts across the pre-existing rock bed	The one that runs parallel to the pre-existing bedrock

Exercise 6. Prepositions.

inside / in, around, below, within, beneath, through, out, up, from, into, away, upward, on, between.

1. Resulted from the process when magma force itself _____ a crack or fault in the rock at the Earth's surface.
2. Formed from magma forced into older *rocks* at depths _____ the Earth's crust, which then slowly solidifies _____ the Earth's surface.
3. The liquid rock matter that we see coming _____ from volcanoes is called magma.
4. The magma cools slowly _____ the Earth's surface as *it* is completely surrounded by the soil and rock presented there.
5. The cooling and the solidification of magma at a depth _____ the Earth's crust result _____ the formation of intrusive igneous rocks.
6. They frequently form from explosive eruptions that crack the area _____ a volcano with the magma filling the cracks.
7. The conduit was probably fractures _____ the Earth rather than a true classic shield-type volcano.
8. That conglomerate, which is sedimentary rock, is actually made _____ of weathered rock _____ the Blue Hills volcano.
9. Through the process of deposition and turning that loose material _____ bedrock, we now have the giant conglomerate.
10. The depth of erosion is so deep here – because we're talking about in excess of 400 million years – that summit (wherever it was) was completely eroded _____.
11. Pumice is formed _____ lava that is full of gas.
12. When people make glass they melt silica rocks like sand and quartz then cool it rapidly by placing it _____ water.
13. With this kind of dynamic aspect of the Earth, it allows for deep-seated movement of molten rock, and since the molten rock is of a lesser density than the overlying called bedrock (whatever it is), these molten bodies will move _____.

14. Pumice is so light that it actually floats _____ water. Huge pumice blocks have been seen floating on the ocean after large eruptions.
15. A dome shaped intrusive body that has intruded _____ layers of sedimentary rock. The rising magma forces the overlying layers to rise _____ into a dome.
16. They are larger than 100 square kilometers and usually form granite cores cooled magma deep _____ the Earth's crust.
17. The lava is ejected and shot _____ the air during an eruption.
18. Some basalts are intrusive having cooled _____ the Earth's interior.

Writing

Describing a process

Описывая процесс, следует:

- ▶ ввести тему, обозначить его основные детали;
- ▶ использовать пассивный залог;
- ▶ применять слова и выражения, указывающие на последовательность действий или событий.

See Appendix A: Grammar (The process description), табл. 2.3.

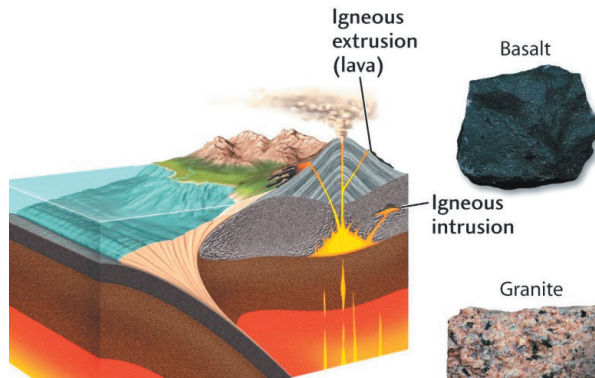
Study the following examples:

1. The **illustration** below **demonstrates the process of how** a geological map is being made. *Иллюстрация ниже показывает процесс того, как создается геологическая карта.*
2. I make an analysis of rocks in the Lab VS **an analysis of rock is made in a Lab**. *Я произвожу анализ пород в лаборатории VS анализ пород производится в лаборатории.*
3. The **illustration** below **demonstrates the process of how** samples of rocks are taken. *Иллюстрация ниже показывает процесс того, как берутся образцы породы.*
4. **Firstly**, the field is mapped. *Во-первых, местность картируется.*

Exercise 7. Imagine that you've started the course on Geology at your university. Write a short report on the process of igneous rocks formation and the types of rocks.

Look at the picture below and write 120–150 words. Here are some useful constructions to start with:

Igneous rocks are formed when magma _____
 Sometimes magma bursts through the surface causing _____
 When magma cools above the surface _____
 Once magma is slowly cools beneath the surface, _____



(abridged from: <https://www.pinterest.ru/pin/504966176951536705/>)

Reading

Before you read

Exercise 8. Practice to pronounce of the following words and word combinations correctly:

Igneous rocks	[ˈɪɡ.ni.əs]	Магматические горные породы
Extrusive rock	[ɪkˈstruːsɪv]	Эффузивные горные породы
Intrusive rock	[ɪnˈtruːsɪv]	Интрузивные горные породы
Intermediate rocks	[ɪntərˈmiːdiət]	Средние магматические горные породы, содержащие от 52 до 65 мас. % кремнезёма
Basic rocks	[ˈbeɪsɪk]	Основные горные породы (45–52 % SiO ₂)
Ultramafic rocks	[ˈʌltrəˈmɛfɪk]	Ультрамафическая порода
Mafic rocks	[ˈmɛfɪk]	Мафическая порода
Composition of rocks	[ˌkɔːmpəˈzɪʃn]	Состав породы
Basalt formation	[bæˈsɔːlt] [fɔːrˈmeɪʃn]	Залежи базальта
Mantle	[ˈmæntl]	Мантия
Lava flows	[ˈlɑːvə] [fləʊ]	Потоки лавы
Basaltic lava	[bæˈsɔːltɪk] [ˈlɑːvə]	Базальтовая лава
Silica content	[ˈsɪlɪkə]	Содержание кремнезёма / кремния
Frothy volcanic rock	[ˈfrɔːθɪ]	Пористая вулканическая порода
Conchoidal fracture	[kɒŋˈkɔɪd(ə)l] [ˈfræktʃər]	Раковистый излом

Sodium	['səʊdiəm]	Натрий
Potassium	[pə'tæsiəm]	Калий
Quartz	[kwɔ:rtz]	Кварц
Feldspar	['feldspɑ:r]	Полевой шпат
Rhyolite	['raɪəlaɪt]	Риолит
Granite	['grænit]	Гранит
Plagioclase feldspar	['pleɪdʒiə(ɔ)kleɪz] ['feldspɑ:r]	Плагноклазовый полевой шпат
Diorite	['daɪəˌraɪt]	Диорит
Andesite	['ændɪsaɪt]	Андезит
Basalts	[bæ'sɔ:lt]	Базальты
Gabbro	['gabrəʊ]	Габбро
Olivine	['ɒlɪvɪ:n]	Оливин / хризолит
Rhyoxene	[paɪ'rɔ:ksɪn]	Пироксен
Pumice	['pʌmɪs]	Пемза
Mica	['maɪkə]	Слюда
Hornblende	['hɔ:nblend]	Роговая обманка (амфибол)
Obsidian	[əb'sɪdɪən]	Вулканическое стекло (обсидиан)
Fine-grained	['faɪn'greɪnd]	Мелкозернистый
Coarse-grained	['kɔ:sgreɪnd]	Крупнозернистый
Eject Erupt	[ɪ'dʒekt] [ɪ'rʌpt]	Извергать
Cool	[ku:l]	Охлаждать
Harden	['hɑ:rdn]	Затвердевать Делать твёрдым
Float	[fləʊt]	Плыть
Arrowheads	['ærəʊhedz]	Наконечники стрел
Spearheads	['spiəhedz]	Острие

Exercise 9. Read the text and answer the following questions:

1. How many types of igneous rocks are distinguished by composition?
2. What is the chemical composition of acidic rocks?
3. What are the types of acidic rocks?

4. Why are intermediate rocks named so?
5. What are the two types of intermediate rocks?
6. What is the chemical composition of ultrabasic rocks?
7. How basalts are formed?
8. How pumice is formed?
9. How obsidian is produced?
10. Why do no crystals form in obsidian?

THE COMPOSITION OF IGNEOUS ROCKS

The composition of igneous rocks falls into four main categories. They are determined by the amount of silica that the rocks contain. The four categories are acidic, intermediate, basic, and ultramafic. Acidic rocks have a high silica content (65 % or more) along with a relatively high amount of sodium and potassium. These rocks are composed of the minerals quartz and feldspar. Rhyolite and granite are the two most common types of acidic rock.

Intermediate rocks contain between 53 % and 65 % silica. They also contain potassium and plagioclase feldspar with a small amount of quartz. Diorite and Andesite are the two most common types of intermediate rock.

Basic rocks are composed of less than 52 % silica and a large amount of plagioclase feldspar and very rarely quartz. The two most common types of basic rocks are basalts and gabbros.

Ultrabasic rocks are composed of less than 45 % silica and contain no quartz or feldspar. They are composed mainly of the minerals olivine and pyroxene. The most common ultrabasic rock is peridotite. Peridotite is a dark green, coarse-grained igneous rock that many scientists believe is the main rock of the mantle.

Basalts are dark colored, fine-grained extrusive rock. The mineral grains are so fine that they are impossible to distinguish with the naked eye or even a magnifying glass. They are the most widespread of all the igneous rocks. Most basalts are volcanic in origin and were formed by the rapid cooling and hardening of the lava flows. Some basalts are intrusive having cooled inside the Earth's interior.

This is a vertical columnar basalt formation. When basaltic lava cools it often forms hexagonal (six sided) columns. Some famous examples of columnar basalt formations are the Columbia Plateau overlooking the Columbia River near Portland, the Giant's Causeway in Northern Ireland, and the Devils Postpile National Monument in California.

Pumice is a very light colored, frothy volcanic rock. Pumice is formed from lava that is full of gas. The lava is ejected and shot through the air during an eruption. As the lava hurtles through the air it cools and the gases escape leaving the rock full of holes.

Pumice is so light that it actually floats on water. Huge pumice blocks have been seen floating on the ocean after large eruptions. Some lava blocks are large enough to carry small animals.

Pumice is ground up and used today in soaps, abrasive cleansers, and also in polishes.

Rhyolite is very closely related to granite. The difference is rhyolite has much finer crystals. These crystals are so small that they can not be seen by the naked eye. Rhyolite is an extrusive igneous rock having cooled much more rapidly than granite giving it a glassy appearance. The minerals that make up rhyolite are quartz, feldspar, mica, and hornblende.

Gabbro are dark-colored, coarse-grained intrusive igneous rocks. They are very similar to basalts in their mineral composition. They are composed mostly of the mineral plagioclase feldspar with smaller amounts of pyroxene and olivine.

Obsidian is a very shiny natural volcanic glass. When obsidian breaks it fractures with a distinct conchoidal fracture. Obsidian is produced when lava cools very quickly. The lava cools so quickly that no crystals can form.

When people make glass they melt silica rocks like sand and quartz then cool it rapidly by placing it in water. Obsidian is produced in nature in a similar way.

Obsidian is usually black or a very dark green, but it can also be found in an almost clear form.

Ancient people throughout the world have used obsidian for arrowheads, knives, spearheads, and cutting tools of all kinds. Today obsidian is used as a scalpel by doctors in very sensitive eye operations.

(abridged from: <http://volcano.oregonstate.edu/igneous-rocks-lesson-12>)

Exercise 10. Read the text and decide if the following statements are true or false. Correct the false ones.

1. Pumice is full of rock full of holes.
2. Rhyolite has a glassy appearance.
3. Many scientists believe that obsidian is the main rock of the mantle.
4. Pumice cannot float on water because it is too heavy.
5. Pumice today is used for making arrowheads.
6. Basalts are only cooled on the Earth's surface.
7. Basalts blocks have been seen floating on the ocean after large eruptions and some basalts blocks are large enough to carry small animals.
8. Rhyolite's crystals are so small that they cannot be seen without microscope.
9. Silica rocks like sand and quartz are usually melted and then cooled in water.
10. Gabbro is fine-grained intrusive rock.
11. Obsidian is usually red or a very dark green.
12. Today obsidian is used as a knife by doctors in very sensitive eye-operations.

Exercise 11. Skim the text and find the words according to the following definitions:

1. Very thin or in very small pieces or drops.
2. A break or crack in something hard, especially a bone.
3. The beginning or cause of something.

4. (of a liquid) with small white bubbles on the surface.
5. A common type of mineral found especially in igneous rocks such as granite.
6. Everything that is within something.
7. A natural substance like glass that breaks easily into thin layers and is not damaged by heat, often used in electrical equipment.
8. Rough and not smooth or soft, or not in very small pieces.

(abridged from: <https://dictionary.cambridge.org/ru/>)

Exercise 12. Find the pictures of the rocks on the Internet and match the following rocks according to their descriptions.

1. Gabbro
2. Diorite
3. Granite
4. Vesicular basalt
5. Andesite
6. Rhyolite

a) _____ is a coarse-crystalline felsic intrusive rock. The presence of quartz is a good indicator of _____. _____ commonly has large amounts of salmon pink potassium feldspar and white plagioclase crystals that have visible cleavage planes.

b) _____ is a fine-crystalline felsic extrusive rock. It is commonly pink and will often have glassy quartz phenocrysts. Because felsic lavas are less mobile, it is less common than granite.

c) _____ is a coarse-crystalline intermediate intrusive igneous rock. _____ is identifiable by its Dalmatian-like appearance of black hornblende and biotite and white plagioclase feldspar.

d) _____ is a fine crystalline intermediate extrusive rock. It is commonly grey and porphyritic. It is the fine grained compositional equivalent of diorite.

e) _____ is a coarse-grained mafic igneous rock, made with mainly mafic minerals like pyroxene and only minor plagioclase. Because mafic lava is more mobile, it is less common than basalt.

f) _____ is a fine-grained mafic igneous rock. It is commonly vesicular and aphanitic. When porphyritic, it often has either olivine or plagioclase phenocrysts.

(abridged from: [https://geo.libretexts.org/Bookshelves/Geology/Book%3A_An_Introduction_to_Geology_\(Johnson_Affolter_Inkenbrandt_and_Mosher\)/04%3A_Igneous_Processes_and_Volcanoes/4.01%3A_Classification_of_Igneous_Rocks](https://geo.libretexts.org/Bookshelves/Geology/Book%3A_An_Introduction_to_Geology_(Johnson_Affolter_Inkenbrandt_and_Mosher)/04%3A_Igneous_Processes_and_Volcanoes/4.01%3A_Classification_of_Igneous_Rocks))

Exercise 13. Put the words into the right order to make questions.

1. From other locations / In the Blue Hills / from / why / it would be different?
2. Is / Give us / how old / the Blue Hill volcano / a sense of / can you?
3. A volcano / as opposed to / why / would be here / like Salem or Plymouth?

4. Did / interested / in geology / you / become / when?
5. The top / you / where / say / is / of the volcano / can?
6. Great Blue Hill / the one thing / is / that you think / what / people / about / might not know?
7. Can / Of Great Blue Hills / What else / with us / about the geologic history / share?
8. Before / here / the volcano / was / what?
9. Would they go / if / to find lava / where / in the Blue Hills / if someone wanted.

Exercise 14. Read the interview with Lest Tyralla (local geologist) about Great Blue Hills and put these questions in the following text.

Judy: We will be speaking with a geologist about a story of the origins of the Blue Hills that few people know. Les, thank you so much for joining us today.

1) _____

Les Tyralla: Well, like many kids I was fascinated by bright shiny minerals. Then I discovered I could actually have a career in geology and got a bachelor's degree from the College Alliance in Arizona, did my graduate studies in Texas, and have worked at this as a job just for my whole career.

Judy: Oh, that's great! You have so much information about the Great Blue Hill that I'm sure people would be really interested in hearing.

2) _____

Les: Well based on my experience of having spent a lot of time here in the Blue Hills, few people realize that we're walking across a large igneous body. In this case, it really is an extinct volcano is the way to think about it. It goes back several hundred million.

Judy: So why don't you give us a sense of why this would be different, why the Blue Hills would be different,

3) _____

Les: Yes. It's perplexed geologists not only for the Blue Hills volcano but other volcanos that seem to be isolated (as this feature is) and it's still debated. With the understanding of plate tectonics, this provides a mechanism for fracturing, moving, banging together continental masses. In this case, the North American plate and the European plate and also the African plate. With this kind of dynamic aspect of the Earth, it allows for deep-seated movement of molten rock, and since the molten rock is of a lesser density than the overlying called bedrock (whatever it is), these molten bodies will move upward.

Judy:

4) _____

Les: Studies have been done to age-date it. Principally the most recent time, Professor Emeritus Jim Skehan of Boston College and Professor Emerita Meg Thompson of Wellesley College have had grant money to understand volcanism. Their efforts have indicated that this particular feature is about 410 million years old. The age-dating is based on certain minerals that contain isotopes, particularly a mineral called zircon. It has a radioactive isotope in it called U 238. With geologic time, that

degrades into lead. The half-life of zircon (this U 238 to lead) is almost 2.5 billion years. So with that kind of extreme half-life, we can accurately date the volcano and in fact go right back to the genesis of the Earth.

Judy:

5) _____

Les: It's been interpreted as, a level area. There were previous volcanic eruptions here, and it's been named the Mattapan volcanic sequence. Where it is exposed in Mattapan, Quincy, and Milton, it's basically flat-lying so it hasn't been disturbed too much. There may have been some topography here where it was flowing downward and outward, but for the most part it appears to have been flowing out gently on a level surface. The conduit was probably fractures in the Earth rather than a true classic shield-type volcano.

Judy: Lava is not something we think about when we think of the Blue Hills. Can you give us a sense of what it is and

6) _____

Les: Yes. There are four broad categories of magma, and it has to do with the geochemical makeup of it. We have rhyolite, which is here. It's a very silica-rich lava, and then it grades compositionally into an andesite then a dacite and ultimately a rock referred to as basalt. Hingham has exposures of basalt, and the North Shore has exposures above andesite and dacite and we have rhyolite.

Judy: That's great.

7) _____

Les: Well, fortunately, we have lots of good exposure, and we can thank the glacial activity for having done that. Any trail going up to the meteorological observatory will be crossing the lava flows, which as I mentioned a moment ago, is called a rhyolite or in the older literature it's referred to as a quartz-porphyry. If you're doing some homework, you'll see those two terms. It's very well exposed on Red Dot path, and also at the very summit there are nice exposures there and also of the older Mattapan of volcanics, which are dated back in excess of 500 million years.

Judy: That's great.

8) _____

Les: The depth of erosion is so deep here – because we're talking about in excess of 400 million years – that summit (wherever it was) was completely eroded away. So it's a process of both natural erosion and glacial activity literally bulldozing and conveying away the rocks. So we don't know that.

Judy: Great. And it looks like Kathie Edmunds Bendix, who gave us the name of this show Blue Hills A-Live, says she loved being in the area as a child in the 1950s (wow!) and the 60s. It's so great to hear some of the great memories of the Blue Hills.

9) _____

Les: If you have gone walking on many of the other trails we have here, you have seen what is called the "giant conglomerate". That conglomerate, which is

sedimentary rock, is actually made up of weathered rock from the Blue Hills volcano. Through the process of deposition and turning that loose material into bedrock, we now have the giant conglomerate. It's an impressive feature that tells us at one point there was a lot of kinetic energy here, meaning something like the Front Range of Colorado: lots of flowing water, moving large rocks, and turning them into rounded boulders.

(abridged from: https://friendsofthebluehills.org/geology_transcript/)

Exercise 15. Read the text again and answer the following questions:

1. What is another name for the Great Blue Hill?
2. What have been discovered about volcanism in the region?
3. What is the Mattapan volcanic sequence?
4. How many categories of magma were mentioned in the interview?
5. Where are lava flows exposed most?
6. How "giant conglomerate" were formed. Which processes were mentioned in the interview?

Exercise 16. Find the words in the text based on the following definitions:

1. A very large rock.
2. How the separate pieces of it move, and the effects of this movement.
3. A rock that consists of small, rounded stones that are held together by clay and sand.
4. Having a lot of silica content.
5. A break or crack in something hard, especially rocks.
6. A volume of igneous material, which can be molten.

(abridged from: <https://dictionary.cambridge.org/ru/>)

Speaking

Exercise 17. What are the typical locations for gabbro, diorite, granite, vesicular basalt, andesite, rhyolite?

Study some typical locations and search the Internet:

Ocean floor, continental crust, lower oceanic crust, Andes Mountains, island arcs, the Andes Mountains as well as the Henry and Abajo mountains of Utah, Yellowstone National Park, the Grand Canyon of the Yellowstone, mid-ocean ridges.

Study the following constructions to answer the question:

1. _____ is formed at _____
2. _____ makes up _____
3. _____ is a good approximation for _____
4. _____ it is found in _____
5. _____ it can be found in _____
6. _____ it is the major component of _____

7. The examples of _____ include several lava flows in _____
8. _____ is the most common rock on the Earth's surface.

Grammar

The Participle II (причастие II)

Причастие II (причастие прошедшего времени) используется для выражения законченного процесса в английском языке. Для этого к основе глагола необходимо прибавить суффикс ed:

- ▶ extract (извлекать) – extracted (извлеченный);
- ▶ produce (производить) – produced (произведенный);
- ▶ break (ломать) – broken (сломанный / разломанный).

See Appendix A: Grammar (The Participle II), табл. 2.4–2.5.

Study the following examples:

1. Intrusive rocks, also **called** plutonic rocks, cool slowly without ever reaching the surface.
2. Igneous rocks form when magma (molten rock) cools and crystallizes, either at volcanoes on the surface of the Earth or while the **melted** rock is still inside the crust.
3. They can also look different **based** on their cooling conditions.

(abridged from: <https://www.nationalgeographic.org/encyclopedia/igneous-rocks/>)

Exercise 18. Underline the correct word in these sentences and translate the sentences into Russian.

1. Most igneous rocks are produced deep underground by the **cooling** / **cooled** and **hardening** / **hardened** of magma.
2. Magma is **melted** / **melting** rock under the surface of the Earth.
3. Magma is **produced** / **producing** in the upper reaches of the mantle or in the lowest areas of the crust usually at a depth of 50 to 200 kilometres.
4. Magma is less dense than the **surrounding** / **surrounded** rock which causes it to rise.
5. This is the volcano Paricutin that is located in Mexico. It is **erupting** / **erupted** cinders and pumice which are examples of extrusive igneous rocks.
6. Millions and even billions of years ago molten rock was **cooling** / **cooled** and thus hardening into igneous rocks deep under the surface of the Earth.
7. These rocks are now visible because mountain building has thrust them upward and erosion has removed the softer rocks **exposing** / **exposed** the much harder igneous rocks.
8. Intrusive igneous rocks have such a name because the magma has **intruded** / **intruding** into pre-existing rock layers.

9. Rock beds frequently are formed from explosive eruptions that crack the area around a volcano with the magma **filling** / **filled** the cracks forming a dike.
10. A laccolith is a dome **shaped** / **shaping** intrusive body that has intruded between layers of sedimentary rock.
11. The **rising** / **raised magma** forces the overlying layers to rise up into a dome.
12. A sill is similar to a dike with the exception that sills run parallel to the **existing** / **existed** rock bed instead of **cutting** / **cut** through it.

(abridged from: <http://volcano.oregonstate.edu/igneous-rocks-lesson-12>)

Exercise 19. Translate the sentences into English using Participle II.

- | | |
|--|-----------------------------|
| 1. Intergranular pores | a) расплав |
| 2. Silica-rich | b) насыщенный краснозёмом |
| 3. Viscosity | c) вязкость |
| 4. Melt | d) слагающие породы |
| 5. Lithospheric mantle | e) литосферная мантия |
| 6. Intrude through continental lower crust | f) внедряться в нижнюю кору |
| 7. Melting point | g) очаг плавления |
| 8. Constituent rocks | h) межзерновые поры |

1. Три рассмотренных механизма зарождения расплава нередко сочетаются.
2. Образовавшаяся магма внедряется в литосферную мантию и нижнюю кору, приводя к частичному плавлению слагающих их пород.
3. Возникший очаг плавления представляет собой твёрдую породу, пронизанную заполненными расплавом капиллярами.
4. При достижении 30–40 объёмных % расплава эта смесь приобретает свойства жидкости и выжимается в область более низких давлений.
5. Наибольшая вязкость присуща магмам, возникшим за счёт плавления вещества верхней континентальной коры при дегидратации минералов: они образуются при температуре 700–600 °C и максимально насыщены кремнезёмом.
6. Выжимаемый из межзерновых пор расплав фильтруется вверх со скоростью от нескольких сантиметров до нескольких метров в год.
7. При кристаллизации магмы образуются, соответственно, ультраосновные и основные магматические породы.
8. Из разделившихся магм будут кристаллизоваться различные по составу породы.
9. Интрузивные породы образуются при кристаллизации магматического расплава на глубине в толщах горных пород; в зависимости от глубины образования они разделяются на две фации.

(abridged from: http://popovgeo.sfedu.ru/lecture_15)

Scientific Corner Archives

Exercise 20. Put the words in the correct order to make sentences and do the test on weathering processes.

1. *rocks / have formed / of molten magma / are called / rocks that / by cooling / igneous*
All these rocks have textures. The missing word is:

- a) Crystalline.
- b) Fragmental.
- c) Rough.

2. *of granite / a good material / makes it / to use / what property / for gravestones?*

- a) It contains several different minerals.
- b) It is hard and resistant to weathering.
- c) It is rough and can be used as an abrasive.

3. *it a good material / property / for road / of basalt / what / surfaces / makes?*

- a) It is hard and resistant to weathering.
- b) It is dark in colour.

c) It can be polished to look attractive.

4. *to use / property / makes it / what / for worktops / of gabbro / a good material?*

- a) When broken it has a rough surface.
- b) It contains several different minerals.
- c) It can be polished to look attractive.

5. *in city centres / paving / like granite / used for / igneous / street / igneous / and kerb stones / because:*

- a) They are hard and do not wear away easily.
- b) They contain several different minerals.
- c) They can be polished to look attractive.

(abridged from: <https://www.geolsoc.org.uk/ks3/gsl/education/resources/rockcycle/page3645.html>)

UNIT 2D. METAMORPHIC ROCKS

Learning objectives

In this part you will:

- ▶ read about types of metamorphism;
- ▶ listen about the properties of metamorphic rocks;
- ▶ study phrasal verbs with prepositions WITH; TO; FROM related to process description;
- ▶ study lexical patterns with TAKE PLACE and OCCUR;
- ▶ express your opinion on the topic;
- ▶ review the Passive Voice with prepositional phrases to describe a process;
- ▶ do a professional test on metamorphic rocks.

Reading

Part 1

Before you read

Exercise 1. Practice to pronounce of the following words and word combinations correctly:

Adjustment	[ə'dʒʌstmənt]	Присоединение / согласование
Diagenesis	[di'dʒenəsɪz]	Диagenез
Mineral assemblage	[ə'semblɪdʒ]	Ассоциация минералов / группа минералов
Buried deeper	['berɪd] [di:per]	Глубоко залегающий
Continental collisions	[kɒntrɪ'nent(ə)l kə'liʒn]	Столкновение континентальных плит
Subduction	[səb'dʌkʃ(ə)n]	Субдукция

Exercise 2. Read the text and answer the following questions:

1. Where does the word "Metamorphism" come from?
2. Why are subjected to metamorphism rocks sometimes buried deeper in the Earth?
3. Under which could conditions metamorphic process be changed into igneous ones?
4. What is metamorphic grade?
5. What is the difference between low-grade metamorphism and high-grade metamorphism?

The mineralogical and structural adjustment of solid rocks to physical and chemical conditions that have been imposed at depths below the near surface zones of weathering and diagenesis and which differ from conditions under which the rocks in question originated.

The word "Metamorphism" comes from the Greek: meta = after, morph = form, so metamorphism means the after form. In geology this refers to the changes in mineral assemblage and texture that result from subjecting a rock to conditions such pressures, temperatures, and chemical environments different from those under which the rock originally formed.

Note that Diagenesis is also a change in form that occurs in sedimentary rocks. In geology, however, we restrict diagenetic processes to those which occur at temperatures below 200 °C and pressures below about 300 MPa (MPa stands for Mega Pascals), this is equivalent to about 3 kilobars of pressure (1 kb = 100 MPa).

Metamorphism, therefore occurs at temperatures and pressures higher than 200 °C and 300 MPa. Rocks can be subjected to these higher temperatures and pressures as they are buried deeper in the Earth. Such burial usually takes place as a result of tectonic processes such as continental collisions or subduction.

The upper limit of metamorphism occurs at the pressure and temperature where melting of the rock in question begins. Once melting begins, the process changes to an igneous process rather than a metamorphic process.

As the temperature and/or pressure increases on a body of rock we say the rock undergoes prograde metamorphism or that the grade of metamorphism increases. Metamorphic grade is a general term for describing the relative temperature and pressure conditions under which metamorphic rocks form.

Low-grade metamorphism takes place at temperatures between about 200 to 320 °C, and relatively low pressure. Low grade metamorphic rocks are generally characterized by an abundance of hydrous minerals. With increasing grade of metamorphism, the hydrous minerals begin to react with other minerals and/or break down to less hydrous minerals.

High-grade metamorphism takes place at temperatures greater than 320 °C and relatively high pressure. As grade of metamorphism increases, hydrous minerals become less hydrous, by losing H₂O, and non-hydrous minerals become more common.

(abridged from: <https://www.tulane.edu/~sanelson/eens212/typesmetamorph.htm>)

Vocabulary

Exercise 3. Match the verbs with the prepositions.

- | | |
|-------------|---------|
| 1. Differ | a) with |
| 2. Refer | b) to |
| 3. Come | c) from |
| 4. Change | d) to |
| 5. Restrict | e) to |
| 6. Result | f) to |
| 7. React | g) from |
| 8. Subject | |

Exercise 4. Find the words in the text according to their definitions:

- To experience or be subjected to (something, typically something unpleasant or arduous).
- To be affected by (a particular condition or occurrence, typically an unwelcome or unpleasant one).
- Five main layers the ocean is divided into.
- Containing water usually in chemical association.
- A very large quantity of something.
- An instance of one moving object or person striking violently against another.
- Becoming liquefied by heat.

Grammar

Exercise 5. Study and translate into Russian the following patterns and translate them into Russian.

- High-grade metamorphism *takes place at temperatures* greater than 320 °C and relatively high pressure.

2. We restrict diagenetic processes to those which *occur at temperatures* below 200 °C and pressures below about 300 MPa.
3. Metamorphism *occurs at temperatures and pressures* higher than 200 °C and 300 MPa.
4. Such burial usually *takes place as a result of* tectonic processes such as continental collisions or subduction.
5. The upper limit of metamorphism *occurs at the pressure and temperature* where melting of the rock in question begins.
6. Low-grade metamorphism *takes place at temperatures between* about 200 to 320 °C, and relatively low pressure.

Exercise 6. Put the words in the correct order.

1. Metamorphism / is / if cold rock / a hot igneous body / intruded and heated / also / take place / by / near the surface.
2. involves / takes place / temperatures above 150 °C, / Metamorphism / at which the parent rock / some metamorphism / at temperatures / lower than those / is formed.
3. Metamorphism / being deeply buried /, where it is subjected to / involves / higher temperatures and pressures / than those under which it formed. / the rock beneath other rocks.
4. Most metamorphism / to the point where / than those at which they formed / results from the burial of igneous, / they experience different pressures / sedimentary, or pre-existing metamorphic / and temperatures.
5. Metamorphic rocks have different / mineral assemblages / from their parent rocks / typically / and different textures.

(abridged from: <https://opentextbc.ca/geology/part/chapter-7-metamorphism-and-metamorphic-rocks/>)

Exercise 7. Complete the sentences using the word given.

1. Since only a small area surrounding the intrusion is heated by the magma, metamorphism _____ the zone surrounding the intrusion or contact aureole.

RESTRICT

2. Because the temperature contrast between the surrounding rock and the intruded magma is larger at shallow levels in the crust where pressure is low, contact metamorphism _____ as high temperature, low pressure metamorphism.

REFER

3. Outside of the contact aureole, the rocks _____ the intrusive event.

NOT AFFECT

4. Most regional metamorphism _____ deformation under non-hydrostatic or differential stress conditions.

ACCOMPLISH

5. When sedimentary rocks _____ depths of several kilometers, temperatures greater than 300 °C may develop in the absence of differential stress.

BURY

6. New minerals grow, but the rock _____ metamorphosed.

APPEAR

7. Heat _____ the friction of sliding along such a shear zone, and the rocks tend to be mechanically deformed, being crushed and pulverized, due to the shearing.

GENERATE

8. Cataclastic metamorphism is not very common and _____ a narrow zone along which the shearing occurred.

RESTRICT

9. When an extra-terrestrial body, such as a meteorite or comet impacts with the Earth or if there is a very large volcanic explosion, ultrahigh pressures _____ in the impacted rock.

CAN GENERATE**Reading****Part 2****Before you read****Exercise 8. Match the word to their definitions**

1. Intrusion
2. Foliated
3. Shatter
4. Fold
5. Surround

- a) A bend in a layer of rock under the earth's surface caused by movement there.
- b) The act of going into a place.
- c) Consisting of thin layers that can be separated.
- d) To (cause something to) break suddenly into very small pieces.
- e) To be or go everywhere around something or someone.

(abridged from: <https://dictionary.cambridge.org/ru/>)

Exercise 9. Read the following text and headline the paragraphs. Then classify the highlighted characteristics into 4 types.

1. Burial metamorphism.
2. Shock (Impact) metamorphism.
3. Contact metamorphism.
4. Regional metamorphism.

TYPES OF METAMORPHISM

1) _____ adjacent to igneous intrusions and results from **high temperatures** associated with the **igneous intrusion**.

Since only a small area surrounding the **intrusion is heated by the magma**, metamorphism is restricted to the zone surrounding the intrusion, called a metamorphic or contact aureole. Outside of the **contact aureole**, the rocks are not affected by the intrusive event. The grade of metamorphism increases in all directions toward the intrusion. Because the temperature contrast between the surrounding rock and the intruded magma is larger at shallow levels in the crust where pressure is low, this metamorphism is often referred to as **high temperature, low pressure metamorphism**. The rock produced is often a fine-grained rock that shows no foliation, called a hornfels.

2) _____ occurs over **large areas** and generally does not show any relationship to igneous bodies. Most of that metamorphism is accompanied by **deformation under non-hydrostatic or differential stress conditions**. Thus, the metamorphism usually results in forming metamorphic rocks that are **strongly foliated**, such as slates, schists, and gniesses. The differential stress usually results from tectonic forces that produce compressional stresses in the rocks, such as when two continental masses collide. Thus, regionally metamorphosed rocks **occur in the cores of fold/thrust mountain belts or in eroded mountain ranges**. Compressive stresses result in folding of rock and thickening of the crust, which tends to push rocks to deeper levels where they are subjected to higher temperatures and pressures.

3) _____ When sedimentary rocks are **buried to depths** of several kilometers, temperatures greater than 300 °C may develop in the absence of differential stress. **New minerals grow**, but the rock does not appear to be metamorphosed. The main minerals produced are often the Zeolites. Burial metamorphism overlaps, to some extent, with diagenesis, and grades into regional metamorphism as **temperature and pressure increase**.

4) _____ When an **extra-terrestrial body**, such as a meteorite or comet **impacts** with the Earth or if there is a very large volcanic explosion, ultrahigh pressures can be generated in the impacted rock. These ultrahigh pressures can produce minerals that are only stable at very high pressure, such as the SiO₂ polymorphs coesite and stishovite. In addition, they can produce textures known as **shock lamellae in mineral grains**, and such textures as shatter cones in the impacted rock.

Exercise 10. Answer the following questions:

1. What is a contact aureole?
2. How does metamorphism change vary on the pressure and temperature conditions?
3. When rocks are pushed to deeper levels?
4. What types of rocks do usually undergo burial metamorphism?

5. What could be an extra-terrestrial body?
6. In what way extra-terrestrial body could impact the Earth's surface?

Speaking

Expressing opinion on the topic

Exercise 11. Give your opinion of the text

As for me...,	По моему мнению
I find it + adjective	Я нахожу текст
To my mind	На мой взгляд
It seems reasonable (not) to + verb	Мне кажется обоснованным, что
The information given in the text was + adjective	Информация в тексте была
Text might be + adjective for	Текст может быть _____ для
The idea of the text was not clearly expressed	Идея текста не была ясно выражена
The text contains a lot of details on	Текст содержит много деталей по теме

- Use some of the following patterns:
- _____ usually happens when _____
- _____ often occurs when _____
- It's common for _____
- _____ takes place at _____ temperatures and pressures.
- _____ results in _____
- The typical rocks that undergo _____ metamorphism are _____

Listening

Exercise 12. Listen again. Are these statements true or false? Correct the false ones.

1. Metamorphosis is caused by the exposure to severe weather conditions.
2. The first type of a metamorphism is called "contact" because it involves existing rocks coming into contact with really intense pressure which is generally provided by lava or magma.
3. Regional metamorphism is when two plates are coming together along a fault or a crack. In the middle of a crack is usually an immense pressure which cause the rock trapped in the middle and become metamorphosized.
4. The typical progression of metamorphism is when you start with a gneiss, and if you add heat and pressure it will be changed into shale.

(abridged from: <https://youtu.be/1oQ1J0w3x0o>)

Exercise 13. Work in pairs and try to complete the sentences. Then listen to the recording and check your answers.

1. The original rock can either be sedimentary or i _____.
2. The original rock tends to c _____ in its mineral c _____ and texture often forming larger crystals.
3. Metamorphism often involves various processes, recrystallization, pressure solution, plastic d _____ (bending and folding rock).
4. Heat allows minerals to r _____ with others, decompose, and new mineral grow.

(abridged from: <https://youtu.be/HF--7idAmYM>)

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Exercise 14. Put the words in the correct order to make sentences and do the test on metamorphism.

1. in / the source of / regional / and pressure / metamorphism / increased temperature / is:
 - a) A local intrusive heat source.
 - b) Impact metamorphism.
 - c) The increase in temperature with increasing depth of burial.
 - d) Due to increased rate of radioactive decay.
2. will result in / of metamorphic / the alignment / which type / minerals / of pressure
 - a) Contact pressure.
 - b) Directed pressure.
 - c) Confining pressure.
 - d) Chemical pressure.
3. a large volume / is caused / of metamorphism / by high temperature / what type / imposed over / and high pressure / of crust?
 - a) Burial.
 - b) Contact.
 - c) Regional.
 - d) Cataclastic.
4. metamorphic / is / textural feature / rocks / the most / of regional / prominent / what
 - a) Doliation.
 - b) Bedding.
 - c) Cataclasis.
 - d) Ripples.
5. cause / which / processes / will / metamorphism / of the following?
 - a) A change in the chemical environment.
 - b) An increase in temperature.
 - c) An increase in pressure.
 - d) All of these.

(abridged from: <https://uh.edu/~jbutler/physical/chap8mult.html>)

UNIT 3

SOURCES OF ENERGY

UNIT 3A. FOSSIL FUELS

Learning objectives

In this part you will:

- ▶ read about the types and locations of fossil fuels;
- ▶ study the pattern BE FOUND IN / BE ABUNDANT IN;
- ▶ study the pattern IT IS USED TO / IN / AS / UP;
- ▶ speak about advantages and disadvantage, practical uses of fossil fuels;
- ▶ listen about 300 Years of fossil fuels;
- ▶ review Zero and First Conditionals;
- ▶ learn how to give instructions on safety rules;
- ▶ review Passive voice with GET;
- ▶ do a professional test on fossil fuels.

Reading

Before you read

Exercise 1. Before reading the text about Fossil Fuels train the pronunciation of the following words and word combinations.

Available	[əˈveɪləbl]	Полезный
Energy	[ˈenədʒi]	Энергия
Water power	[ˈwɔːtər] [ˈpaʊər]	Гидроэнергия
Fossil fuels	[ˈfɔːsl] [ˈfjuːəlz]	Горючие полезные ископаемые
Decay	[diˈkeɪ]	Разложение
Refer to	[rɪˈfɜːr]	Иметь отношение
Footprint	[ˈfʊtprɪnt]	Отпечаток
Mudstone	[ˈmʌdstəʊn]	Аргиллит

Crude oil	[kru:d] [ɔɪl]	Сырая нефть
Charcoal	[ˈtʃɑːrkoʊl]	Древесный уголь
Methane	[ˈmeθeɪn]	Метан
Thermal efficiency	[ˈθɜːrml] [iˈfɪjnsi]	Полезная теплоотдача
Research	[riˈsɜːrtʃ]	Исследование
Raw material	[rɔː][məˈtriəl]	Сырье
Obtain	[əbˈteɪn]	Добывать
Gaseous fuels	[ˈɡæsiəs][ˈfjuːəl]	Газовое горючее
Carbon sulfur	[ˈkɑːrbən][ˈsʌlfər]	Сероуглерод

FOSSIL FUELS

The chief sources of energy available to man today are oil, natural gas, coal, water power and atomic energy. Coal, gas and oil represent energy that has been concentrated by the decay of organic materials accumulated in the geologic past. These fuels are often referred to as fossil fuels. Today the term fossil generally means any direct evidence of past life, for example, the footprints of ancient animals. Fossils are usually found in sedimentary rocks, although sometimes they may be found in igneous and metamorphic rocks as well.

They are most abundant in mudstone, shale and limestone, but fossils are also found in sandstone, dolomite and conglomerate. Fuels may be solid, liquid and gaseous. Solid fuels may be divided into two main groups, natural and manufactured. The former category includes coal, wood, peat and other plant products. The latter category includes coke and charcoal obtained by heating coal in the absence of air.

Petroleum is a mixture consisting of elements such as hundreds hydrogen and carbon sulfur, oxygen and nitrogen and others elements. Petroleum is usually associated with water and natural gas. It is found in porous sedimentary rocks where the geological formation allowed the oil to collect from a wide area. Petroleum is one of the most efficient fuels and raw materials. Of gaseous fuels the most important are those derived from natural gas, chiefly methane or petroleum. Using gaseous fuels makes it possible to obtain high thermal efficiency, ease of distribution and control. Gas is the most economical and convenient type of fuels.

Today gas is widely utilized in the home and as a raw material for producing synthetics. Scientists consider that a most promising source of natural resources may be the floor of the sea, a subject which now has become an important field of research. Generally speaking, all types of fossil fuels described in the text are of great economic importance as they represent the sources of energy the man uses today.

(abridged from: <https://lingualeo.com/ru/jungle/fossil-fuels-183697>)

Exercise 2. Read the text again and answer the following questions:

1. Where fossils are usually found?
2. What is the composition of petroleum?
3. Where is petroleum usually found?
4. How high thermal efficiency could be obtained?
5. What's the most promising source of energy according to scientists?
6. What area of Earth's crust is under investigation these days?

Exercise 3. Decide if the following statements are true or false.**Correct the false ones.**

1. Fossils are usually found in metamorphic rocks.
2. Plant products include coke and charcoal obtained by heating coal.
3. Petroleum is a mixture of elements such as water and natural gas.
4. The most important gaseous fuels are those derived from natural gas, methane or petroleum.
5. According to the text there are two groups of solid fuels: natural and manufactured.
6. Crude oil is the basis of all industrial fuels.

Exercise 4. Skim the text and find the adjectives to characterise coal uses according to the following definitions:

1. Paragraph 1:
 - ▶ most important;
 - ▶ gradually become bad or weak or be destroyed, often because of natural causes like bacteria or age.
2. Paragraph 2:
 - ▶ existing in large quantities.
3. Paragraph 3:
 - ▶ working well and not wasting time or energy;
 - ▶ easy to use or suiting your plans well.
4. Paragraph 4:
 - ▶ likely to be very good or successful in the future.

*(abridged from: <https://dictionary.cambridge.org/ru/>)***Grammar**

Считается, что использование пассивного залога с глаголом GET – это призна-
 мета разговорной речи. Однако в научной речи структура с глаголом GET
 является достаточно распространенной. В некоторых случаях использова-
 ние данной структуры позволит выразить более точное значение быстрого
 действия.

GET + Past Participle (-ed or -en)

Глагол GET выражает действие и может быть использован с другими глаголами, обозначающими физическое или ментальное действие, и никогда не употребляется с глаголами состояния. *Исключением* является глагол understand: *She'll get understood.*

Значения использования структуры:

- ▶ привлекать внимание к специфической информации о человеке или действии;
- ▶ говорить о неожиданных, негативных, нежелательных обстоятельствах или последствиях.

Part 1. Revision. Passive voice with GET

Exercise 5. Study the following examples and translate the sentences into Russian.

1. The dense forest present in the low-lying wetland **got buried in** the earth millions of years ago.
2. Soil kept depositing over them and they **got compressed**.
3. As a result, the substances slowly **got converted into** coal.
4. They **got compressed by** the layers of sand and clay.

(abridged from: <https://byjus.com/biology/fossil-fuel/>)

Exercise 6. Study and translate into Russian the following sentences. Write similar sentences about coal and natural gas.

1. Fossils **can be found in** sedimentary rocks, although sometimes they may be found in igneous and metamorphic rocks as well. *Фоссилии могут быть обнаружены в осадочных породах, хотя иногда их также можно найти в магматических и метаморфических породах.*
2. They **are most abundant in** mudstone, shale and limestone, but fossils **are also found in** sandstone, dolomite and conglomerate. *Они в избытке встречаются в аргиллите, сланце и известняке, но фоссилии также встречаются в песчанике, доломите и конгломерате.*
3. Petroleum **is found in** porous sedimentary rocks where the geological formation allowed the oil to collect from a wide area. *Нефть находят в пористых осадочных породах, где геологическая формация позволяла собирать ее на обширной территории.*

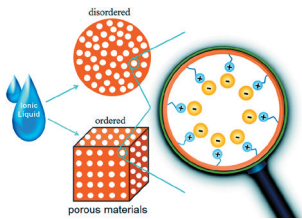
Vocabulary

Exercise 7. Match to make collocations.

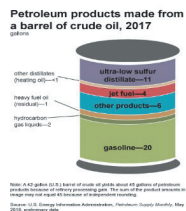
- | | |
|-------------------------|--------------|
| 1. Porous and permeable | a) remains |
| 2. The floor of | b) rock beds |
| 3. High carbon | c) energy |

- | | |
|--------------------|--------------------|
| 4. Made up mostly | d) oil consumption |
| 5. Petroleum-based | e) of hydrocarbons |
| 6. Buried | f) the sea |
| 7. Reducing | g) cars |
| 8. Clean | h) content |
| 9. Propel | i) product |

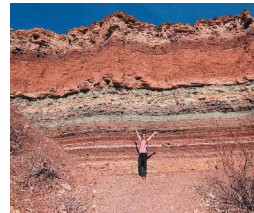
Try to match the pictures to some of the vocabulary above



1 _____



2 _____



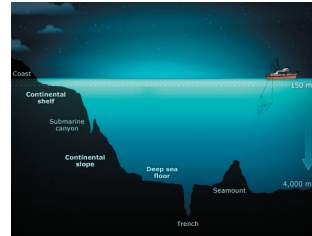
3 _____



4 _____



5 _____



6 _____

Exercise 8. Complete the sentences using the word given.

1. Fossil fuels are the fuels _____ natural processes such as decomposition of dead and buried organisms.

FORM

2. Fossil fuels are buried flammable _____ deposits of organic substances.

GEOLOGY

3. These deposits _____ with the passage of time and got _____ natural gas, coal, and petroleum due to the extreme heat and pressure inside the earth's crust.

DECAY

CONVERT

4. They are _____ everywhere, from the air we breathe to the water in the seas.

FIND

5. Most of the energy used by us is obtained by the _____ of fossil fuels.

BURN

6. With the increased demand for the _____ of various energies, fossil fuel energy is declining. It is difficult to _____ them.

PRODUCE

PLACE

Exercise 9. Complete the sentences with the preposition: at / with / to / under/ from / into / between

1. The phytoplankton and zooplankton sink _____ the bottom of the ocean and mix _____ organic materials to form an organic-rich mud.
2. The mud buried _____ more sediments and lithifies to form an organic shale.
3. This is done to protect the organic materials _____ being decomposed by bacteria.
4. The increasing pressure and temperature transform the shale _____ a waxy material known as the kerogen.
5. At temperatures _____ 90–60 °C kerogen is transformed _____ natural gas.
6. The sea animals and plants died and their bodies settled _____ the bottom of the sea.
7. The petroleum is separated _____ the crude oil by a series of processes in a refinery.

(abridged from: <https://byjus.com/biology/fossil-fuel/>)

Exercises 10. Fill the chart with the following chunks:

/ a clear, oily liquid, usually green or black / “Black Gold” / a clean and non-toxic / a high concentration of oxygen and hydrogen / a moderate form of coal / anthracite, bituminous and lignite / as a starting material in chemicals and fertilizers / as compressed natural gas (CNG) / as fuels in automobiles / at homes for cooking / carbon concentration / carbon, hydrogen, nitrogen, oxygen, and sulphur / coke, coal tar, and coal gas / colourless and odourless / for generating power / in roofing, road pavements, and as a water repellent / less polluting and less expensive / manufacturing detergents, plastics, fibers / produce steam in the railway engines / strange smell / through pipelines / to cook food / to generate electricity in thermal plants / to power internal combustion engines in the form of petrol / a mixture of petroleum gas, diesel, paraffin wax, petrol, lubricating oil / in industries as fuel / hard and black colored substance / the hardest type of coal

Fossil	Colour	Texture	Composition	Derivatives	Uses
Coal					
Natural gas					
Petroleum					

(abridged from: <https://byjus.com/biology/fossil-fuel/>)

Speaking**Before you speak***Exercise 11. Study and translate the following patterns:*

1. Coal **is used to** generate electricity in thermal plants.
2. Coal **is used in** industries as fuel.
3. Petrol **is used as** fuels in automobiles.
4. Natural gas can **be used at** homes for cooking.
5. These fossil fuels **are used up** at a faster rate.

Exercise 12. In groups, describe properties of fossil fuels using the following constructions. Choose one type of fossils per each group.

- ▶ It is _____
- ▶ It has _____ smell / colour / concentration
- ▶ It termed as _____
- ▶ It is stored as _____ / in _____
- ▶ It can be transferred through _____
- ▶ It is made up of _____
- ▶ It can be used in _____
- ▶ It can be used to _____
- ▶ It can be used as _____
- ▶ The major types of _____ are
- ▶ The major derivatives of _____ are
- ▶ _____ is processed industrially to obtain _____
- ▶ _____ moderate form of _____

Grammar**Part 2. Zero and First Conditionals (условные предложения нулевого и первого типов)**

Предложения в условном наклонении обозначают, что действие или состояние, обозначаемые глаголом, представлены не как факт, а как воображаемое или желаемое.

Условное предложение нулевого типа (Zero Conditional) используется тогда, когда мы говорим о вещах, справедливых всегда (о научных фактах и очевидных явлениях). Обе части условного предложения ставятся в настоящее время.

IF [Present], [Present]

Условное предложение первого типа (First Conditional) используется, когда мы говорим о реальных событиях будущего времени. То есть если выполнится условие, то действие произойдет в будущем.

IF [Present], [*Future]

See Appendix A: Grammar (Zero and First Conditionals), табл. 3.1, 3.2.

Study the following examples:

1. If you **burn** coal, it **emits** carbon dioxide.
2. If you **inhale** silica, you **might get** cancer.
3. If you **don't wear** protective coveralls, your skin is **exposed to** dangerous chemicals.
4. If operators on the rig **don't** manage it properly, it **will explode**.

Exercise 13. Open the brackets using correct forms of conditional 1 and 2.

1. If you (see) smoke, fossil fuel (burn) to release the energy stored in them.
2. If factories (continue) to burn fossils, we (end up) with fossil fuel pollution and more adverse effects for humans and the earth as a whole.
3. If there (be) enough coal and natural gas within the earth to keep using for many years, accessing those natural stores (only become) more difficult and expensive.
4. If burning coal (release) toxic particles like dioxide and heavy metals into the atmosphere, these compound (cause) acid rain and respiratory damage in humans.
5. If a person (inhale) fossil particles, it (can) cause such diseases like cancer and asthma.
6. If you (use) hydrofracking, it (leave) dangerous pollutants in the earth, which can enter our water supply.
7. If a power plant operators (manage) fossil fuels improperly, it (might) lead to an explosion, death and largest oil spills.
8. If society (continue) to move towards renewable energy sources, solar energy (continue) to grow.
9. If we (use) solar energy, it (help) to avoid the electricity costs.
10. If oil (give off) vapour, it (ignite or catch fire) very easily.

(abridged from: <https://news.energysage.com/disadvantages-fossil-fuels/>)

Exercise 14. Match to make sentences.

Условные предложения первого типа также активно используются, чтобы отдавать Команды, приказы и инструкции. Вторая часть условного предложения – в данном случае вспомогательный глагол будущего времени (will) – заменяется на первую форму глагола.

IF [Present], [IMPERATIVE]

Study the following examples:

1. If you **see** a miner without face protection, **ask** a person in charge!
2. If your glasses **are** dirty, **clean** it.
3. If **there is** a problem with loading, **give** the emergency stop signal.

Exercise 15. Match 1–7 to a–g to make conditional sentences

1. If dirt is being moved,
2. If you don't know how to lift heavy items,
3. If you work underground in a mining shaft,
4. If you are trapped in the mine,
5. If your harnesses and railings are worn,
6. If you are a novice in the mine,
7. If you don't know proper lifting techniques,

- a) take a plan for fall prevention.
- b) ask for support and assistance.
- c) heavy equipment needs to be relocated.
- d) study safety labels and signs.
- e) throw them away.
- f) turn on emergency response system.
- g) ask for help.

(abridged from: <https://www.equipmentandcontracting.com/11-safety-tips-for-mining/>)

Speaking

Advantages and disadvantages of using fossil fuels

Before you speak

Advantages	Disadvantages
An advantage A good point A benefit A positive effect	A disadvantage A downside A drawback A negative effect
_____ of + Ving is / are + it is + Adjective _____ of + Ving is / are + that + S + V <i>An advantage of using fossil fuels is it is cost effective.</i> <i>A drawback of using fossil fuels is that it makes the environment more acidic.</i>	

(abridged from: <https://youtu.be/lwL4YnMStEo>)

Exercise 16. Classify the following phrases into advantages and disadvantages

/ can be found very easily / causes fatal diseases among the people / contribute to global warming / cost effective / drillers are constantly exposed to chemicals and

silica / emit carbon dioxide when burnt / generate a large amount of electricity at a single location / have become safer over time / It is available in plenty / makes the environment more acidic / suffer from Black Lung Disease / they cannot be replaced.

Advantages	Disadvantages

(abridged from: <https://byjus.com/biology/fossil-fuel/>)

Exercise 17. In pairs, give a talk on the advantages and disadvantages of using fossil fuels. Use conditionals 1 and 2 and some of the ideas above.

Follow the example:

In my opinion, a downside of suing fossil fuels is it's their toxicity. If drillers are constantly exposed to chemicals, they might suffer suffer from Black Lung Disease.

Listening

Part 2

Exercise 18. Listen to the recording about 300 Years of fossil fuels and fill the gaps.

1. People in Britain ran out of fire wood and started burning _____.
2. Miners used the coal on the ground, they dug deep coal mines filled with _____.
3. Samuel Newcomen invented _____ to pump out water so miners can keep digging.
4. Now we have ingredients for the industrial revolution: _____, _____, _____.
5. *Edwin Drake* _____ the first rock oil _____ in Pennsylvania.
6. *The Right Brothers* start first _____ – _____ aviation.
7. *Karl Busch* made _____ from fossil fuels.
8. World one is the first _____ – _____ conflict.
9. In-between there was first depression cause by _____.
10. *Oil companies* are drilling miles of _____.

(abridged from: <https://youtu.be/cJ-J9ISwP8w>)

Scientific Corner Archives

Exercise 19. Put the words in the correct order to make sentences and do the test on fossil fuels.

1. Is / fuel / which / a fossil / of the following?
 - a) Natural gas.
 - b) Nuclear.
 - c) Hydrogen.
2. formed / a coal / was / what / from?
 - a) Marine animals.

- b) Plants.
- c) Water.
- 3. Oil / from / what / was / formed?
 - a) Marine animals.
 - b) Sedimentary rock.
 - c) Petrol.
- 4. fuel / of the following / a / which / is / renewable?
 - a) Natural gas.
 - b) Oil.
 - c) Wood.
- 5. dead / is / made / crude / organisms / how / oil / from?
 - a) Buried – compressed – heated.
 - b) Heated and stirred.
 - c) Eaten by larger organisms.
- 6. the crust / extracted / crude / is / how / from?
 - a) By drilling.
 - b) By mining.
 - c) By fracking.
- 7. from the atmosphere / absorbs / which of / carbon dioxide / these processes?
 - a) Respiration.
 - b) Combustion of fossil fuels.
 - c) Photosynthesis.
- 8. into the air / which of / carbon dioxide / these processes / releases?
 - a) Dissolving in sea water.
 - b) Combustion of fossil fuels.
 - c) Plants being eaten by animals.
- 9. a fuel / is / be obtained / which of / that / crude / can be / these / oil?
 - a) Diesel.
 - b) Hydrogen.
 - c) Wood.

(abridged from: <https://www.bbc.co.uk/bitesize/guides/z27thyc/test>)

UNIT 3B. COAL AND ITS CLASSIFICATION

Learning objectives

In this part you will:

- ▶ read on to learn some interesting facts about US coal;
- ▶ learn how to describe types of coal and their properties;
- ▶ learn to express your opinion on the topic;

- ▶ listen about US coal mine;
- ▶ review Second and Third Conditionals;
- ▶ use conditionals to talk about accident connected to coal mining;
- ▶ learn how write a short summary of the text.

Reading

Before you read

Exercise 1. Before reading the text about Coal and its Classification train the pronunciation of the following words:

Carbon	['kɑ:bən]	Углерод; угольный электрод
Hydrogen	['hɪdrədʒən]	Водород
Sulphur	['sʌlfər]	Сера
Nitrogen	['nɪtrədʒən]	Азот
Oxygen	['ɒksədʒən]	Кислород
Rank	[ræŋk]	Разряд; ранг
Heterogeneous	[ˌhetərəˈdʒiːniəs]	Гетерогенный; неоднородный
Carbonization	['kɑ:bənaɪˈzeɪʃ(ə)n]	Обуглероживание; карбонизация
Peat	['pi:t]	Торф
Bituminous	[brɪˈtʃu:mɪnəs]	Битуминозный; жирный (торф)
Fuel	['fju:əl]	Топливо
heat value	['hi:tˈvælju:]	Тепловой эквивалент

Exercise 2. Give each text appropriate heading

Read the texts:

- Coal production include the direct employment of nearly 116,000 people and the creation of 289,000 indirect coal mining jobs.
- Today's new coal-fueled power plants have reduced emissions by 90 %.
- 24 % of the world's coal reserves are held by the US.
- The average computer contains 66 different minerals.
- 3 million acres of mined land have been restored by U.S. mining companies.
- Every American uses an average of 40,000 pounds of newly mined materials every year, including two tons of coal.
- About two-thirds of today's coal production results from surface, rather than underground, mining.
- Coal is America's most abundant energy resource – making up 87 % of U.S. fossil energy reserves on a Btu basis.

Headings:

- a) Coal Demand
- b) Coal Production
- c) and the Environment
- d) Coal Mining Employment

Exercise 3. Find the words in the texts according to the following definitions:

1. The remains or impression of a prehistoric plant or animal (NOUN).
2. Have or hold (VERB).
3. Piece of land (NOUN).
4. Existing or available in large quantities; plentiful (ADJECTIVE).
5. Only just; recently (ADVERB).
6. Make smaller or less in amount, degree, or size (VERB).

Exercise 4. Read the texts again and tick what you think are positive aspects of coal industry. Discuss in pairs and give one argument per each aspect.

Follow the example:

I could be wrong, but I believe that the emissions from coal power plants are defiantly negative aspects of coal industry. Lots of people might choke on. Moreover, it contributes to the greenhouse effect.

As far as I know, ...	Насколько я знаю
I could be wrong, but ...	Я могу ошибаться, но
I'd guess/imagine that ...	Я бы предположил, что
I'd say that ...	Я бы сказал, что
I'm absolutely certain that ...	Я абсолютно уверен, что

(abridged from: <http://www.rmcmi.org/education/coal facts#.YJZupLUzbIW>)

Exercise 5. Match the words and their definitions.

1. Material such as coal, gas, or oil that is burned to produce heat or power.
2. Firm and stable in shape; not liquid or fluid; strongly built or made of strong materials.
3. Continuous physical force exerted on or against an object by something in contact with it.
4. The reason for which something is done or created or for which something exists.
5. The ratio of the useful work performed by a machine or in a process to the total energy expended or heat taken in.
6. Alteration of the composition or structure of a rock by heat, pressure, or other natural agency.
7. Shiny and smooth; high-quality smooth shiny paper.

(abridged from: <https://www.lexico.com/en/definition/>)

- a) Solid fuel
- b) Glossy
- c) Fuel
- d) Residential purposes
- e) Pressure
- f) Efficiency
- g) Metamorphism

NB!:

due to natural processes – вследствие (по причине) природных процессов

these trees got buried – эти деревья оказались погребены

water-saturated environment – водонасыщенная среда

steam-electric power generation – (паро)теплоэнергетика

Exercise 6. Match 1–4 to a–j. More than one variant is possible.

- 1. Anthracite
- 2. Bituminous
- 3. Subbituminous
- 4. Lignite

- a) can be used in the iron and steel industry
- b) deposits tend to be relatively young
- c) deposits were not subjected to extreme heat or pressure
- d) has a lower heating value than bituminous coal
- e) has high moisture content
- f) has the highest heating value of all ranks of coal
- g) is an important fuel and raw material for making coking coal
- h) is the most abundant rank of coal
- i) is used to generate electricity
- j) mainly used by the metals industry

(abridged from: <https://www.eia.gov/energyexplained/coal/>)

Exercise 7. Read the sentences about the properties of coal types and match the names of coal types with the pictures.

Anthracite. The highest rank of coal. It is a hard, brittle, and black lustrous coal, often referred to as hard coal.

Bituminous. Bituminous coal is a middle rank coal between subbituminous and anthracite.

Subbituminous. Subbituminous coal is black in color and is mainly dull (not shiny).

Lignite. Lignite coal, aka brown coal, is the lowest grade coal with the least concentration of carbon.

(abridged from: https://www.usgs.gov/faqs/what-are-types-coal?qt-news_science_products=0#qt-news_science_products)



1 _____



2 _____



3 _____



4 _____

Listening

Exercise 8. Listen to the recording about the World's biggest mine: US coal and answer the following questions.

1. Where is the mine?
2. What are the two current problems connected coal mining?
3. What is a carbon budget?
4. What is negative impact for locals who live near shafts?
5. What is the company's strategy towards the local lands for coal mining?

Exercise 9. Listen again and fill the gaps.

1. Out of the North Antelope Rochelle Mine comes about _____ of America's coal.
2. Out of the entire Powder River Basin _____ of coal comes out of here.
3. Write now coal has two big problems: _____ and a carbon constraint world.
4. Does a company have a position on climate change? What's _____.
5. Just one ton of this coal produces _____ of carbon dioxide emissions, and there are billions of tons here in the powder river basin.
6. We have what's called "carbon budget" which is _____ of carbon that can be used.
7. Coal is in the biggest access because coal is geologically _____.
8. Local people have _____ about its effects on water and air pollution.
9. Peabody told us off camera that they are making preparations to _____. That's all public land.
10. We need a deep _____ philosophy to carry us forward.

Exercise 10. Match 1–8 to a–h to make collocations.

- | | |
|---------------|---------------|
| 1. Produce | a) carbon |
| 2. Greenhouse | b) combustion |

- | | |
|-------------------|--------------------------|
| 3. Effects on | c) emissions |
| 4. Carbon dioxide | d) the warming |
| 5. Coal and gas | e) land |
| 6. Climate | f) air and water quality |
| 7. Public | g) change |
| 8. Drive | h) effect |

Exercise 11. Explain in your own words the meaning of this collocations:

1. Coal country
2. Carbon budget
3. Powder river basin
4. Carbon constraint world
5. Fight climate change
6. Have a position on climate change
7. Black mark against coal
8. Climate change is already through the door
9. Carry us forward

(abridged from: <https://youtu.be/1dsxtCmUvrc>)

Grammar

Part 1

Exercise 12. Complete the sentences using the word given.

1. Subbituminous coal typically contains 35–45 % carbon, and it has a lower _____ value than bituminous coal.

HEAT

2. About 44 % of total U.S. coal _____ in 2019 was subbituminous and about 88 % was _____ in Wyoming and 9 % in Montana.

PRODUCE

3. Bituminous coal is the most abundant rank of coal _____ in the United States, and it _____ for about 48 % of total U.S. coal production in 2019.

FIND

ACCOUNT

4. Lignite coal deposits tend to be relatively young and were not _____ extreme heat or pressure.

SUBJECT

5. A facility in North Dakota also converts lignite to synthetic natural gas that is sent in natural gas pipelines to _____ in the eastern United States.

CONSUME

(abridged from: <https://www.eia.gov/energyexplained/coal/#:~:text=Coal%20is%20classified%20into%20four,energy%20the%20coal%20can%20produce>)

Grammar**Part 2****Second and Third Conditionals****(Условные предложения второго и третьего типов)**

Предложения в условном наклонении обозначают, что действие или состояние, обозначаемые глаголом, представлены не как факт, а как воображаемое или желаемое.

Условное предложение второго типа (Second Conditional) используется тогда, когда мы говорим о воображаемых событиях настоящего или будущего времени:

IF [Past], [would + V1]

Условные предложения третьего типа (Third Conditional) используются, когда мы говорим о прошедших событиях с целью:

- ▶ сожалеть о свершившемся;
- ▶ критиковать какие-либо действия;
- ▶ положительно оценить произошедшее:

IF [Past Perfect], [would have + Ved/3f]

See Appendix A: Grammar (Second and Third Conditionals), табл. 3.3, 3.4.

Study the following examples:

1. If we **hadn't left** the electrical equipment tuned on, we **wouldn't have triggered** methane and ignited coal dust explosions. *Если бы мы не оставили включенным электрооборудование, то не произошло бы выброса метана и взрывов угольной пыли.*
2. If I **were you**, I **would clear** the land of trees and vegetation before drilling the strata. *На вашем месте я бы очистил землю от деревьев и растительности перед бурением пластов.*
3. If you **had followed** safety precautions, you **wouldn't have been injured**. *Если бы вы соблюдали меры предосторожности, вы бы не пострадали.*
4. If we **had** more investment, we **would realize** it in local industry development and environmental projects. *Если бы у нас было больше инвестиций, мы бы реализовали их в развитии местной промышленности и экологических проектах.*
5. If I **hadn't applied** for mining engineer position, I **wouldn't have become** a site supervisor. *Если бы я не подавал заявку на должность горного инженера, я бы не стал руководителем площадки.*

Exercise 13. Transform the following sentences about accidents connected to the mining activities using 3 Conditional.

Before you start

Dust – угольная пыль

Fatalities – жертвы

Explosive fumes – взрывчатые пары дыма

Blast – взрыв

1. “The tragic Courrières accident, the worst ever mine disaster in Europe, was directly caused by methane and dust. It caused the death of 1,099 miners in Northern France on March 10, 1906”.
2. “In underground mines, most explosive-related fatalities were caused by miners being too close to the blast, followed by explosive fumes poisoning, misfires, and premature blasts”.
3. “The use of explosives might cause earthquake-like events that collapse mine workings, and traps miners in, as happened to the 33 miners stuck underground from August to October 2010 in a Chilean mine near the city of Copiapo, or kill them, flood the mine and damage structures on the surface”.

(abridged from: <https://www.thebalancesmb.com/most-common-accidents-occurring-in-the-mining-industry-2367335>)

Exercise 14. Now, make the sentences using 2 conditionals to explain what would happen if we didn't have mining accidents.

Follow the example:

1. If _____, we would not have leaks of poisonous gases.
2. If _____, dust explosions would not happen too often.
3. If _____, there would not be collapsing of mine stopes.
4. If _____, floods would not cause offsite / onsite damage.
5. If _____, the mining equipment would be used properly.
6. If _____, dangerous explosives would be used underground properly.

(abridged from: https://en.wikipedia.org/wiki/Mining_accident#:~:text=Mining%20accidents%20can%20occur%20from,errors%20from%20improperly%20used%20or)

Speaking

Exercise 15. Write Third conditional sentences about the following situations. Then, discuss with a groupmate.

1. Follow the example: If I hadn't applied for the job, I wouldn't have become a mining engineer.
2. “Benxihu Colliery disaster”: Gas and coal dust exploded. It resulted in the death of 1,540 miners. It was caused by carbon monoxide poisoning. The reason was the closure of the ventilation system.
3. “Courrieers coal mine disaster”: Massive explosion was caused by an underground fire in pits. It led to death of 1,099 people. The reason was ignition of methane by the flame from a miner's lamp.
4. “Mitsubishi Hojyo coal mine disaster”: Accident was caused by a gas explosion at the underground coal mine. It led to death of 687 people.

It resulted in the release of thick black smoke through the air vents, affecting people.

5. "Mitsui Miike coal mine disaster": A disaster killed 458 miners and left 833 injured. A massive blast, which was caused by a coal dust explosion. It led to collapse of the tunnel roof at various locations in the mine.
6. "Dhanbad coal mine disaster": A disaster killed 372 people. In the deep mine, a coal dust explosion resulted in a blast that destroyed the roof barrier with a water tank above it. Flooding of water into the mine was the cause for most of the deaths in the accident.

(abridged from: <https://www.nsenenergybusiness.com/features/worst-coal-mining-disasters/>)

Writing

Summarising the text

Exercise 16. Classify the constructions for making a summary into 4 columns.

General idea of the text	The beginning	The main body	Conclusion

- a) After discussing ... the author turns to ...
- b) Finally, the author admits that...
- c) First / at the beginning the author points out that/notes that/describes... The main content of the text...
- d) In the end the author emphasizes that ...
- e) It must be emphasized that / should be noted that / is evident that / is clear that / is interesting to note that...
- f) Next / further / then the author tries to / indicates that / explains that...
- g) The author concludes that / summarizes the...
- h) the author emphasizes / points out / admits that ...
- i) The beginning of the text...
- j) The conclusion is that the problem is ...
- k) The end of the text...
- l) The first paragraph deals with ...
- m) The next (following) part deals with / presents / discusses / describes...
- n) The objective / purpose of this text is to present / to discuss / to describe / to show / to develop / to give...
- o) The paper / text / article begins with a short discussion on / deals firstly with the problem of ...
- p) The paper / text / article discusses some problems relating to / deals with some aspects of / considers the problem of / presents the basic theory / provides information on / reviews the basic principles of...

- q) The paper / text / article is concerned with / is devoted to...
- r) The paper / text / article puts forward the idea / attempts to determine...
- s) The text / article / paper states / describes / ends with...
- t) Then follows a discussion on ...
- u) Then the author goes on to the problem of ...
- v) To sum up / to summarize / to conclude...

(abridged from: <https://infourok.ru/metodicheskaya-razrabotka-learn-to-make-a-summary-1036051.html>)

Exercise 17. Match 1–8 to a–h to make phrases for summarising the text.

- | | |
|----------------|----------------------|
| 1. Begin | a) the idea of |
| 2. Turn | b) with |
| 3. Concern | c) out |
| 4. Go on | d) with |
| 5. Be devoted | e) to |
| 6. Sum | f) to the problem of |
| 7. Put forward | g) up |
| 8. Point | h) to |
| 9. Deal | i) with |

Exercise 18. Choose the write variant according to the definitions.

- 1. Talk or write about (a topic) in detail, taking into account different issues or ideas.
 - a) indicate
 - b) discuss
 - c) admit
- 2. Cause (something) to occur in a particular way or to have a particular nature.
 - a) conclude
 - b) determine
 - c) point out
- 3. Give information of...
 - a) develop
 - b) present
 - c) summarise
- 4. Make (an idea or situation) clear to someone by describing it in more detail or revealing relevant facts.
 - a) explain
 - b) point out
 - c) determine
- 5. Notice or pay particular attention to (something).
 - a) explain

- b) admit
- c) note

Exercise 19. Read the texts taken from an online journal “The conversation” paying attention to the word in bold and make a summary using the constructions from exercise 16.

Student A.

“Coal mines can be closed without destroying livelihoods – here’s how”

“Countries across the globe are trying to wind down coal production. **While** this will help in the battle against climate change, those communities that have specialised in coal mining may see their local job market decline. **Most of these places** have mined coal for many generations.

Workers in extractive industries like mining or oil are often presented as the public face of opposition to environmental protection. **However**, research has shown that workers in “dirty” industries do tend to support environmentally friendly policies once their immediate interests are not negatively affected.

Furthermore, there is clear evidence that environmental protection and transitioning to the low-carbon economy has the potential to create employment just as much as it can cause unemployment.

We found that active dialogue with communities is key. **In North Rhine-Westphalia**, Germany, policy is jointly formulated by employees and employers, giving workers a voice which is largely equal to that of industrialists. **In contrast**, Hazelwood coal power station and adjoining mine **in Victoria, Australia** were closed with minimal consultation with unions or government, and after just five months notice. **In coal villages in Alberta**, Canada, such as Forestburg or Wabamun, the industry did attempt to talk to workers and local officials but the structure of the talks was poorly defined, resulting in workers not trusting the decarbonisation processes. **In Victoria**, the dominance of the coal industry has hindered the transition towards a lower-carbon economy. **In Alberta**, a number of production facilities are simply shifting from coal to gas. **While** this shift creates jobs outside the coal sector, it does little to secure employment overall, since natural gas extraction and production requires fewer workers than coal. **For example**, energy company TransAlta is converting its coal-fired Sundance power plant in Wabamun to natural gas, which means the overall workforce will be cut in half when the layoffs are complete. **In North Rhine-Westphalia and Victoria**, government funding has primarily focused on roads and rail alongside investment in community infrastructure such as sports and recreational facilities. **This ensures that** former mining areas do not remain synonymous with coal production, pollution and socio-economic problems, and makes them a more attractive place for other industries to invest.

Moving away from fossil fuels such as coal is central to achieving emissions targets. **This doesn’t have to create** huge social unrest. With the goodwill of policymakers

and through measures such as those we have identified, decarbonisation strategies can be developed and implemented while maintaining livelihoods for those directly affected”.

Owen Douglas (Post-Doctoral Researcher, Environmental Policy, University College Dublin)

Kieran Harrahill (PhD Researcher on the Bioeconomy and Society, University College Dublin)

(abridged from: <https://theconversation.com/coal-mines-can-be-closed-without-destroying-livelihoods-heres-how-124336>)

Student B “A major coal mine expansion was knocked back today, but where’s the line in the sand?”

The mine’s proponents had been seeking to extract 78 million additional tonnes of coal out to 2048. The New South Wales Department of Planning, Industry and Environment (DPIE) had recommended the mine be approved. The backing came despite grave concerns over the mine’s impact on drinking water supplies.

The problem is rife in both state and federal laws, and must urgently be addressed. **In its verdict released on Friday**, the IPC said the project would cause “unacceptable” damage and should be refused. **Among the reasons** for the decision were: the risk of significant “subsidence” or sinking of the ground’s surface resulting from the longwall mine design; potentially significant surface water losses into the groundwater system, damaging ecological processes; the impact of past and existing longwall mining in the catchment, including the loss of surface water flows from some sections of rivers and streams; uncertainty around managing mine water inflow (**surface waters permanently diverted underground**) after mine closure.

Climate change and drought have crippled urban water supplies in recent years. **Yet** underground coal mines have been allowed to eat away at Sydney’s water catchments, Pac-Man like, for decades.

Our research shows existing coal mines in the catchments of Sydney’s “Metropolitan Special Area” have, or will, divert 450 billion litres of drinking water into underground fractures. That’s almost as much water as is contained in Sydney Harbour.

Few environmental problems are more pressing than permanent impacts on a major city’s water supply. **But** protecting water resources from cumulative harm requires the following:

- ▶ well-defined thresholds, set with rational justification and able to be changed as new information arises;
- ▶ robust measurements to assess if thresholds are being approached or exceeded;
- ▶ clear conditions for developers that require concrete actions if thresholds are crossed;
- ▶ transparency and trust in how the decisions are being made.

Clearly, the law and associated planning processes must consider the accumulating damage stressing the natural world. **Otherwise**, we may reach irreversible tipping points without even realising it.

Pete Dupen (PhD Student, University of Technology Sydney)

Rebecca Louise Nelson (Associate Professor in Law, The University of Melbourne)

(abridged from: <https://theconversation.com/a-major-coal-mine-expansion-was-knocked-back-today-but-wheres-the-line-in-the-sand-154173>)

Exercise 20. Explain in your own words.

For Student A	For Student B
1) to wind down coal production 2) the battle against climate change 3) workers in “dirty” industries 4) support environmentally friendly policies 5) shift from coal to gas 6) a lower-carbon economy	1) grave concerns over the mine’s impact 2) to eat away at Sydney’s water catchments 3) cumulative harm 4) transparency and trust 5) stress the natural world 6) irreversible tipping points

Scientific Corner Archives

Exercise 21. Put the words in the correct order to make sentences and do the test on fossil fuels.

1. *LPG / to help / its leakage / is: / the chemical / detect / added*

- a) Ethyl nitrate.
- b) Butane.
- c) Methyl amine.
- d) Ethyl mercaptan.

2. *Is not / which / a constituent / of the following / of petroleum?*

- a) Coke.
- b) Lubricating oil.
- c) Petrol.
- d) Paraffin wax.

3. *of coal / as / coal is / the variety / household / use:*

- a) Lignite.
- b) Bituminous.
- c) Anthracite.
- d) Peat.

4. *Be / from / vaseline / can / made*

- a) Bitumen.
- b) Paraffin Wax.
- c) Napthalene.
- d) Kesosone.

5. *Is / the slow / of conversation / called / of dead / into a coal / the vegetation*

- a) None of these.
- b) Refining.
- c) Carbonization.
- d) Decantation.

6. *was / in Indiana / the first / drilled / oil well / in the state of:*

- a) Assam.
- b) Tripura.
- c) Maharashtra.
- d) Gujarat.

7. *Was / from / petroleum / formed / organisms:*

- a) Living on the land.
- b) Living in the sea.
- c) Living on the rocks.
- d) Living on the plants.

(abridged from: <https://physicscatalyst.com/testprep/online-test-for-class-8-science/>)

UNIT 3C. ALTERNATIVE SOURCES OF ENERGY

Learning objectives

In this part you will:

- ▶ acquire the vocabulary to describe alternative sources of energy;
- ▶ read about renewable and non-renewable energy;
- ▶ listen about the most promising energy sources;
- ▶ review grammar on Participle 1;
- ▶ learn to moderate, listen and express your opinion in a discussion;
- ▶ discuss advantages and disadvantages of alternative sources of energy.

Reading

Before you read

Exercise 1. *Before reading the text about Alternative Forms of Energy train the pronunciation of the following words and word combinations:*

Amount	[ə'maʊnt]	Количество, величина, объем, размер; равняться, составить, составлять
Depend on	[dɪ'pend]	Зависеть от
Consumption	[kən'sʌmpʃn]	Потребление, расход, затрата
Delay	[dɪ'leɪ]	Задержка, отсрочка, промедление

Be broken down	[ˈbrəʊkən daʊn]	Здесь быть разделенным на
Revenue	[ˈrevɪnjuː]	Доход, выручка, поступление, прибыль
Require	[rɪˈkwaɪə]	Требовать, нуждаться, потребоваться, потребовать
Renewable	[rɪˈnjuːəbl]	Возобновляемый, восстанавливаемый, воспроизводимый
Heavily	[ˈhevɪli]	Тяжело, интенсивно, усиленно
Facilities	[fəˈsɪlɪtɪz]	Оборудование, приспособления; средства
Supply	[səˈplaɪ]	Поставка, подача, подвод
Substation	[ˈsʌbstetʃn]	Подстанция, тяговая подстанция
Sustainable	[səˈsteɪnəbl]	Устойчивый, стабильный, долговременный
Tremendous	[trɪˈmendəs]	Огромный, громадный, колоссальный
Wavelength	[ˈweɪvlɛŋθ]	Длина волны
Wind up	[wɪnd ʌp]	Заводить, завести

Exercise 2. Read the text and answer the following questions about alternative forms of energy:

1. What are 5 types of alternative energy sources?
2. Why do we use alternative sources of energy?
3. What is the best alternative energy source?
4. What are the disadvantages of geothermal energy?
5. What are the pros and cons of Hydroelectric Energy?

ALTERNATIVE ENERGY SOURCES OF ENERGY

There are different alternative sources of energy that are used in the world to generate power. These can be broken down into renewable and non-renewable energy sources. A renewable energy source is any natural resource that can replace it quickly and dependably. These energy sources are plentiful, sustainable, naturally replenished and good to the environment. A non-renewable energy source is a source with a limited supply that we can mine or extract from the earth, and it'll eventually run out. These are formed over thousands of years from the buried remains of ancient sea plants and animals that lived millions of years ago. Most of these energy sources are "dirty" fossil fuels, which are generally bad for the environment.

Solar Energy. The primary source of energy is the sun. Solar power harvests the energy of the sun by using collector panels to create conditions that can then be turned

into a kind of power. Large solar panel fields are often used in the desert to gather enough power to charge small substations, and many homes use solar systems to provide for hot water, cooling and supplement their electricity. The issue with solar is that while there is plentiful amounts of sunlight available, only certain geographical ranges of the world get enough of the direct power of the sun for long enough to generate usable power from this source.

Wind Energy. Wind power is becoming more and more common. The new innovations that are allowing wind farms to appear are making them a more common sight. By using large turbines to take available wind as the power to turn, the turbine can then turn a generator to produce electricity. But at the same time it requires high investment, and wind speed is also not uniform every time, which affects the generation of power.

Geothermal Energy. Geothermal energy is the energy that is produced from beneath the earth. It is clean, sustainable and environmentally friendly. High temperatures are produced continuously inside the earth's crust by the slow decay of radioactive particles. Hot rocks present below the earth heats up the water that produces steam. The steam is then captured, which helps to move turbines. The rotating turbines then power the generators. The biggest disadvantage of geothermal energy is that it can only be produced at selected sites throughout the world.

Hydrogen Energy. Hydrogen is available with water (H_2O) and is the most common element available on earth. Water contains two-thirds of hydrogen and can be found in combination with other elements. Once it is separated, it can be used as a fuel for generating electricity. Hydrogen is a tremendous source of energy and can be used as a source of fuel to power ships, vehicles, homes, industries and rockets. It is completely renewable, can be produced on demand and does not leave any toxic emissions in the atmosphere.

Wave Energy. Wave energy is produced from the waves that are produced in the oceans. Different techniques for transforming wave energy to electric power have been studied with dam-like structures or ocean floor-anchored devices on or just below the water's surface. Wave energy is renewable, environment friendly and causes no harm to the atmosphere. It can be harnessed along coastal regions of many countries and can help a country to reduce its dependence on foreign countries for fuel. Producing wave energy can damage the marine ecosystem and can also be a source of disturbance to private and commercial vessels. It is highly dependent on wavelength and can also be a source of visual and noise pollution.

Hydroelectric Energy. What many people are not aware of is that most of the cities and towns in the world rely on hydropower, and have for the past century. Every time you see a major dam, it is providing hydropower to an electrical station somewhere. The power of the water is used to turn generators to produce the electricity that is then used. It is non-polluting, entails no waste or produces toxic gases, and environment friendly. The problems faced with hydropower right now have to do with the aging of

the dams. Many of them need major restoration work to remain functional and safe, and that costs enormous sums of money. The drain on the world's drinkable water supply is also causing issues as townships may wind up needing to consume the water that provides them power too.

(abridged from <https://www.conserve-energy-future.com/different-energy-sources.php>)

Exercise 3. Decide if the following statements are true or false.

1. Correct the false ones:
2. The sources of energy that are used in the world can be broken down into renewable sources and fossil fuels.
3. A renewable energy source is any natural resource that we can mine or extract from the earth.
4. Solar power is the primary source of energy.
5. Large solar panel fields get enough of the direct power of the sun to generate usable power.
6. Wind can then turn a generator to produce electricity.
7. Geothermal energy can only be produced at selected sites throughout the world.
8. Wave energy depends on wavelength and can also damage the marine ecosystem.

Exercise 4. Match the words and their definition.

1. an energy that is sustainable – something that can't run out, or is endless, like the sun.
 2. a source of energy that will eventually run out.
 3. is created by nuclear fusion that takes place in the sun.
 4. is used to produce electricity using the kinetic energy created by air in motion.
 5. a type of renewable energy taken from the Earth's core.
 6. is unique because it is the most concentrated form of renewable energy on earth, with power density much higher than that of wind and solar energy.
 7. a form of renewable energy that uses the power of moving water to generate electricity.
 8. a fuel cell combines hydrogen and oxygen to produce electricity, heat, and water.
-
- a) Renewable energy source
 - b) Solar energy
 - c) Hydrogen energy
 - d) Non-renewable energy
 - e) Hydroelectric energy
 - f) Hydrogen energy
 - g) Wind energy
 - h) Geothermal energy
 - i) Wave energy

NB!:

fuel cell – топливный элемент

power density – удельная мощность, плотность энергии, энергетическая плотность

kinetic energy – кинетическая энергия

sustainable energy – устойчивые источники энергии; устойчивая энергетика

Exercise 5. Match the verbs with the collocates.

1. Power
 2. Harvest
 3. Gather
 4. Generate
 5. Produce / consume / provide / supply
 6. Capture
 7. Harness
-
- a) power
 - b) the sun's energy
 - c) wave energy
 - d) usable power / electricity
 - e) drinkable water / hot water / energy / electricity / steam
 - f) steam
 - g) ships / vehicles / homes / industries / rockets

Exercise 6. Put the words in the correct order.

1. collector / of the sun / the energy / by / **Solar power** / harvests / using / panels
2. **large solar** / are / used in / often / panel fields / to gather / in the desert / to charge / small substitutions / enough power
3. heats up / **hot rocks** / below the earth / the water that / present / produce steam
4. damage / the marine / wave energy / can damage / **producing** / can / ecosystem
5. **wave energy** / of many / can be / regions / countries / harnessed / along coastal
6. **dam** / to an electrical / is providing / somewhere / hydropower / somewhere
7. of the water / to turn / **the power** / to produce / generators / the electricity / is used

Speaking

Exercise 7. Read an exam conversation between a professor and a student. Try to predict what questions a student is being asked.

Professor: We discuss alternative sources of energy. My first question is about hydropower. 1) _____

Student: Hydropower or water power is power derived from the energy of falling or fast-running water, which may be harnessed for useful purposes.

For example, many kinds of watermills has been used number of times as a renewable energy source for irrigation and the operation of different mechanical devices, such as gristmills, sawmills, textile mills, trip hammers, dock cranes, domestic lifts, and ore mills.

Professor: 2) _____?

Student: A hydropower resource can be evaluated by its available power. Power is a function of the hydraulic head and volumetric flow rate. The head is the energy per unit weight (or unit mass) of water. Each unit of water can do an amount of work equal to its weight times the head.

Professor: 3) _____

Student: Some hydropower systems such as water wheels can draw power from the flow of a body of water without necessarily changing its height. Over-shot water wheels can efficiently capture both types of energy. The water flow in a stream can vary widely from season to season. Dams and reservoirs provide a more dependable source of power by smoothing seasonal changes in water flow. The design of dams must account for the worst-case, “probable maximum flood” that can be expected at the site; a spillway is often included to bypass flood flows around the dam.

Professor: 4) _____

Student: Wave power is the capture of energy of wind waves to do useful work – for example, electricity generation, water desalination, or pumping water. A machine that exploits wave power is a wave energy converter.

Professor: 5) _____

Student: Wave power is distinct from tidal power, which captures the energy of the current caused by the gravitational pull of the Sun and Moon. Waves and tides are also distinct from ocean currents which are caused by other forces including breaking waves, wind, the Coriolis effect, cabbeling, and differences in temperature and salinity.

Professor: 6) _____

Student: Waves are generated by wind passing over the surface of the sea. As long as the waves propagate slower than the wind speed just above the waves, there is an energy transfer from the wind to the waves. Both air pressure differences between the upwind and the lee side of a wave crest, as well as friction on the water surface by the wind, making the water to go into the shear stress causes the growth of the waves.

Professor: 7) _____

Student: Wave height is determined by wind speed, the duration of time the wind has been blowing, fetch (the distance over which the wind excites the waves) and by the depth and topography of the seafloor (which can focus or disperse the energy of the waves).

Professor: 8) _____

Student: In general, larger waves are more powerful but wave power is also determined by wave speed, wavelength, and water density.

Professor: 9) _____

Student: Oscillatory motion is highest at the surface and diminishes exponentially with depth. However, for standing waves (clapotis) near a reflecting coast, wave energy is also present as pressure oscillations at great depth, producing microseisms.

Professor: 10) _____

Student: The waves propagate on the ocean surface, and the wave energy is also transported horizontally with the group velocity.

Professor: All right, no more questions.

(abridged from: <https://en.wikipedia.org/wiki/Hydropower>)

Exercise 8. Read the text again and fill the gaps.

1. Fast running _____
2. Mechanical _____
3. Water _____
4. Propagate _____
5. Sheer _____
6. Over-slot _____

Exercise 9. Act out any part of the conversation (ask and answer 3 questions).

Grammar

Part 1

Exercise 10. Complete the sentences using the word given.

1. Renewable power is _____, as innovation brings down costs and starts to deliver on the promise of a clean energy future.

BOOM

2. American solar and wind generation are _____ records.

BREAK

3. The sun has _____ warmth during the day and helped kindle fires to last into the evening.

PROVIDE

4. _____ are increasingly displacing “dirty” fossil fuels in the power sector.

NEW

5. Humans have been _____ solar energy for thousands of years to grow crops, stay warm, and dry foods.

HARNESS

6. Wind has _____ boats to sail the seas and windmills to grind grain.

POWER

7. Solar energy systems don't produce air _____ or greenhouse gases, and as long as they are responsibly sited.

POLLUTE

8. Not all sources of energy marketed as “renewable” are _____ to the environment.

BENEFIT

9. The _____ in renewables is also happening at scales large and small, from rooftop solar panels.

EXPAND

(abridged from: <https://www.nrdc.org/stories/renewable-energy-clean-facts>)

Grammar**Part 2****Participle 1 (Причастие 1)**

В английском языке причастие 1 (причастие настоящего времени) образуется при помощи прибавления к основе глагола суффикса -ing.

- ▶ to work (работать) – working
- ▶ to write (писать) – writing
- ▶ to stand (стоять) – standing
- ▶ to sit (сидеть) – sitting

Причастные обороты:

- ▶ выражающее обстоятельство времени: перед причастием обычно употребляется when; while;
- ▶ выражающее обстоятельство образа действия (сопутствующего обстоятельства);
- ▶ выражающее обстоятельство причины;
- ▶ выступающее частью сравнительной условной конструкции.

See Appendix A: Grammar (Participle 1), табл. 3.5, 3.6.

Study the following examples:

1. (When) **going** to the headquarters I met my colleague. *По дороге в штаб (когда я шел) я встретил своего коллегу.*
2. The operators were excavating, **talking** about their shifts. *Операторы разрабатывали шахту, рассказывая о своих сменах.*
3. (While) **analysing** the data from geological log we discussed the exploration plan. *Анализируя данные геологического журнала, мы обсуждали план геологоразведочных работ.*
4. **Having** a great job, he often worked in the field. *Имея отличную работу, он часто работал вне офиса.*
5. A subsurface manager looked at me **as if wanting** to say something important. *Специалист по недропользованию посмотрел на меня так, словно хотел сказать что-то важное.*

Exercise 11. Transform the sentences according to the model.

Model: When you translate from technical English, pay attention to the grammar.
(When) Translating from technical English, pay attention to the grammar.

1. Be careful when you switch on the facility.
2. When you leave the laboratory, don't forget to switch off the light.
3. When they were travelling in Central Africa, the geologists found some ore deposits.
4. When you write a scientific report in English, pay attention to the terms.
5. You must have such a practice when you are learning to work on a new computer.
6. All the people who take part in this expedition are students.
7. The man who is speaking now is our new professor.
8. The apparatus that stands in the corner of the laboratory is quite new.
9. The young man who helps the professor with his experiments studies in our institute.
10. Students who write reports on their scientific research must do the work in time.
11. There are many people in our group who take part in the conference on geology.

Exercise 12. Translate from English into Russian paying attention to the participle.

1. The man speaking on geological prospecting is our professor's son.
2. The student asked the professor to go on with his lecture promising not to miss a word of it.
3. Receiving a letter from his boss, the company representative decided to stop the exploring operation.
4. The lecture stopped the speech promising to restart it in an hour.
5. She stood at the door writing a report on her investigation.
6. I sat at the computer trying to calculate the ultimate algorithm.
7. Seeing the professor, the students put up their hands showing him that they were ready.
8. Having read all the monograph several times, she knew all the details quite well.
9. Being checked with great care, the article didn't contain any errors.
10. While working on a new exploring and prospecting project, the company manager asked the geologist for help.

Exercise 13. Translate from Russian into English paying attention to the participle.

1. Оборудование, разработанное в нашем регионе, скоро будет отправлено на тестирование.
2. Во время написания отчета следует обращать внимание на структуру и содержание.

3. Закончив все вычисления, специалисты указали место проведения взрывных работ.
4. Графики, включенные в эту статью, были подробно прокомментированы нашим профессором.
5. Обладая огромным опытом, они были незаменимы при подготовке рудных залежей к разработке.
6. Полученные на компьютере расчеты очень огорчили всю комиссию.
7. Обломки горных пород, увиденные в музее, заинтересовали членов делегации.
8. Компания, разрабатывающая угольные залежи, имела большое преимущество перед конкурентами.
9. В нашей библиотеке есть немало книг, повествующих о жизни геологов в условиях Крайнего Севера.
10. Исправив поломку буровой установки, они продолжили работы.

Listening

Top 10 Energy Sources of the Future.

Exercise 14. Watch the video on Top 10 Energy Sources of Future and answer the following questions:

1. What is the most promising energy source for the future?
2. What is a renewable and non-renewable resource?
3. What are the most used renewable energy sources in the world?
4. Why can't we quit fossil fuels?
5. Why are fossil fuels so hard to quit?
6. Why should we save fossil fuels?
7. Which energy resource is most beneficial in your opinion, explain your answer?

(abridged from: <https://www.youtube.com/watch?v=uStFvcz9Or4>)

Exercise 15. Listen to the recording and fill the gaps.

1. Around the world alternative energy is on the _____.
2. Alternative energy sources could hold the key to _____ climate change.
3. Renewable energy naturally _____ itself and never run out.
4. Over _____ consumed by humans is derived from fossils.
5. Renewable energy creates no direct greenhouse _____.
6. The only emissions that renewable energy sources produce are indirect. Meaning those that result from _____ parts, installation, operation and maintenance.
7. Renewable energy can _____ pollution and therefore reduce threats to our health.
8. Once built, renewable _____ cost very little to operate.
9. While renewable energy has many advantages, it is not without _____.

10. It's difficult for renewable energy sources to generate power on the same large_____.
11. Building wind farms and dams can_____ wildlife and migration patterns and lead to ecological destruction.
12. Both solar and wind energy are_____ they only generate the power while the Sun is shining and the wind is blowing.
13. Batteries can't store excess energy for_____. However, they are often_____.
14. Advanced technologies make renewable energy more affordable and_____.

(abridged from: https://res.cloudinary.com/dtpgi0zck/video/upload/q_auto/vc_vp9/v1/videos/Climate%20101:%20Renewable%20Energy.webm?_s=vp-1.5.1)

Speaking

Advantages and Disadvantages of Alternative sources of energy

Exercise 16. List the advantages and disadvantages of using alternative sources of energy.

Exercise 17. Work in groups. Group A is going to be for alternative energy sources, Group B is going to speak against. Study the chart below and make some notes on advantages and disadvantages.

Give opinion	In my opinion / I believe / From my point of view – по моему мнению One of the advantages / disadvantages is – одно достоинство / недостаток заключается в
Refer to other people	According to (scientist) – согласно Experts say – эксперты утверждают Some people say – некоторые полагают, что
Agree	I completely agree / absolutely – я полностью согласен I think so too – я тоже так думаю You are right – ты прав There's no doubt in it – в этом нет никаких сомнений
Disagree	I am against – я против I disagree – я не согласен I would not agree – я бы не согласился
Accept an opinion	I see what you mean – я понимаю, что вы имеете в виду
Ask for someone's else opinion	What do you think – что вы думаете? What's your opinion on this – каково ваше мнение по данному вопросу?

Follow the example:

Student A: One of the advantages of using alternative energy sources is that they are renewable and don't produce any emissions. What do you think on that? Do you agree with me?

Student B: I see what you mean. Don't contribute to climate change. What's your opinion on this?

Student C: They don't produce direct emissions but manufacturing of the installations for alternative energy facilities might result in more emissions compared to those of fossil fuels.

Student D: I absolutely agree with you! Moreover, the installations and batteries are expensive!

Additional reading

Before you read

Exercises 18. What do you think the following statements might mean?

1. Russia has **set its sights on** developing alternative sources of energy in remote areas.
2. Russia **seeks to develop** solar power in **hard-to-access regions** with a high level of solar radiation.
3. Just five years ago many Russians viewed solar power plant construction projects as nothing but a **costly diversion**.
4. The subsidized cost of **hooking private households up** to power infrastructure is 550 rubles (\$ 14.20) per 15 kilowatts (KW).
5. Russia's first and only science and technology **center has been up and running** in St. Petersburg since 2010.

Exercise 19. Read the text.

A SUNNY FUTURE IN RUSSIA

Russia has set its sights on developing alternative sources of energy in remote areas, despite climate conditions and rich natural reserves. Recently the Republic of Altai launched the country's largest solar power plant. Other regions have also started to design and build their own solar power plants.

Until recently, Russia had been developing solar energy primarily in the space industry. The times are changing, yet the value of hydrocarbons remains important. Russia seeks to develop solar power in hard-to-access regions with a high level of solar radiation. In September, work at Russia's largest solar power plant was initiated in the village of Kosh-Agach in Altai. This is Russia's first 5-megawatt (MW) solar power facility.

Prior to that, the most powerful facilities were no more than 2 MW. This station is the first of five solar power plant construction projects in the Republic of Altai, which combined will have a 45-MW capacity.

Solar power plants are also being erected in the Republics of Khakassia and Bashkortostan, the Orenburg and Astrakhan regions and other areas.

An alternative strategy

“The launch of a solar power plant in the village of Kosh-Agach ushers in a new stage in the development of the Russian energy industry,” Anton Usachev, director of the Association of Solar Power Enterprises, told RBTH.

Just five years ago many Russians viewed solar power plant construction projects as nothing but a costly diversion. High production costs, low solar module productivity, long periods of investment return, the lack of a legal framework, and less-than-favorable climatic conditions prevented investors and bankers from putting up substantial sums to fund these types of projects. Since then the situation has changed radically.

It may not seem necessary to develop alternative sources of energy in one of the most hydrocarbon-rich countries in the world. The Russian government continues to trust forecasts asserting that the structure of consumption will not change in the next decade despite rising demand.

“The value of hydrocarbons will remain just as important as it is today,” Russian President Vladimir Putin said at the opening of the Kosh-Agach power plant.

“It will also be important to develop nuclear energy. But for hard-to-reach regions, remote regions, the use of alternative sources of energy, of renewable sources of energy, is an extremely important development. And it is a very good example of what needs to be done.”

Solar energy will primarily be developed in regions with a high level of insolation (solar radiation) where the cost of diesel generation is particularly high such as southern Russian, southern Siberia and the Far East.

“Despite its climatic conditions, Russia has every opportunity to create a competitive solar power generation industry,” a representative of the firm Rusnano’s press office told RBTH. “For example, in Astrakhan, the annual level of insolation reaches 1.38 MW/m², and in Altai it can reach 2.2 MW/m². Meanwhile, in Germany, insolation per square meter averages 0.9-1.2 MW per year, which doesn’t interfere with the development of solar energy in that country.” The sun shines in the remotest of areas.

According to Alexander Khurudzhi – the chairman of Territorial Grid Organizations, a non-profit association – from the physical standpoint there is a sufficiently high potential for solar energy in southern Russia, particularly the Crimea. However, such projects remain economically viable only in inaccessible areas that lack power infrastructure. The subsidized cost of hooking private households up to power infrastructure is 550 rubles (\$14.20) per 15 kilowatts (KW).

Now that alternative energy sources are becoming a priority in power generation, major investors are starting to raise funds to transfer advanced technology and improve it in cooperation with Russian scientific organizations. For example, the largest solar module factory in Europe has been built in Russia as a joint project between Renova and Rusnano. Russia’s first and only science and technology center has been up and running in St. Petersburg since 2010. It develops new solar module production technologies for both

industrial power plants and spacecraft. Government support for the industry has identified all of the conditions needed to create a successful, profitable solar power business.

(abridged from https://www.rbth.com/science_and_tech/2014/09/28/a_sunny_future_in_russia_developing_alternative_energy_sourc_40159.html)

Exercise 20. Decide if the following statements are true or false. Correct the false ones.

1. The largest solar power plant was launched in Sochi.
2. New solar power plant is Russia's first 5-megawatt (MW) solar power facility.
3. Solar energy will primarily be developed in regions with a high level of insolation (solar radiation) such as western Russia and the Far East.
4. Major investors are starting to invest in European scientific organizations.
5. Renova and Rusnano built the largest solar module factory for European countries.
6. For example, the largest solar module factory in Europe has been built in Russia as a joint project between Renova and Rusnano.

Scientific Corner Archives

Exercise 21. Put the words in the correct order to make sentences and do the test on Alternative Energy resources.

1. *resource / Of these / a non-renewable / which / energy*
 - a) Coal.
 - b) Geothermal.
 - c) Wind.
2. *Generate / wind / directly / what / turn to / does / electricity?*
 - a) Generator.
 - b) Motor.
 - c) Turbine.
3. */ of these / is / an advantage / energy / which / of wind?*
 - a) There is no electricity when there is no wind.
 - b) No harmful gases are produced.
 - c) Turbines may be noisy.
4. *required / power / tidal / what / to harness / is?*
 - a) A barrage.
 - b) A wind turbine.
 - c) A photovoltaic panel.
5. *is a disadvantage / power / which of these / of hydroelectric?*
 - a) Dams destroy the habitats of estuary species.
 - b) There are no fuel costs.
6. *of energy / does not / from the Sun / which type / come?*
 - a) Biomass.

b) Wind.

c) Geothermal.

7. *a disadvantage / of geothermal / which of these / energy / is*

a) Power stations can only be built in certain areas.

b) It is renewable.

c) No harmful gases are produced.

8. *Generate / do / panels / what / photovoltaic?*

a) Electricity.

b) Steam.

c) Hot water.

9. *come from / where / power stations / the energy / in geothermal / does?*

a) Fuel.

b) The Sun.

c) The Earth's hot core.

(abridged from: <https://www.bbc.co.uk/bitesize/guides/zsmph7h/test>)

UNIT 4

PROSPECTING AND EXPLORATION

UNIT 4A. PROSPECTING METHODS

Learning objectives

In this part you will:

- ▶ acquire the vocabulary associated with geological prospecting;
- ▶ listen about the geological mapping techniques;
- ▶ review passive voice with modal verbs;
- ▶ read about some prospecting methods;
- ▶ speak on geological ground prospecting method;
- ▶ learn how to explain process and describe plans.

Reading

Before you read

Exercise 1. Before reading the text about Prospecting train the pronunciation of the following words and word combinations:

Search	[sɜːrtʃ]	Поиск
Prospecting	[ˌprɒˈspektɪŋ]	Разведка
Occurrence	[əˈkɜːrəns]	Месторождение
Value	[ˈvæljuː]	Оценивать
Determine	[dɪˈtɜːrmin]	Определять
Contain	[kənˈteɪn]	Содержать
Sulphur	[ˈsʌlfər]	Сера
Phosphates	[ˈfɔːsfets]	Фосфаты
Mineral fuels	[ˈmɪnərəl] [ˈfjuːəl]	Минеральное топливо

Petroleum	[pə'troʊliəm]	Нефть
Within	[wɪ'dɪn]	В пределах
Preliminary investigation	[prɪ'lɪmɪnəri] [ɪn,vestɪ'geɪʃn]	Предварительная разведка
Subdivide into	['sʌbdɪvaɪd] ['ɪntə]	Подразделять на
Mapping	['mæpɪŋ]	Картография
Panning	['pænɪŋ]	Промывка
Trenching	[trentʃɪŋ]	Прокладывание канав
Borehole	['bɔ:rhooɪ]	Буровая скважина
Survey	['sɜ:rveɪ]	Обследование, съемка

PROSPECTING

The search for mineral deposits that can be worked is prospecting. A prospect is an occurrence of minerals of potential value, before its value has been determined by exploration and development. Mineral deposits include those containing metallic elements, such as copper, lead, zinc, or iron; non-metallic materials, such as asbestos, clay, phosphates, or sulphur; and mineral fuels, such as coal or petroleum. Deposits such as sand, gravel or stone are usually considered the deposits of the rock itself.

Mineral prospecting normally proceed from the general to the specific, from consideration of large regions to smaller areas within the region, and finally to individual prospects. Following a preliminary investigation, including a study of available maps and reports, prospecting may often be concentrated on smaller areas immediately. Prospecting methods may be subdivided into direct and indirect methods. Direct methods include geologic and photography mapping; the study of guides to ore; and the field examination of the surface, supplemented by panning, trenching, drilling or sampling. Indirect methods are of two kinds: 1) geophysical methods, which include magnetic, electromagnetic and radioactivity surveys, both from air and on the surface; electrical resistivity, self-potential, gravimetric, and seismic surveys on the surface; electric, self-potential, radioactivity, and temperature surveys, in boreholes; and 2) geochemical and botanical surveys.

(abridged from: <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/mineral-exploration>)

Exercise 2. Answer the questions about some methods in mineral prospecting.

1. What does the term “prospecting” mean in mining?
2. What determines a potential value of minerals?
3. What phases does the preliminary investigation involve?
4. How many geological exploration methods are there?
5. What's the difference between direct and indirect prospecting methods?

6. What technical operations supplement the field surface surveys?
7. What is the geophysical prospecting method?
8. What do you know about the geochemical survey?

Exercise 3. Decide if the following statements are true or false.

1. Correct the false ones.
2. Mineral deposits include metallic and non-metallic materials.
3. Coal or petroleum are usually considered the deposits of the rock itself.
4. A preliminary investigation may be concentrated only on smaller areas.
5. Geologic mapping presents the field examination of the surface study.
6. Magnetic, electromagnetic and radioactivity surveys are made from air and on the surface.
7. According to the text there are three methods of mineral prospecting.
8. Direct methods are supplemented by two kinds of indirect methods.

Vocabulary

Exercise 4. Match the words and their definitions.

1. Examine and record the area and features of (an area of land) so as to construct a map, plan, or description by the emission of ionizing radiation or particles.
2. A map showing the geological features of an area, especially the type of rock on or under the surface.
3. Focus all one's attention on a particular object or activity.
4. The first claim made in an area and marked out by the discoverer of the deposit.
5. The action of making a hole in something by boring with a drill.
6. Preceding or done in preparation for something fuller or more important.
7. An element or substance that is not a metal.

(abridged from: <https://www.lexico.com/en/definition>)

- a) Geological map
- b) Prospecting claim
- c) Preliminary investigation
- d) Radioactivity survey
- e) Non-metallic materials
- f) To concentrate
- g) Drilling

NB!:

potential value – предполагаемая оценка; ценность

electrical resistivity – удельное электрическое сопротивление

the rock itself – сами породы; чистые породы без примесей

temperature surveys – температурные исследования

Exercise 5. Complete the sentences using the word given.

1. In some areas a _____ must also make claims, meaning they must erect posts with the placards on all four corners of a _____ land they wish to prospect and register this claim before they may take samples.

PROSPECT

DESIRE

2. Magnetic separators may be useful in _____ the magnetic fraction of a heavy mineral sand from the nonmagnetic fraction.

SEPARATE

3. These low frequency waves will respond differently based on the material they pass through, allowing for analysts to create three-_____ images of potential ore bodies or _____ intrusions.

DIMENTION

VOLCANO

4. The majority of early prospectors had no _____ and relied mainly on luck to discover deposits.

TRAIN

5. Traditionally prospecting relied on direct observation of _____ in rock outcrops or in sediments.

MINERAL

Exercise 6. Read the lecture on geological prospecting and fill the gaps.

- a) geological mapping
- b) carried out
- c) prospecting indicators
- d) yield valuable minerals
- e) the genesis
- f) exposure of bedrock
- g) shallow mining operations
- h) reconnaissance maps

Student: Professor, tell us, please, about geological prospecting operations.

Professor: The totality of operations involved in discovering deposits of useful minerals. Geological prospecting is 1) _____ on the basis of a study of the geological structure of the terrain together with 2) _____. Sometimes it is based on data from earlier geological survey. As a scientific endeavor, geological prospecting depends on maps of the probable distribution of useful minerals in the territories under investigation or 3) _____ that predict the location of useful minerals.

Student: What do geological prospectors take into account?

Professor: Prospectors take into account the conditions under which deposits of useful minerals are formed or 4) _____ that is manifested by the association of

certain minerals with certain elements of the geological structure of the terrain. The use of these elements in searching for deposits of useful minerals requires a knowledge of what are called 5) _____. These include characteristics of the deposits' link with elements of the local stratigraphy, lithology, tectonics, petrography, geochemistry, and geomorphology.

Student: What are the necessary investigations to make?

Professor: The types of special field and laboratory investigations that are made during prospecting depend on such geological conditions as the degree of 6) _____, the thickness of the cover of loose deposits, and the relief of the terrain.

Student: What methods do prospectors use while exploring and what operations do they provide?

Professor: In surface geological and mineralogical exploration, the river-detritus, glacial boulders, and concentrate methods are used. In areas covered by loose anthropogenic deposits, the regularities in the location of glacial boulders, river gravel, and slope talus are studied, the useful minerals located among them are determined, and the distribution of these minerals is characterized. Washing of river sands or loose deposits on slopes may 7) _____, such as gold, platinum, tin ore, wolframite, and diamonds, which are found in the heavy fraction (concentrate) of these deposits. 8) _____, such as the digging of test pits, trenches, and holes, are usually performed during geological prospecting. In places where theoretical considerations indicate the presence of buried deposits that do not reach the surface, geological prospecting involves drilling exploratory boreholes and, sometimes, digging deep shafts and adits.

(abridged from: <https://encyclopedia2.thefreedictionary.com/Geological+Prospecting>)

Exercise 7. Now answer the following questions using the information from the text. Try to give as many details as it is possible.

1. What is geological mapping used for?
2. What types of procedures are usually carried out while prospecting?
3. What are the prospecting indicators?
4. What might yield valuable minerals?
5. What is the genesis?
6. In what way the bedrock could be espoused?
7. What shallow mining operations were mentioned in the text?
8. Why do geologists need to use reconnaissance maps?

Listening

Exercise 8. Listen to the recording about land-use facts during geological prospecting and fill the gaps.

1. Exploration is very different from mining. You are _____ an assessment of what's below the ground, what's the _____ around the surface.

2. It's a long stage from exploration and the environmental process, you assess _____, you assess _____ and _____ impacts.
3. The time frame for all the assessment could be up for _____.

(abridged from: <https://youtu.be/SvckV-RIz8>)

Exercise 9. Listen to a detailed talk on geological mapping and answer the questions:

1. What types of activities do geologists perform?
2. Who exactly conducts the study?
3. How do geologists do the work?
4. Why do geologists need aboriginal traditional knowledge?

Exercise 10. Now listen for the details:

1. Now we have a lot of geologists trying to visit as many pieces of the _____. Rock as it's possible.
2. We usually map in teams of three people which are composed of a _____ geologist, an engineering geologist, and a local _____.
3. The structural geologist will characterise the lithology, the character of the rock and _____, and faults.
4. The engineering geologist will measure the rock _____, its physical properties, the magnetic character of the rock, and the local guide gives us knowledge about what _____.
5. For structural geologists the most important thing is _____, this gives us the orientation on lineal features of the rock like such as a fault or a joint.
6. Also, the _____ is used to characterise the rock hardness.
7. From the aboriginal prospective we are trying to understand _____ and avoid culturally sensitive areas.

(abridged from: <https://youtu.be/RyF0-vrgHYI>)

Grammar

The Passive Voice: Revision: Modal Verbs

Модальные глаголы в английском языке выражают возможность, вероятность, необходимость или способность совершения действия:

- ▶ «must» используется для выражения долженствования, исходящего от говорящего;
- ▶ «can» – «уметь», «мочь»;
- ▶ «should» – «следует» – используется для советов;
- ▶ «need to» – «нужно» – для выражения потребности говорящего.

Общая схема пассивного залога с модальными глаголами

[Modal Verb] + be Ved/3f

**Схема для построения пассивного залога с прошедшими формами
модальных глаголов**

[Modal Verb] + have been + Ved3f

See Appendix A: Grammar (Passive Voice: Modal Verbs), табл. 4.1.

Study the following examples

1. The pits **might have been excavated** yesterday. *Карьер возможно уже разрыли вчера.*
2. You **should have studied** the maps and reports before surveying the field. *Вам следовало бы изучить карты местности и отчеты перед проведением исследований.*
3. You **must wear** safety coveralls while prospecting. *Ты обязан носить защитный комбинезон во время разведки полезных ископаемых.*
4. Tom was bitten by a snake. He **mustn't have put on** boots and coveralls. *Тома укусила змея. Должно быть, он не надел защитные ботинки-комбинезон.*

Exercise 11. Open the brackets and put the following verbs into the passive voice, consult the text “Processing” if you need to.

1. Prospecting methods may (subdivide) into direct and indirect methods.
2. Geologic and photography mapping; the study of guides to ore; and the field examination of the surface, supplemented by panning (consider) to be direct methods.
3. Following a preliminary investigation, including a study of available maps and reports, prospecting may often (concentrate) on smaller areas immediately.
4. Deposits such as sand, gravel or stone are usually (consider) the deposits of the rock itself.
5. The search for mineral deposits that can be (work) is prospecting.
6. A prospect is an occurrence of minerals of potential value, before its value has been (determine) by exploration and development.
7. Metallic elements, such as copper, lead, zinc, or iron; non-metallic materials, such as asbestos, clay, phosphates, or sulphur; and mineral fuels, such as coal or petroleum (include) to mineral deposits.
8. Mineral deposits (find) all over the territory of Federation of Russia.
9. Geological prospecting and other technical majors are well (teach) in SibFU.
10. Before mineral deposits (extract) and (produce), they need to (prospect) and (explore).

Exercise 12. Transform the past passive voice into the future passive.

1. The peak of expenditure on exploration had been reached about 14 years ago.
2. In Australia most of mineral deposits was recovered in non-ferrous mineral exploration expenditures in 2010.

3. The Bureau of Statistics has been disappointed by the report on current trends.
4. The decreasing discovery rate was reflected strongly focused on brownfields drilling.
5. Designing drill programs has always been based on geophysical and structural targets.
6. Significant exploration challenges were caused by the cost of discovery and lack of technical innovations.
7. One gold discovery, three base metal discoveries and one molybdenum discovery were identified by geoscience during two years.
8. Geological analysis had been understood as a key component of Greenfields exploration support.
9. Under the influence of necessity the industry has been moved from a phase of discovery of near-surface deposits to generating methods for discovery of deposits at depth, either below an unconformity or within a basement terrane, but with no exposure at surface.
10. Huge coal and iron resources were discovered a year ago in an area that had seemed to be run out of mineral resources.

Exercise 13. Open the brackets and put the following sentences into past, present and future passive.

1. The core of geological prospecting competency (base) on applying new modeling and visualisation techniques.
2. Computers (see) as underpinning technical innovations and improving the process of geological prospecting.
3. When the professor came to the conference he (give) a registration form.
4. Computers (use) to model the most difficult processes that (considered) purely theoretical.
5. Everybody (inform) that measuring the effectiveness of geological exploration and looking for trends that will lead to improved exploration success are key drivers for continued investment in the exploration industry.

Speaking

Discussing process and explaining plans (Обсуждение процессов и планов)

How to talk about plans and schedules			
Ask about the results for now	Ask about current actions	Ask about the past events	Ask about future plans
Present Perfect Have / has + Ved/3f	Present Progressive Am/is/are + Ving	Past Simple + Ved? When did + S + V1	Future Simple will + V1
Have you search for outcrops of ore deposits?	What are you doing now?	When did you analyses the core samples?	When will you examine the mechanical aureole of ore fragments?

Exercise 14. *Ehere is a geological ground prospecting schedule. Read the schedule ask your partner up to 5 questions on the plan and answer your partner's questions. Now it's third week of October.*

Geological ground prospecting schedule												
Techniques and methods	September				October				November			
	1	2	3	4	1	2	3	4	1	2	3	4
a study of available maps and reports	*											
perform geologic mapping		*										
perform aerial survey		*										
perform study the guides to ore			*									
determine the location of prospecting work				*								
trench the site					*	*						
drill the borehole / well, etc							*					
perform electric, self-potential, radioactivity, and temperature surveys, in boreholes								*				
take samples									*			
analyze the samples in a Lab										*		
perform geochemical and botanical surveys											*	
report to the environmental agencies and policies												*

UNIT 4B. EXPLORATION OF MINERAL DEPOSITS

Learning objectives

In this part you will:

- ▶ learn the words associated with mineral exploration and mining slang language;
- ▶ read about the professional activity of an exploration geologist;
- ▶ listen about mineral explorations activities;
- ▶ speak on methods of mineral exploration;
- ▶ review the gerund and the infinitive;
- ▶ write a line graph description on geological exploration case.

Reading

Before you read

Exercise 1. Before reading the text about Mineral Exploration train the pronunciation of the following words and word combinations:

Exploration	[eksplə'reɪʃn]	Разведка месторождения с попутной добычей
Searching for	[ˈsɜːrtʃɪŋ] [fər]	Проводить изыскательные работы
Reconnaissance	[rɪˈkɑːnɪsɪs]	Предварительная разведка
Feasibility study	[ˌfiːzəˈbɪləti] [ˈstɑːdi]	Геолого-экономическая оценка
Commodity	[kəˈmɑːdəti]	Предмет потребления; ценный ресурс
Convenience	[kənˈviːniəns]	Выгода; преимущество
Technical inputs	[ˈteknɪkl] [ˈɪnpʊts]	Технические материалы
Good will	[ɡʊd] [wɪl]	Денежная оценка предполагаемой прибыли
Power grid	[ˈpaʊər] [ɡrɪd]	Единая энергосистема
Industrial water	[ɪnˈdʌstriəl] [ˈwɔːtə]	Вода для промышленного потребления
Visualization	[ˈvɪʒʊəlɪz(ə)ʃ(ə)n]	Наглядное представление
Brownfield	[ˈbraʊnfiːld]	Вторичная разработка ранее использованного месторождения
Greenfield	[ˈɡriːnˈfiːld]	Разработка нового месторождения «с нуля»
Beneficial	[ˈbenɪˈfiʃ(ə)l]	Значимый с практической точки зрения

Exercise 2. Read the text. Try to guess what the words in bold mean.

MINERAL EXPLORATION

Mineral exploration is a complete sequence of activities. It ranges between searching for a new mineral prospect (reconnaissance) and evaluation of the property for economic mining (feasibility study). It also includes augmentation of additional ore reserves and resources in the mine and **total mining district**. Various exploration techniques have been followed over the centuries. Exploration is conducted by one or a combination of multiple available global techniques and depends on the demand of the commodity being searched for, convenience of infrastructures, funds from the exploration institution, size and **complexity of the deposit**, price of end products, government policy, good will, and tax and royalty structures. Programs include multidisciplinary data generation in sequence.

In addition to technical inputs, activities encompass collection of information about the infrastructure around the area, such as accessibility (road, rail, nearest rail-head, airport, and sea port), average rainfall, availability of potable and industrial water,

power grid and supply system, local community, living conditions, health care, security, forests, and environmental issues. **Background information** about agencies from federal and state/regional/provincial governments and the public and private sectors, including multinational companies engaged in any mineral exploration program in the area, will be beneficial.

(abridged from: <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/mineral-exploration>)

Exercise 3. Decide if the following statements are true or false. Correct the false ones.

1. Mineral exploration ranges between searching for a new mineral prospect and a reconnaissance.
2. A feasibility study includes augmentation of additional ore reserves.
3. A reconnaissance and evaluation of the property for economic mining are included in a complete sequence of mining activities.
4. Exploration is conducted by a combination of global techniques.
5. According to the text the infrastructure around the area includes multidisciplinary data generation in sequence.
6. Multinational companies are engaged in any mineral exploration program in the area.

Exercise 4. Match 1–7 to a–g.

1. The basic physical and organizational structures and facilities (e.g. buildings, roads, power supplies) needed for the operation of a society or enterprise.
2. Concerns the environment in which something is produced indicating it's public purpose or agenda.
3. Preliminary surveying or research.
4. A part of an object or surface.
5. Through analysis of a subject or theme.
6. By-product of industrial or commercial activities used for fabricating, processing, washing, diluting, cooling, or transporting a product.
7. An assessment of the practicality of a proposed plan or method.

(abridged from: <https://www.lexico.com/en/definition/>)

- a) Industrial water
- b) Exploration
- c) Area
- d) Feasibility study
- e) Reconnaissance
- f) Background information
- g) Infrastructure

NB!:

evaluation of the property – оценка свойства/ качества

sequence of activities – последовательность действий

multidisciplinary – многопрофильный; междисциплинарный

mining district – район проведения горных работ

Exercise 5. Answer the questions about some methods in mineral exploration.

1. What sequence of activities does the mineral exploration include?
2. What is the feasibility study of exploration?
3. Can you determine the first exploration activity?
4. What factors determines the choice of exploration techniques?
5. What's the difference between *reconnaissance* and *feasibility study* in mining?
6. What are technical inputs in mining exploration?
7. Why the collection of information about the infrastructure is important?
8. What background information will be beneficial for any mining company?

Vocabulary and language use practice

Part 1

Exercise 6. Complete the sentences using the word given.

1. The holes are _____ so that the actual position of the hole at each elevation can be accurately _____ and data incorporated into a computer block model.

SURVEY

PLOT

2. _____ of an orebody may lead to an increased mine life in years or to a decision to increase annual production rate.

EXTENT

3. Artisanal workings can be a useful guide for formal exploration teams to the location of deposits and the _____ geology of an area.

STRUCTURE

4. Diamond drilling can be _____ to depths of several thousand metres.

CARRY

5. Scientific exploration for minerals starts with regional geological _____ which may be incorporated into geographic information system (GIS) databases.

MAP

6. Exploration companies may supplement existing geological mapping with satellite _____ or aerial mapping.

IMAGE

7. The decision to _____ exploration in any area is based primarily on geological prospectively.

TAKE

8. Computer _____ are used to compare unexplored regions with geologically similar areas and to make mathematical _____ of the probabilities of desired economic outcomes of exploration.

SIMULATE**PREDICT**

(abridged from: <https://www.extractiveshub.org/topic/view/id/39/chapterId/276>)

Part 2**Pit talk**

Exercise 7. Read the introduction of the article “The secret coal mine language that’s now is going extinct” and try to guess the missing words.

- All languages contain different accents and dialects and these aren’t just linked with **g** _____ **l** _____ **n**.
- Mining language is distinctive but is now at **r** _____ **k of being l** _____ **t** following the widespread colliery closures across the country.
- With the **c** _____ **e** of the last coal mines and the ageing mining population, we must now **c** _____ **t** such data with a greater sense of urgency.
- This language forms a large part of the identity and camaraderie of the miners and should be **p** _____ **d** for future generations to understand.

(abridged from: <https://theconversation.com/pit-talk-the-secret-coal-mine-language-thats-now-going-extinct-96594>)

Exercise 8. Now try to guess what the following words might mean. Match 1–6 to a–f.

- | | |
|--|--------------------------------------|
| 1. Marra | a) miners’ comradeship |
| 2. Brotherhood | b) a water bottle used by miners |
| 3. Stint | c) used to describe a length of coal |
| 4. Snap / bite / piece | d) cages / chairs |
| 5. Dudley | e) noxious gasses found in the mines |
| 6. Unload the lifts | f) to refer to lunch or dinner time |
| 7. Blackdamp / fire damb / whitedamp / chokedamp | g) a north-east word for “mate” |

(abridged from: <https://theconversation.com/pit-talk-the-secret-coal-mine-language-thats-now-going-extinct-96594>)

Exercise 9. Now match to describe mining professions.

- | | |
|-------------------|--|
| 1. Fitters | a) those who carried the explosives |
| 2. Sparkies | b) in charge of sinking new shafts |
| 3. Sinkers | c) mechanics |
| 4. Powder monkeys | d) those who removed the roof supports |
| 5. Shot firers | e) those who put up the roof supports |

- | | |
|-----------------|---|
| 6. Chockers | f) those who carried drills and drilled holes |
| 7. Back rippers | g) electricians |
| 8. Borers | h) those who controlled explosions |

(abridged from: <https://theconversation.com/pit-talk-the-secret-coal-mine-language-thats-now-going-extinct-96594>)

Listening

Part 1

Exercise 10. Listen to the recording on Mineral Exploration and answer the following questions:

- What does a geologist do?
- Do geologists get paid well?
- What does a geologist do every day?
- How hard is it to be a geologist?
- What are the disadvantages of being a geologist?
- How many types of geologists are there?
- What tools do geologists use?

(abridged from: https://youtu.be/LI0Zh_7XUdw)

Listening

Part 2. Mining operations

Exercise 11. Watch the video to answer the following questions in a discussion:

1. What's the problem with ore reserves?
2. What are the types of mines?
3. What's the difference between surface and sub-surface mining?
4. What does processing of rocks include?
5. Why mines around the world become abandoned?
6. What does "peak oil / ore / coal" mean in the context of non-renewable resources?

Extra questions:

1. What is the main purpose of mining?
2. Why do we need minerals?
3. What are the 4 types of mining?
4. For what purpose was the first mining legislation adopted?
5. What is the impact of mining on the environment?
6. What is the main purpose of the SMCRA?
7. How can mining lands be restored?

(abridged from: <https://www.youtube.com/watch?v=3uXyZ3FGTC0>)

Exercise 12. Match the types of mining and the activities.

1. Mountaintop mining
2. Open pit mining

3. Placer mine
4. Strip mining
5. Subsurface mining
6. Giant copper mine

- a) Remove the top of a mountain
- b) Common with coal, build strip after strip
- c) Get ore that are that is really deep
- d) Dig down from the top
- e) Sink a shaft and dig out ores
- f) Dig the ore out and use water to rinse it off

Choose the translation equivalents:

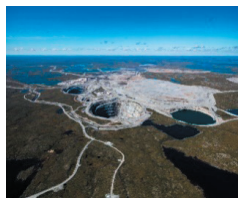
Example: Giant copper mine stands for.....

Добыча на гребне горы / Открытая разработка месторождений / Открытые горные работы / Подземные горные работы / Разработка медного рудника / Россыпная добыча / разработка россыпей.

Exercise 13. Look at the pictures and try to guess which type of mining is depicted.



1 _____



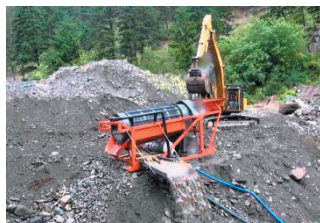
2 _____



3 _____



4 _____



5 _____



6 _____

Speaking

Part 1

Exercise 14. Work in pairs. Student A, explain how mining operations are being performed in the pictures and what type of mining is depicted, but make some mistakes. Student B, correct Student A or ask for additional information if it's necessary.

Speaking

Part 2

Exercise 15. Read the conversations, underline the most important information and act out with your groupmate. You can divide the conversation into two parts if necessary.

Assistant professor: Professor, what is the aim of mineral exploring?

Professor: Mineral exploration aims to discover deposits of minerals and rocks that can be used to meet the resource needs of society. It encompasses the search for industrial raw materials (clay, limestone, sulphur, salts, and fertilizer minerals and rocks), ores from which metals are extracted (iron, copper, and zinc ores), and gemstones (diamonds, sapphires, and opals), and includes the search for solid fuels (coal, oil shale, and uranium) but not liquid or gaseous fuels (petroleum and natural gas). Mineral exploration can be as basic as prospecting, using elementary techniques such as panning for gold, or it can be very sophisticated, involving the use of complex technology for data gathering and interpretation.

Assistant professor: Well, and the definition?

Professor: Mineral exploration can be technically defined as “all the activities and evaluation necessary before an intelligent decision can be made establishing size, initial flow sheet, and annual output of new extractive operation”. The purpose of mineral exploration is the discovery and acquisition of new mineral deposit amenable to economic extractive operations now or in future. The prime objective of mineral exploration is to find and acquire a maximum number of such economic mineral deposits at a minimum cost and within minimum time.

Assistant professor: And what is mineral exploration as a phenomenon?

Professor: Mineral exploration is a complete sequence of activities. It ranges between searching for a new mineral prospect (reconnaissance) and evaluation of the property for economic mining (feasibility study). It also includes augmentation of additional ore reserves and resources in the mine and total mining district. Various exploration techniques have been followed over the centuries. Exploration is conducted by one or a combination of multiple available global techniques. In addition to technical inputs, activities encompass collection of information about the infrastructure around the area, such as accessibility (road, rail, nearest rail-head, airport, and sea port), average rainfall, availability of potable and industrial water, power grid and supply system, local community, living conditions, health care, security, forests, and environmental issues.

Assistant professor: We will need to mention and describe the necessary procedures.

Professor: Mineral exploration is the follow-up of geological, geochemical, and geophysical anomalies from a reconnaissance survey. Again in this stage geological, geochemical, and geophysical methods are employed to follow up the anomalies or targets.

At this stage, pitting, trenching, sampling, and pit trench wall logging program are conducted to delineate the bedrock geology of the area and obtain geochemical samples

in order to confirm the source of geochemical, geological and geophysical anomalies that were found in the reconnaissance survey and determine accurate grade estimates of the deposit. A hand drill or an auger may be used for shallow drilling to understand the geology of the anomaly and ascertain the position of the deposit.

Soil and rock geochemical sampling, analysis, and interpretation are conducted to ascertain or confirm the presence of mineral deposit. The area is gridded and soil samples are taken at fixed intervals to offer a more clear shape and structure of the ore body. At this stage, ground geophysical surveys may be undertaken for conductive ore bodies like sulfide and oxides mineralization. The geophysical methods may include gradient array induced polarization, resistivity, magnetic, and gamma-ray spectrometry.

Assistant professor: Is it all at the moment?

Professor: Unfortunately, yes, the article is far from being completed...

(abridged from: <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/mineral-exploration>)

Grammar

The Gerund

Герундий – неличная форма английского глагола с суффиксом -ing, соединяющая в себе черты существительного и глагола и несущая в себе оттенок значения некоторого процесса:

- ▶ *to check* – *checking*;
- ▶ *to read* – *reading*;
- ▶ *to write* – *writing*.

See Appendix A: Grammar (The Gerund), табл. 4.2.

Study the following examples

1. The company representative **doesn't mind collaborating** with us. *Представитель компании не возражает против того, чтобы поработать с нами.*
2. **Avoid using** an out of date rock drilling facility. *Избегайте использования устаревшего оборудования для бурения горных пород.*
3. I simply **adore making** geological maps. *Я просто обожаю создавать геологические карты.*

Exercise 16. Open the brackets and write the gerund forms of the verbs.

1. Could you please stop (make) mistakes in your reports at the conferences?
2. I don't enjoy (write) scientific articles on geological survey.
3. Does your work of a surveyor involve (deal) with technical equipment, (do) the paperwork of (meet) with people?
4. I consider (take) the job of a prospecting specialist but in the end I decided against.

5. I don't fancy (ask) my boss for some help.
6. The battery of this laptop need (charging).
7. She denied (read) the instruction.
8. Could you consider (reduce) the cost of prospecting?

Exercise 17. Translate from English into Russian using the gerund.

1. Докладчик заговорил ровно в девять часов и продолжал свою речь о геологоразведке на протяжении всего заседания.
2. Представьте себе, сколько труда нужно, чтобы составлять геологические карты.
3. Пожалуйста, продолжайте работать, мы не будем вам мешать.
4. Инспектор сказал, что он не прочь подождать окончания подготовительных работ.
5. Он заметил, как зажегся аварийный сигнал, но продолжал повышать обороты.
6. Инженеры постарались все предвидеть, но они не смогли предотвратить вынужденный простой.
7. Сперва мне нравилась работа добытчика угля, но затем я устал от выполнения тяжелой работы в неблагоприятных условиях под землей.
8. Карьерные работы постоянно прерываются. Это потому что руководитель постоянно забывает конкретизировать повседневные задачи.
9. Нам было предложено перепроверить точечное местоположение рудной жилы до того, как наносить уже отмеченный участок на геологическую карту.
10. Модернизация производственного процесса может повлечь расширение штата рабочего персонала.
11. Компания отложила разработку золотоносной жилы из-за угрозы закрытия проекта.
12. Прошу вас, прекратите работы на этом участке, угольный пласт истощился.

Grammar

The Gerund and the Infinitive

В английском языке широко используются герундий и инфинитив. Некоторые глаголы употребляются с инфинитивом, некоторые – с герундием.
See Appendix A: Grammar (The Gerund and The Infinitive), табл. 4.3.

Study the following examples:

1. The surveyor **asked** his assistants **to** keep quiet. *Геодезист попросил своих помощников замолчать.*
2. Every company **hates doing** the same analysis, over and over again. *Каждая компания ненавидит делать один и тот же анализ снова и снова.*

3. He **decided to** give up field work. *Он решил бросить полевые работы.*
4. I am **thinking of** applying that new geological method for pit reserves prospecting. *Я думаю о применении этого нового геологического метода для разведки карьерных запасов.*
5. I **remember** the professor **speaking** on types of coal. *Я помню, как профессор говорил о типах угля.*

Exercise 18. Make two lists of verbs: followed by gerunds and by infinitives.

The Gerund	The Infinitive

Adore, agree, anticipate, arrange, avoid, consider, delay, demand, deserve, detest, dread, enjoy, expect, fail, help, hesitate, imagine, invite, involve, keep, mention, miss, need, offer, order, plan, postpone, practice, pretend, recall, resend, risk, suggest, tend, threaten, warn.

Writing

Exercise 19. Read the text and classify the phrases in bold.

Up	Steady	Down

Measuring the effectiveness of geological exploration and looking for trends that will lead to improved exploration success are key drivers for continued investment in the exploration industry.

Expenditure on exploration in Australia, for example, **reached a peak** in 2008, which reflects **a massive increase** in exploration for iron ore resources and, to a lesser extent, coal resources. The correction after the global financial crisis in late 2008 **resulted in a significant drop** in 2009 – up to 42 % globally, most of which was recovered in non-ferrous mineral exploration expenditures in 2010. The Australian Bureau of Statistics report on current trends shows continuing strength, but the return on expenditure on new deposits has been disappointing.

Geoscience Australia identifies only one gold discovery, three base metal discoveries and one molybdenum discovery from 2008–2010. This **decreasing discovery rate** is reflected in Australia strongly focused on brownfields drilling, with 63 % of expenditure on those targets. While the latest trends **show a slight increase in** greenfields exploration, the overall **trend shows a continuing focus on** areas with a higher probability of success.

With respect to greenfield exploration, the industry is **moving from a phase** of discovery of near-surface deposits to generating methods for discovery of deposits at

depth, either below an unconformity or within a basement terrane, but with no exposure at surface.

(abridged from: <https://www.srk.com/en/newsletter/exploration-geology/exploration-mineral-deposits-global-trends>)

Exercise 20. What's the main idea in each paragraph?

- Paragraph 1. the search for successful exploration techniques
Paragraph 2. _____
Paragraph 3. _____
Paragraph 4. _____

Exercise 21. Which tenses did the author use to describe trends?

1. Expenditure on exploration in Australia, for example, **reached** a peak in 2008, which **reflects a massive increase**.
2. The correction after the global financial crisis in late 2008 **resulted** in a significant drop in 2009 – up to 42 % globally.
3. While the latest trends **show** a slight increase in greenfields exploration, the overall trend **shows** a continuing focus on areas with a higher probability of success.
4. With respect to greenfield exploration, the industry **is moving** from a phase of discovery of near-surface deposits to generating methods for discovery of deposits at depth.

Exercise 22. Search the Internet and find a line graph describing geological exploration. Analyze and write a description of the graph.

Use some of the following ideas for your writing task:

The graph shows _____

As an overall trend, It is clear that _____

It can be clearly seen that _____ increased / dropped / remain unchanged / remained steady _____

There was a fall / a drop / a rise in _____

There has been a slight increase _____

In conclusion, the graph shows that _____

(abridged from: https://www.ieltsexam.net/preparing/Writing_task_one_single_line_graph/208/)

UNIT 4C. MINING AND THE ENVIRONMENT

Learning objectives

In this part you will:

- ▶ study the words associated with mining and the environment;

- ▶ read about mining effects on the environment;
- ▶ listen about the pros and the cons of mining;
- ▶ learn how to explain a problem and talk about an alternative solution on the example of mining companies;
- ▶ review reported speech.

Before you read

Exercise 1. Practice to pronounce of the following words and word combinations correctly:

Environment	[ɪn'vaɪərənmənt]	Окружающая среда, природная среда
Activity	[æk'tɪvɪtɪ]	Деятельность, работа
Pollution	[pə'luːʃn]	Загрязнение окружающей среды, загрязнение
Dispose	[dɪs'pəʊz]	Располагать, расположить
Waste	[weɪst]	Отходы, стоки
Impact	[ɪ'mpækt]	Влияние, воздействие, эффект
Release	[rɪ'liːs]	Освобождать, выпускать
Contaminants	[kən'tæmɪnənts]	Вредные вещества
Linked to	[lɪŋkt]	Связанный, сопряженный, связываемый
Decline	[dɪ'klaɪn]	Снижение, спад, падение
Failure	[ɪ'feɪljə]	Неудача, провал
Policy	[ɪ'pɒlɪsi]	Политика, стратегия
Preserve	[prɪ'zɜːv]	Сохранить, поддерживать
Sinkholes	[ɪ'sɪŋkhəʊl]	Карстовая воронка

Before you read

Exercise 2. Match 1–8 to a–h to make collocations.

- | | |
|-----------------|--------------------|
| 1. Water | a) runoff |
| 2. Release | b) the environment |
| 3. Negative | c) sinkholes |
| 4. Policy | d) changes |
| 5. Avoid | e) impact |
| 6. Preserve | f) pollution |
| 7. Contaminated | g) pollutants |
| 8. Waste | h) disposal |

Try to guess what is depicted below:



1 _____



2 _____



3 _____

Exercise 3. Read the text and write down all the negative effect of mining.

MINING AND THE ENVIRONMENT

Mining can have negative effects on the environment. For example, some mining activities can result in water pollution. This is especially true if the miners don't dispose of waste properly. Mining companies can reduce their negative impact on the environment by being careful about how they dispose of their waste. Another way to reduce the negative impact of mining on the environment is to use new mining methods that do not harm the environment.

According to an environmental protection group, local mining companies such as Turtle Mines and Wilkins Mining Group are doing a great job of reducing the negative impact of mining on the environment. In particular, the group reported that mining companies released fewer pollutants and contaminants in the last year. Furthermore, there were no coal fires, which in the past have been linked to deforestation and a decline in biodiversity.

Executives at local mines credit various policy changes for these improvements. "We have designed improved systems for waste disposal": said Jason Gregson of Turtle Mines. Gregson explained that safe disposal of waste prevents the hazardous byproducts of mineral processing from contaminating groundwater. As a result, there are also fewer instances of siltation and contaminated runoff.

Meanwhile, Todd Wilkins of the Wilkins Mining Company reported that mining companies are doing more to avoid problems in the future. "We've spent a lot of time working with experts to avoid geological failures such as sinkholes and erosion", he says, "it's important to Wilkins Mining Company that we conduct our business in the most environmentally-responsible manner. We want to preserve the environment, not destroy it".
(abridged from: <file:///F:/E%20book%20mining/Mining/N%20R%20II%20Mining/MINING.pdf>)

Exercise 4. Decide if the following statements are true or false. Correct the false ones.

1. Turtle Mines improved systems for waste disposal.

2. Mining companies can be more careful about how they dispose of their waste.
3. Coal fires haven't been linked to decline in biodiversity.
4. To use new mining methods is the best way to reduce the negative impact on the environment.
5. Wilkins Mining Company wants to preserve the environment, not destroy it.
6. Siltation arc prevents the hazardous byproducts.

Exercise 5. Match the words and their definitions.

1. A secondary product derived from a production process, manufacturing process or chemical reaction.
2. Involving risk or danger.
3. A depression or hole in the ground caused by some form of collapse of the surface layer.
4. The complex of physical, chemical, and biotic factors that act upon an organism or an ecological community and ultimately determine its form and survival.
5. An unwanted by-product of a manufacturing process, chemical laboratory, or nuclear reactor.
6. A situation or occurrence in which something does not work as it should.
7. A substance that makes something (as air or water) impure and often unsafe.

NB!:

environmentally-responsible – экологически ответственный

waste disposal – утилизация отходов; размещение отходов

coal fires – возгорание угля

hazardous by-products – опасные побочные продукты

- a) Pollutant
- b) Failure
- c) Waste
- d) Environment
- e) Sinkhole
- f) Hazardous
- g) Byproduct

(abridged from: <https://www.merriam-webster.com/dictionary/waste>)

Exercise 6. Answer the questions about the impact of mining on the environment.

1. What are some effects that mining has on the environment?
2. How can mining companies reduce their negative impact on the environment?

3. What role do mining engineers play in encouraging mining companies to use safe mining techniques?
4. How can groundwater pollution be reduced?
5. What is the environmentally-responsible manner of conducting business?

Exercise 7. Complete the sentences using the word given.

1. Open pit mining, where material is _____ an open pit, is one of the most common forms of mining for strategic minerals.

EXCAVATE

2. The _____ water can pollute the region surrounding the mine and beyond.

CONTAMINATE

3. Open-pit mining is particularly _____ to the environment because strategic minerals are often only available in small concentrations, which increases the amount of ore needed to be mined.

DAMAGE

4. When _____, some of the rocks expose radioactive elements, asbestos-like minerals, and metallic dust.

CRUSH

5. _____ with hydraulic pumps removes ecologically _____ topsoil containing seed banks, making it difficult for vegetation to recover.

BLAST and VALUE

6. Brine mining involves _____ and _____ the brine solutions to remove harmful elements and compounds.

EXTRACT and EVAPORATE

(abridged from: <https://web.mit.edu/12.000/www/m2016/finalwebsite/problems/mining.html>)

Listening

Exercise 8. Listen to the recoding about the Filipinos split over pros and cons of mining and fill the gaps.

1. At present there are 4 mining sits in Palawan. All being _____ by the local government.
2. This large scale mining operation has been going on in Rio Tuba Mine for 30 years. It has not just _____ the landscape of area but it also helped the town _____.
3. Local government has _____ over 100 mining applications this year.
4. We are here to keep the balance; we are not really saying that we want to _____ the province and leave all this natural wealth _____.
5. The local government says over mining would be environmentally catastrophic, so it has effectively put _____ on additional operations.
6. For mining operator Robert Rodriguez _____ mining is the answer.

Exercise 9. Listen to the recording again and classify the following statements into problems and solutions.

Problems	Solutions

1. Find the balance between the price of development and cost of the environment.
2. Government encourage industries growth.
3. Have an environmental law in place.
4. Keep balance between mining and the environmental protection.
5. Leave natural wealth untouched.
6. Monitor the sites.
7. Over mining would be environmentally catastrophic.
8. Put a ban on additional operations.
9. Reject applications for the area.
10. Responsible mining is the answer.
11. Take measures to stop polluting local rivers.
12. Too many claims over every square inch on the Island.

(abridged from: <https://youtu.be/JOgZ8xyCClw>)

Writing

Exercise 10. Write who those statements relate to: an interviewer / local government / a mining operator / local communities and people / vice governor.

Speaking

Part 1

Problems and Solutions

Language to describe problems	Language to describe solutions
<p><i>We've got a problem with</i> – у нас проблема с</p> <p><i>It looks like we face a problem of</i> – выглядит так, как будто бы столкнулись с проблемой</p> <p><i>There is / isn't</i> – имеется, присутствует</p> <p><i>There are / aren't</i> – имеются / присутствуют</p> <p><i>We can't</i> – мы не можем</p> <p><i>We don't understand how</i> – мы не понимаем, как</p> <p>Для описания имеющихся проблем обычно используются:</p> <ul style="list-style-type: none"> • Настоящее время глагола to be (Present of "to be" form) <p><i>It looks like there is a problem in a mining shaft</i></p> <ul style="list-style-type: none"> • Настоящее совершенное время (Present Perfect) <p><i>We've got some problems with the schedule</i></p> <ul style="list-style-type: none"> • Настоящее продолженное время (Present Progressive) <p><i>The alarm system isn't working properly</i></p>	<p><i>Let's try to</i> – давай попробуем</p> <p><i>Let's [V]</i> – давай (сделаем)</p> <p><i>We need to</i> – нам нужно</p> <p><i>[Noun] needs + Ving</i> – нуждается</p> <p><i>We might / we could</i> – мы могли бы</p> <p><i>It's a good idea to</i> – хорошая идея</p>

Exercise 11. Pretend to be at the meeting discussing various problems and solutions on the topic of environmental problems. Transform the following sentences using the table above.

“Most of the mining industry has not been proactive in environmental protection. Mining must be and can be fixed. It can be made an environmentally friendly activity. It only takes the will. All communities must band together and do it”.

Professor of Mining Engineering, MTU, Dr. Gertsch

What seems to be the problem? (Что представляет собой проблему?)

1. “The need for minerals will expand. Computers, cars, and houses are minerals. The world wants these products. The world needs these products. Mining supplies the minerals that keep people alive, but not without side effects”.
2. “The power to run the computers was generated from coal and distributed by aluminum and copper conductors. Toothpaste, baby powder, electric guitars, paper, scouring powder, aspirin, prosthetics, symphony orchestras, toilets, all contain earth materials. The demand for the products of mining will not go away”.
3. “Along with the valuable materials released from the earth come destructive chemicals (or, more broadly, chemicals that are not yet valuable). Two of the worst examples are acid drainage and heavy metal pollution. The sulfur reacts with water to form acid. In addition, when mining leaves waste rock behind, contained metals often leach into the kind and the water”.
4. “Holes and piles of rock are left behind. The old coal mining districts of West Virginia and Kentucky have a legacy of virtually worthless land. To see a haphazard jumble of rock piles and holes makes us wonder whether humans can ever be good stewards of the planet”.
5. “Recycling is sometimes posed as an alternative to mining. This formulation is also the wrong way to frame the issue. To say that mining impacts can be lessened by recycling is true, but recycling is only pan of the solution. There will always be a need for new earth materials, particularly if human populations continue to growth”.

Exercise 12. Now move toward the solutions might come up with. Chose the appropriate variant to the problems above.

As for the solutions, _____ (что касается решений, то)

One of the solutions is that _____ (Одно из решение заключается в том, что)

1. The waste rock chemicals from mining and milling can be removed and turned into useful products. Total control over the chemical content of the rock is required, for example, why isn't waste sulfur used to produce acid for the manufacturing industry?

2. Mines move a lot of rock that winds up as waste. Other mines produce rock that is used as building, construction, and pavement aggregate. An obvious question is why isn't waste rock used as aggregate? The answer may be that new ways of product separation are needed or that new formulations of concrete and asphalt may be required.
3. It is not hard to envision new methods of mining that would have less impact on the environment and would reduce or eliminate scarring of the land. For example, perhaps techniques as diverse as directional drilling in the petroleum industry' and for that matter laparoscopic surgery in medicine could be applied to recovering valuable metals and minerals while dramatically reducing the amount of rock that must be moved. At the very least such an approach is suggestive. Take a systems approach to planning projects. If projects are planned from the outset with a low impact perspective, it should be possible to avoid problems or turn potential problems into assets. For example, open pits can be used as lakes or reservoirs if a project is properly planned. Perhaps post-recovery uses could be found for underground mines if such uses were taken into account at the design phase.
4. A key objection to mining from the environmental industry is that they have little faith in the outcome of mining operations. A certified project would eliminate doubt. Approved projects could proceed faster, thereby rewarding good mining practices. It's time to make mining work in the environment.

(abridged from: https://ctb.ku.edu/en/table_of_contents/implement/physical_social_environment/environmental_quality/ma_nbeing_a_coal_miner_was_incredibly)

Speaking

Part 2

Questions for in-class discussion on environmental problems

Exercise 13. Answer the following questions. You may use the information from the Internet.

1. What are theoretical and methodological foundations of ecological geology?
2. What are problems of ecological geology and modern eco-politics in the field of rational subsurface use, including various regions?
3. What modern methods of obtaining and generalizing geological information do you know?
4. What are ecological bases and methods of assessment of the state of the natural environment?
5. What are mechanisms and principles of natural and subsurface use management, environmental management?
6. What methodological aspects of the training of ecologists in higher education are used?
7. What are modern problems of ecological geology?

8. What methods of obtaining and summarizing geological information, as well as the principles of ecological and geological mapping, do you know?

Exercise 14. Develop the following ideas. You may use the information from the Internet.

1. Theoretical and methodological foundations of ecological geology and rational subsurface use.
2. Modern methods of obtaining and summarizing information on environmental problems of subsurface use.
3. Criteria and methods for assessing the state of the natural environment and ways of its rehabilitation.
4. Scientific and methodological aspects of training of bachelors, masters and postgraduates in environmental geology and rational subsurface use.

Exercise 15. Make up a dialog between a journalist and a mining executive using some of the ideas on the topics above:

Follow the example:

Journalist (F): Good morning, Mr. Gregson. Thank you for making time for this interview.

Mining Executive (M): It's my pleasure.

Journalist: I understand that your company has recently implemented a number of changes that are meant to reduce its impact on the environment.

Mining Executive: That's correct. We want to make sure our activities aren't hurting anyone.

Journalist: Can you give me any specifics about this?

Mining Executive: Absolutely. For one, our engineers designed tailing ponds that are less likely to spill.

Journalist: Which prevents the contamination of groundwater?

Mining Executive: Right, that's a big concern for us.

Journalist: That's wonderful to hear. What other changes has the company made?

Mining Executive: We realized that awareness is a great tool against accidents.

Journalist: That's interesting ... so, you are trying to educate your employees about environmental issues?

Mining Executive: Exactly. Recently, we started hosting training sessions for these important issues. Journalist: Like what?

Mining Executive: For example, once a month, we have a training workshop on the proper storage of coal. Hopefully, that will help prevent coal fires.

Journalist: That's wonderful. It's great to hear that your company is doing so much to be environmentally responsible.

Grammar**Reported Speech (косвенная речь)**

Косвенная речь – это речь, передаваемая не слово в слово, а только по содержанию, в виде дополнительных придаточных предложений, без сохранения стилистики автора. Все предложения, имеющие косвенную речь, являются сложноподчиненными, где в главном предложении используются слова автора, а в придаточном – сама косвенная речь.

(abridged from: <https://speakenglishwell.ru/kosvennaya-rech-v-anglijskom-yazyke/>)

See Appendix A: Grammar (Reported Speech), табл. 4.4–4.16.

Study the following patterns:

1. An inspector **said** that the reason of an explosion **had been** a coal fire. *Инспектор сказал, что причиной взрыва был угольный пожар.*
2. Experts **said** that the geological failures **were being investigating**. *Эксперты заявили, что в настоящее время ведется изучение геологических провалов.*
3. Environmental protection representatives **said** that local governments **had to put** a ban on the release of pollutants and contaminants from mining facilities. *Представители охраны окружающей среды заявили, что местные органы власти должны были наложить запрет на выброс загрязняющих веществ и загрязняющих примесей с горнодобывающих предприятий.*

Exercise 16. Transform the direct into indirect speech.

1. The student told his professor: “I hope to pass the exam on geology”.
2. She said: “The professor is listening to us”.
3. One student says to another: “I didn’t make any mistakes in my report”.
4. The university director told his colleagues: “I saw new monographs on geological ecology”.
5. The ecology specialist said: “I can’t read articles in English”.
6. My professor told me: “Get ready for the credit on geology”.
7. The student said: “I will not work on my major in the future”.
8. My colleague said to me: “I’m not really ready for the conference”.
9. The teacher says: “You have plenty of ideas to write the report on this topic”.
10. I said to my teacher: “I haven’t attended geology classes for a very long time”.

Exercise 17. Transform the questions into the indirect speech.

1. The professor asked me: “Are you going to report on your scientific research”?
2. A student stopped me and asked: “Have you got a program of the conference”?
3. Someone asked me: “Do you want to be a geologist or petroleum well driller”?

4. The professor asked me: “How many types of rocks making the Earth’s crust do you know”?
5. The professor asks: “What is the difference between metamorphic rocks and magmatic rocks?”
6. The professor asked the students: “What do you know about faults and folds”?
7. The professor asks: “How large is this coal field”?
8. Students ask: “What are the problems of modern geology”?
9. The student asked: “Is it difficult to write a doctor’s thesis on geology”?
10. The teacher asks: “Will you tell us about sedimentary rocks”?

Exercise 18. Translate from Russian into English.

1. Мы попросили автора монографии пояснить нам некоторые моменты его книги.
2. Профессор велел нам готовить аннотацию к статье на русском и на английском языках.
3. Я сказал своему преподавателю, что не смогу сдать геологию автоматом.
4. Наши соавторы говорят нам, что еще не отредактировали свою часть доклада.
5. Организатор конференции предупредил нас, что на доклад предоставляется не более десяти минут.
6. Директор института велел нам заполнить журнал на английском языке.
7. Профессор попросил меня стать соавтором его статьи.
8. Секретарь конференции сказала мне отнести документы директору.
9. Начальник экспедиции запретил нам употреблять спиртное при исполнении.
10. Представитель геологической компании сказал, что у них есть вакансии на должность исследователей-экспериментаторов.

APPENDIX A: GRAMMAR BANK

UNIT 1

The verb “to be”

Таблица 1.1

Лицо	Настоящее время (Present forms of “to be”)	Прошедшее время (Past forms of “to be”)	Будущее время (Future forms of “to be”)
I	Am	Was	Will be
You We	Are	Were	
He She It	Is	Was	

При составлении утвердительных и отрицательных предложений необходимо сохранять прямой порядок слов (табл. 1.1):

S + V (to be)

S + V (to be) + not

При составлении вопросов в предложении необходимо поменять прямой порядок слов на обратный. Это значит, что субъект и глагол поменяются местами:

(Wh-questions) + V (to be) + S

Present Tenses

Present Simple (настоящее простое время)

Мы используем настоящее простое время для того, чтобы подчеркнуть, что действие, о котором мы говорим, происходит регулярно (каждый день / неделю / год), или для того, чтобы говорить о действиях, которые справедливы всегда (табл. 1.2).

Слова-индикаторы времени в предложении:

- ▶ always (всегда);
- ▶ usually (обычно);
- ▶ often (часто);
- ▶ seldom (редко);
- ▶ sometimes (иногда);
- ▶ never (никогда);
- ▶ every day / every week (каждый день / каждую неделю).

Таблица 1.2

Present Simple		
	I, We, You, They	He, She, It
+	S + V	S + V (s/es)
–	S + do not + V	S + does not + V
?	Do + S + V	Does + S + V

Present Progressive (настоящее продолженное время)

Мы используем настоящее продолженное время для того, чтобы подчеркнуть, что действие, о котором мы говорим, происходит в момент речи / в настоящий период времени / запланировано нами на ближайшее будущее (табл. 1.3).

Слова-индикаторы времени в предложении:

- ▶ момент речи:
 - now (сейчас);
 - at the present moment (в настоящий момент);
 - at this moment (в этот момент);
- настоящий период времени:
 - currently (на настоящее время);
 - at present (на настоящий период);
- ▶ ближайшее будущее:
 - tonight (сегодня вечером);
 - this weekend (в этот выходной);
 - today (сегодня днем).

Таблица 1.3

Present Progressive			
	I	You, We, They	He, She, It
+	S + am + V(ing)	S + are + V(ing)	S + is + V(ing)
–	S + am + not + V (ing)	S + are + not + V(ing)	S + is + not + V(ing)
?	Am + S + V(ing)	Are + S + V(ing)	Is + S + V(ing)

Present Perfect (настоящее совершенное время)

Мы используем настоящее совершенное время для того, чтобы подчеркнуть, что совершенное в прошлом действие имеет актуальный для нас результат или последствия в настоящем времени (табл. 1.4).

Слова-индикаторы времени в предложении:

- ▶ недавнее прошлое:
 - just (только что);

- only just (едва);
- recently (недавно);
- already (уже);
- ▶ наречия и выражения с указанием на настоящий момент:
 - ever / yet (еще);
 - so far (на текущий момент);
 - up to now (до сих пор).

Таблица 1.4

Present Perfect		
	I, We, You, They	He, She, It
+	S + have + V(ed/3f)	S + has + V(ed/3)
–	S + have + not + V(ed/3f)	S + has + not + V(ed/3f)
?	Have + S + V(ed/3f)	Has + S + V(ed/3f)

Past Tenses

Past Simple

Мы используем прошедшее простое время для того, чтобы говорить о событии, которое произошло в определенное время в прошлом, завершилось и не продолжается в настоящем (табл. 1.5).

Слова-индикаторы времени в предложении:

- ▶ yesterday (вчера);
- ▶ the day before yesterday (позавчера);
- ▶ last week / month / year / weekend (на прошлой неделе / в прошлом месяце / году / в прошлые выходные);
- ▶ ago (a day ago / a year ago and etc.) (назад: день назад / месяц назад / год назад);
- ▶ служебные слова: in / on (in 2018 / on Wednesday).

Таблица 1.5

Past Simple		
	I, We, You, They, He, She, It	
+	S + Ved / 2form	S + Ved / 2form
–	S + didn't = did not + V1	S + didn't = did not + V1
?	Did + S + V1	Did + S + V1

Past Progressive

Мы используем прошедшее продолженное время для того, чтобы говорить о действии, которое длилось в определенное время в прошлом.

Слова-индикаторы времени в предложении, указывающие на конкретный момент действия:

- ▶ служебные слова: at, when, while (в / когда / в то время, как).

Таблица 1.6

Past Progressive			
	I	We, You, They	He, She, It
+	S + was + Ving	S + were + Ving	S + was + Ving
–	S + was + not + Ving	S + were + not + Ving	S + was + not + Ving
?	Was + S + not + Ving	Were + S + Ving	Was + S + Ving

Future Tenses and “to be going to”

Future simple

Мы используем будущее простое время для того, чтобы:

сделать предположение о будущем:

- ▶ be sure (быть уверенным);
- ▶ think (думать);
- ▶ believe (полагать);
- ▶ perhaps (возможно);
- ▶ probably (вероятно);
- ▶ certainly (безусловно);

выражать обещания, надежды и опасения:

- ▶ hope (надеяться);
- ▶ promise (обещать);
- ▶ afraid (бояться);
- ▶ swear (клясться);

давать прогнозы на будущее и говорить о спонтанных решениях, которые мы принимаем.

Таблица 1.7

Future Simple		
I	We, They, You	He, She, It
S + will + V		
S + will + not + V		
Will + S + V		

To be going to

Мы используем конструкцию *to be going to* (собираться что-либо делать), когда заранее планируем что-либо сделать и когда говорим о том, что что-либо произойдет с большей вероятностью и для этого есть все признаки.

I am going to apply for a job soon.

Look at these clouds! It is going to rain.

Таблица 1.8

To be going to		
I	You, We, They	He, She, it
S + am going to + V	S + are going to + V	S + is going to + V
S + am not going to + V	S + are not going to + V	S + is not going to + V
Am + S + going to + V	Are + S + going to + V	Is + S + going to + V

UNIT 2**The passive voice**

В страдательном залоге ПОДЛЕЖАЩЕЕ (существительное или местоимение) выражает ЛИЦО (или ПРЕДМЕТ), НА КОТОРОЕ НАПРАВЛЕНО ДЕЙСТВИЕ, выраженное глаголом-сказуемым. Действие производит лицо или предмет, выраженный существительным или местоимением в функции дополнения с предлогом *by* (кем). Но дополнение в страдательном залоге часто отсутствует, поскольку основное внимание направлено не на лицо (или предмет), совершающее действие, а на объект действия и его результат.

Непереходные глаголы, т. е. глаголы, которые не могут иметь при себе прямого дополнения (*to live, to arrive* и др.), не могут употребляться в форме страдательного залога.

Страдательный залог образуется при помощи вспомогательного глагола *to be* / *to get* в соответствующем времени и Participle II смыслового глагола (или третьей формы смыслового глагола).

В зависимости от употребляемой временной формы изменяется глагол *to be* / *to get*, который является показателем лица, числа и времени (табл. 2.1).

(abridged from: <https://catchenglish.ru/grammatika/passive-voice.html>)

Употребление пассивного залога в речи:

- ▶ говорящий не заостряет внимание на том, кем или чем выполняется какое-либо действие: *My geological report will be discussed on Monday;*
- ▶ говорящий указывает на объекта или на субъекта, совершающего действие; при этом употребляются предлоги:

- by, если речь идет об одушевленных субъектах или элементах: *The last geological report was approved by our professor;*
- with, когда указывается на инструмент, оружие либо материал: *The piece of coal can be destroyed with a hammer.*

Таблица 2.1

Tense	Passive	Examples
Present Simple	Am / is / are + Ved / 3form	Many metals are recycled
Present Progressive	Am / is / are + being + Ved / 3form	The metal is being heated
Past Simple	Was / were + Ved / 3form	The new method was called bronze
Past Progressive	Was / were + being + Ved / 3form	While the copper was being heated, the tin was mixed in
Present Perfect	Have / has + been + Ved / 3form	These methods have been used for years
Past Perfect	Had + been + Ved / 3form	Bronze had already been discovered
Future Simple	Will + be + Ved / 3 form	The metals will not be replaced
Future be going to	Am / is / are + going to + be + Ved / 3form	It's going to be replaced
Modals	*should + be + Ved / 3form	Metals can be made better and stronger
Modals Perfect	*should + have + been + Ved / 3form	Bronze may have been discovered by accident

(abridged from: *Cambridge Active grammar B2 Level. Davis Fiona, Rimmer Wayne. 2011: 143*)

Обратите внимание!

- В пассивном залоге могут употребляться только глаголы, имеющие прямое дополнение (переходные). Непереходные глаголы в пассивном залоге ставиться не могут. Например:

to appear – появляться

to arrive – прибывать

to be – быть

to become – становиться

to belong – принадлежать

to come – приходить

to consist – состоять из

to fit – подходить

to fly – лететь
to go – идти
to have – иметь
to hold – держать
to lack – недоставать
to last – длиться
to possess – обладать
to resemble – быть похожим
to seem – казаться
to suit – годиться

- В пассивном залоге нужно употреблять инфинитив после модальных глаголов. Passive Infinitive выглядит следующим образом: *to be done* или *to have been done*.

I want to be helped to analyze my geological report.

My geological report has not been approved, the professor must have rejected it.

- В пассивном залоге перевод с английского на русский некоторых глаголов может затруднить:

to advise – советовать
to allow – позволять
to ask – спрашивать
to deny – отрицать
to forbid – запрещать
to forgive – прощать
to offer – предлагать
to order – приказывать
to pay – платить
to promise – обещать
to refuse – отказывать
to show – показывать
to teach – учить, преподавать

Во избежание упомянутых трудностей следует придерживаться следующего: в пассивных конструкциях английского языка подлежащее соответствует предложному дополнению в русском языке:

they asked – *they were asked*: они спросили – их спросили;

she told her – *she was told*: она сказала ей – ей сказали.

(abridged from: <http://puzzle-english.com/directory/present-simple-passive?>)

Cause and Effect Language

Языковые конструкции для построения предложений, описывающих причину и следствие, представлены в табл. 2.2.

Таблица 2.2

Cause and effect constructions	Translation
This lead to...	Это привело к...
This caused...	Это вызвало...
The cause of ...was	Причиной была...
...was caused by...	... было вызвано...
...resulted in...	... закончилось...
... as a result of...	... в качестве результата ...
If [PRESENT], [will+V].	Если ..., то...

The process description

Языковые конструкции для построения предложений, описывающих процесс и его стадии, представлены в табл. 2.3.

Таблица 2.3

Constructions to describe processes	Translation
Starters to mark the beginning of a process <i>Firstly, the fabric is soaked in the water</i>	First / Firstly (во-первых) First of all (прежде всего) To begin with (в первую очередь) The first step / stage is (первый шаг / этап)
Continuers to make the progress of the process explicit at any given stage <i>Afterwards, the fabric is dried in the sun</i>	Second / Secondly (во-вторых) Third / Thirdly (в-третьих) Next (следующий) Afterwards (потом, в последствии) After (после) Then (затем)
Synchronisers <i>Once the fabric is dried in the sun, the next step is to iron it</i>	While (пока, в то время как) At the same time (в тоже самое время) In the meantime, (тем временем) During (в течение) Before (до, перед тем, как) Earlier (ранее) As soon as (как только) When X, then Y (когда... тогда) Once X, then Y (как только ... тогда)
Finishers to make the ending of the process explicit <i>Lastly, the fabric is folded</i>	Finally, (в итоге) The process finishes by (процесс завершается)

(abridged from: <https://www.coursera.org/lecture/teaching-english/3-1-1-describing-a-process-mjuio>)

The Participle II

Причастие II (причастие прошедшего времени) используется для выражения законченного процесса в английском языке. Для этого к основе глагола необходимо прибавить суффикс *ed*:

extract (извлекать) – extracted (извлеченный)

produce (производить) – produced (произведенный)

break (ломать) – broken (сломанный / разломанный)

В тех случаях, когда глагол неправильный, форму причастия нужно брать из третьей колонки таблицы неправильных глаголов (табл. 2.4).

Таблица 2.4

INFINITIVE	PAST INDEFINITE ACTIVE	PARTICIPLE II
Cut (резать)	Cut	Cut (нарезанный)
Build (строить)	Built	Built (возведенный)
Begin (начинать)	Began	Begun (начатый)

Варианты употребления и перевода причастия II:

Таблица 2.5

Функция	Пример
Определение Положение: слева или справа определяемого слова. Перевод причастием на: -мый, -щийся, -нный, -тый, -вшийся	Molten rock crystallizes and solidifies – Расплавленная порода кристаллизуется и затвердевает. melt – melted – molten / melted
Обстоятельство причины Положение: придаточное причины. Перевод: причастие на -мый, -щийся, -нный, -тый, -вшийся	[Well-known all over the world] the Russian book on electronics was also translated into English. Так как русская книга по электронике известна во всем мире, она была переведена и на английский язык. Know – knew – known
Обстоятельство времени Положение: придаточное времени, иногда вводится союзами <i>when</i> (когда), <i>while</i> (в то время как, во время)	When given the book read the article about environment protection. Когда вам дадут книгу, прочтите статью об охране окружающей среды. Give – gave – given
Часть сказуемого	Igneous rocks are divided into two groups Магматические породы подразделяются на три группы. Divide – divided

(abridged from: <https://study-english.info/participle-2.php>)

UNIT 3

Zero and First Conditionals

Zero conditional

Условное предложение нулевого типа (Zero Conditional) используется тогда, когда мы говорим о вещах, справедливых всегда (о научных фактах и очевидных вещах). Обе части условного предложения ставятся в настоящее время. Общая схема для условных предложений нулевого типа (табл. 3.1):

IF [Present], [Present].

Таблица 3.1

IF clause (condition)	Main clause (result)
If the food is out of date,	I don't eat it
If you heat water at 100 degrees,	It boils
IF I have drunk ,	I don't drive
If you are talking ,	I can't concentrate

First Conditional

Условное предложение первого типа (First Conditional) используется, когда мы говорим о реальных событиях будущего времени. То есть если выполнится условие, то действие произойдет в будущем (табл. 3.2).

IF [Present], [*Future]

Таблица 3.2

IF clause (condition),	Main clause (result)
If it is dangerous out there	I won't come
If you study , If he doesn't call, If you see a smoke from the plant,	you will pass the exam you should tell me immediately press the emergency button
If you have come to class	the exam is going to be very easy
If you are working hard these days,	you will get a pay rise

(abridged from: <https://test-english.com/explanation/b1-2/zero-first-conditional-future-time-clauses/>)

Second and Third Conditionals

Second Conditional

Предложения в условном наклонении обозначают, что действие или состояние, обозначаемые глаголом, представлены не как факт, а как воображаемое или желаемое. Условное предложение второго типа (Second Conditional) используется тогда, когда мы говорим о воображаемых событиях настоящего или будущего времени: **IF [Past], [would + V1]** (табл. 3.3).

Таблица 3.3

Тип условного	IF clause (condition)	Main clause (result)	Пример
Second Conditional Маловероятное настоящее или будущее	If + Past Simple,	Would + глагол без to	<i>If I had vacation in summer, I would spend it at home. I fed with my shifts.</i> Если бы у меня был отпуск летом, я бы провел его дома. Мне надоела моя работа по сменам

Third Conditional

Условные предложения третьего типа (Third Conditional) используются, когда мы говорим о прошлых событиях с целью:

- ▶ сожалеть о свершившемся;
- ▶ критиковать какие-либо действия;
- ▶ говорим о событиях, произошедших в прошлом и положительно повлиявших на текущую ситуацию (табл. 3.4).

IF [Past Perfect], [would have + Ved/3f]

Таблица 3.4

Тип условного	IF clause (condition)	Main clause (result)	Пример
Third Conditional Нереальное прошлое	If + Past Perfect,	Would have + past participle	<i>If we had taken a taxi, we wouldn't have missed the plane.</i> Если бы мы взяли такси, то не опоздали бы на самолет

(abridged from: <https://engblog.ru/conditional-sentences>)

Participle I

Таблица 3.5

Образование причастия I (правила орфографии)	
Если глагол в инфинитиве оканчивается на немое е, то при прибавлении -ing немое е опускается	to give (давать) – giving to write (писать) – writing

Окончание табл. 3.5

Если глагол в инфинитиве оканчивается на одну согласную букву и ей предшествует краткий гласный звук, то эта конечная согласная удваивается	to sit (сидеть) – sitting to swim (плавать) – swimming to run (бегать) – running
Если инфинитив оканчивается на букву «l», то независимо от ударения эта буква в британском варианте удваивается	to travel (путешествовать) – travelling to cancel (отменять) – cancelling
Если инфинитив оканчивается на «-ie», то буква «i» опускается, а «е» переходит в «у»	to die (умирать) – dying to tie (связывать) – tying to lie (лежать) – lying

Таблица 3.6

Употребление Participle I / Present Participle		
В функции определения	Перед существительным, как отглагольное прилагательное (на русский язык переводится причастием или же определительным придаточным предложением)	<i>The speaking girls are our students.</i> Говорящие девушки (девушки, которые говорят) – наши студентки

(abridged from: <https://catchenglish.ru/grammatika/prichastie-nastoyashchego-vremeni.html>)

UNIT 4

The Passive Voice: Modal Verbs

Модальные глаголы в английском языке выражают возможность, вероятность, необходимость или способность совершения действия:

- ▶ «must» используется для выражения долженствования, исходящего от говорящего;
- ▶ «can» – «уметь», «мочь»;
- ▶ «should» – «следует» – используется для советов;
- ▶ «need to» – «нужно» – для выражения потребности говорящего (табл. 4.1).

Таблица 4.1

Описание текущей и/ или будущей ситуации	
Утвердительное предложение	Object + may, must, can, could, ought to, should + be + verb3 <i>The pits should be excavated on time</i>
Отрицательное предложение	Object + may, must, can, could, ought to, should + not + be + verb3

Окончание табл. 4.1

Вопросительное предложение	Must, may, can, should, might + object + be + verb3 (past participle)
Прошедшее время	
Утвердительное предложение	Object + may, must, can, could, ought to, should + be + verb3
Отрицательное предложение	Object + may, must, can, could, ought to, should + not + have been + verb3
Вопросительное предложение	Must, may, can, should, might + object + be + verb3 (past participle)
Обратите внимание на перевод модальных глаголов в прошедшем времени: might have done – возможно / может уже should have done – следовало бы must have done – должно быть	

The Gerund

Герундий – неличная форма английского глагола с суффиксом -ing, соединяющая в себе черты существительного и глагола и несущая в себе оттенок значения некоторого процесса:

- ▶ to check – checking;
- ▶ to read – reading;
- ▶ to write – writing.

The company representative encourages innovative approaches to prospecting and exploring – Представитель компании поощряет инновационные подходы к разведке и поиску.

Образование герундия представлено в табл. 4.2.

Таблица 4.2

Образование герундия	
Правило	Пример
К инфинитиву без частицы «to» добавляется суффикс «-ing», при этом образуется так называемая четвертая форма глагола	To do – doing To work – working
Отрицательная форма герундия при помощи частицы, которая ставится перед формой герундия	For working overtime – за то что работали сверхурочно For not working overtime – за то что не работали сверхурочно

The Gerund and The Infinitive:

Таблица 4.3

Глаголы, употребляющиеся с герундием	Глаголы, употребляющиеся с инфинитивом
<p>Глаголы мышления и говорения: admit, anticipate, deny, consider, discuss, forgive, imagine, mention, recall, recollect, remember, suggest, understand. <i>I remember the professor speaking on types of coal</i></p>	<p>Структура verb + infinitive: afford, agree, arrange, attempt, decide, demand, expect, fail, fond of, forget, hesitate, hope, manage, mean (intend), offer, plan, prepare, pretend, promise, propose, refuse, want, wish. <i>He decided to give up field work</i></p>
<p>Глаголы, выражающие эмоции, чувства и отношения: like, love, enjoy, adore, fancy, dislike, hate, resent, detest, dread, mind. <i>Every company hates doing the same analysis, over and over again</i></p>	<p>Структура verb + object + to infinitive: advise, allow, catch, encourage, find, force (make), help, invite, notice, order, permit, persuade, recommend, remind, see, teach, warn. <i>The prospecting specialists advised us to think well before choosing a job of a geologist</i></p>
<p>Глаголы, выражающие развитие действий: begin, start, commence, continue, go on, finish, stop. <i>We go on doing research on the topic</i></p>	<p>Структура verb + to + infinitive verb + object + infinitive: ask, expect, help, remind, threaten, want. <i>The surveyor asked to keep quiet.</i> <i>The surveyor asked his assistants to keep quiet</i></p>
<p>Глаголы want, need, deserve, require в значении lack, be in need of. <i>The project needs additional financing</i></p>	
<p>Глаголы risk, postpone, miss, help, involve, include, delay, excuse, avoid. <i>We risk 25 % overpaying for this prospecting operation</i></p>	

(abridged from: <https://linguistpro.net/gerundij-v-anglijskom-yazyke>; <https://www.nativeenglish.ru/grammar/gerund>; <https://infourok.ru/prezentaciya-grammaticheskogo-materiala-te-gerund-2413214.html>)

Reported Speech

Direct speech, или прямая речь, выражает фразу человека дословно. Это в своем роде цитата, которую никак изменить нельзя. Как и в русском, прямая речь обрамляется кавычками. Вместо двоеточия перед словами автора в начале или запятой с тире на конце обычно используется одна простая запятая (табл. 4.4).

Таблица 4.4

Схемы предложений прямой речи	
Слова автора,	“прямая речь.”
“Прямая речь”,	слова автора.

Точка в конце предложения в первом случае ставится перед кавычкой, а не после как в русском языке. Кроме того, кавычки в английском всегда ставятся сверху.

Примеры:

- ▶ She asked, “Do you feel comfortable here?” – Она спросила: «Тебе здесь комфортно?»
- ▶ “I will not accept his apology”, she said. – «Я не приму его извинения», – сказала она.

Вопросительные и восклицательные знаки в косвенной речи не употребляются.

Все предложения можно перевести из прямой речи в косвенную. Indirect speech, или косвенная речь (досл. «непрямая речь», или Reported speech), в свою очередь, выражает содержание фразы, не сохраняя дословности и особенностей стилистики. Все предложения, имеющие косвенную речь, являются сложноподчиненными, где в главном предложении используются слова автора, а в придаточном – сама косвенная речь. Как правило, главное предложение ставится первым, а после него идет придаточное, которое в таких речевых конструкциях часто вводится союзом или местоимением (табл. 4.5).

Таблица 4.5

Схема предложений косвенной речи		
слова автора	вводное слово	косвенная речь

Запятая после слов автора в английском не употребляется.

- ▶ She asks when you’ll be free. – Она спрашивает, когда вы будете свободны.
- ▶ He said (that) they liked everything very much. – Он сказал, (что) им все очень понравилось.

Косвенная речь в английском языке: согласование времен

Если главное предложение будет в прошедшем времени, придаточное тоже должно будет поменять свое время на соответствующее. Здесь работает согласование времен:

- ▶ He said, “I have never been to South Korea.”
- ▶ Он сказал: «Я никогда не был в Южной Корее».

Его главная часть используется во времени Past Simple. Косвенная же образуется в Present Perfect. Пока обе эти части используются в предложении с прямой речью, все в порядке, потому как настоящее время используется в кавычках и слово в слово передает фразу человека. Однако если убрать кавычки и превратить прямую речь в косвенную, сохранить Present Perfect не получится, по крайней мере, это будет считаться ошибкой.

В английском языке есть правило: если глагол в главном предложении употребляется в прошедшем времени, придаточные предложения образуются только формами прошедшего или будущего в прошедшем.

► He said that he had never been to South Korea.

► Он сказал, что (он) никогда не был в Южной Корее.

Во-первых, поменялось местоимение для согласования времен. Во-вторых, глагол из Present Perfect перешел в Past Perfect.

Таблица согласования времен (табл. 4.6).

Таблица 4.6

Direct speech (прямая речь)	Indirect speech (косвенная речь)
Present Simple меняется на Past Simple	
He answered, "I want to go to the theatre." (Он ответил: «Я хочу пойти в театр».)	He answered that he wanted to go to the theatre. (Он ответил, что хочет пойти в театр.)
Present Continuous меняется на Past Continuous	
Jim said, "I'm doing English exercises now." (Джим сказал: «Сейчас я делаю упражнения по английскому языку».)	Jim said that he was doing English exercises then. (Джим сказал, что он делает упражнения по английскому языку.)
Present Perfect меняется на Past Perfect	
My son said, "I have read the book twice." (Мой сын сказал: «Я дважды читал эту книгу».)	My son said that he had read the book twice. (Мой сын сказал, что он дважды читал эту книгу.)
Present Perfect Continuous меняется на Past Perfect Continuous	
Bruce confirmed, "She has been living here for 2 years." (Брюс подтвердил: «Она живет здесь уже 2 года».)	Bruce confirmed that she had been living there for 2 years. (Брюс подтвердил, что она живет там 2 года.)
Past Simple меняется на Past Perfect	
He said, "I worked yesterday." (Он сказал: «Я работал вчера».)	He said that he had worked the day before. (Он сказал, что за день до этого он работал.)
Past Continuous меняется на Past Perfect Continuous	
She said: "He was sleeping." (Она сказала: «Он спал».)	She said that he had been sleeping. (Она сказала, что он спал.)

Окончание табл. 4.6

Direct speech (прямая речь)	Indirect speech (косвенная речь)
Past Perfect не меняется	
Mom said, "Tom was tired because he had studied hard." (Мама сказала: «Том устал, потому что он много занимался».)	Mom said that Tom was tired because he had studied hard. (Мама сказала, что Том устал, потому что он много занимался.)
Past Perfect Continuous не меняется	
She said, "We had not been travelling till he graduated from the university" (Она сказала: «Мы не путешествовали, пока он не окончил университет».)	She said that they had not been travelling till he graduated from the university. (Она сказала, что они не путешествовали, пока он не окончил университет.)
Во всех будущих временах will меняется на would, образуя будущее в прошедшем	
He said, "I will be with you whatever what." (Он сказал: «Я буду с тобой, что бы ни случилось».)	He said that he would be with me whatever what. (Он сказал, что будет со мной, что бы ни случилось.)
Модальные глаголы, имеющие прошедшее время, тоже изменяются:	
Can на could; May на might; Will на would	Have to на had to; Shall на would (о будущем); Shall на should (совет)
She said, "He can do it." (Она сказала: «Он может это сделать».)	She said that he could do it. (Она сказала, что он может это сделать.)
Should, must, might, ought to, need, had to не меняются	
The teacher said, "You must consider the translation rules doing the task." (Учитель сказал: «Вы должны учитывать правила перевода, выполняя задание».)	The teacher said that we must consider the translation rules doing the task. (Учитель сказал, что мы должны учитывать правила перевода, выполняя задание.)

Местоимения меняются следующим образом (табл. 4.7).

Таблица 4.7

Direct Speech (прямая речь)	Indirect Speech (косвенная речь)
Личные местоимения (именительный падеж)	
I	I / he / she
You	He / she
We	They
He / she / it / they	He меняются

Окончание табл. 4.7

Direct Speech (прямая речь)	Indirect Speech (косвенная речь)
Личные местоимения (объектный падеж)	
Me	Him / her
You	Him / her
Us	Them
Him / her / it / them	He меняются
Притяжательные местоимения	
My	His / her
Your	His / her
Our	Their
Him / her / its / their	He меняются
Указательные местоимения	
This	That
These	Those
He said, "I like these shoes." (Он сказал: «Мне нравятся эти туфли».)	He said that he liked those shoes. (Он сказал, что ему нравятся те туфли.)

Указатели времени (табл. 4.8):

Таблица 4.8

Указатели времени	
Direct Speech (прямая речь)	Indirect Speech (косвенная речь)
Now (сейчас)	Then (тогда)
Here (здесь)	There (там)
Today (сегодня)	That day (в тот день)
Tomorrow (завтра)	The next day (на следующий день)
The day after tomorrow (послезавтра)	Two days later (два дня спустя)
Yesterday (вчера)	The day before (накануне)
The day before yesterday (позавчера)	Two days before (двумя днями ранее)
Next week / month (на следующей неделе / в следующем месяце)	The next week / month (на следующей неделе / в следующем месяце)

Окончание табл. 4.8

Direct Speech (прямая речь)	Indirect Speech (косвенная речь)
Next year (на следующий год)	The next year / the following year (на следующий год)
Last week / month (на прошлой неделе / в прошлом месяце)	The previous week / month (за неделю / месяц до)
Last year (в прошлом году)	The year before (за год до)
Ago (тому назад)	Before (до этого)
He said, "We will meet next week." (Он сказал: «Мы встретимся на следующей неделе».)	He said that they would meet the next week. (Он сказал, что они встретятся на следующей неделе.)

Глагол say может меняться на tell. Если после say есть уточнение, кому именно что-то было сказано, то в косвенной речи say изменится на tell (табл. 4.9):

Таблица 4.9

Direct Speech (прямая речь)	Indirect Speech (косвенная речь)
He said, "That's disgusting!" (Он сказал: «Это отвратительно!»)	He said that was disgusting. Он сказал, что это отвратительно.
Но	
He said to her, "That's amazing!" (Он сказал: «Это восхитительно!»)	He told her that was amazing. Он сказал ей, что это восхитительно.

Типы предложений в косвенной речи английского языка

Конструкция предложений выше не является единственной. Рассмотрим все варианты косвенных предложений.

Для образования повествовательного предложения в косвенной речи достаточно, как в примерах выше, использования союза that (что), который может при желании опускаться (табл. 4.10):

Таблица 4.10

Direct Speech (прямая речь)	Indirect Speech (косвенная речь)
George said, "I knew the truth." (Джордж сказал, что он знает правду.)	George said (that) he knew the truth. Джордж сказал, что он знает правду.

Повелительные предложения в косвенную речь вводятся инфинитивом (табл. 4.11):

Таблица 4.11

Direct Speech (прямая речь)	Indirect Speech (косвенная речь)
Mom said, "Go home!" (Мама сказала: «Иди домой!»)	Mom said to go home. (Мама сказала идти домой.)

Если повелительное наклонение отрицательное, то перед инфинитивом ставится отрицательная частица *not* (табл. 4.12):

Таблица 4.12

Direct Speech (прямая речь)	Indirect Speech (косвенная речь)
She said to me, "Don't touch my clothes." (Она сказала мне: «Не трогай мои вещи».)	She asked me not to touch her clothes. (Она попросила меня не трогать ее вещи.)
The officer said, "Don't move!" (Офицер сказал: «Не двигайся!»)	The officer ordered not to move. (Офицер приказал не двигаться.)

Заметьте, что в главном предложении возможно использование побудительных слов, которые выражают приказ или просьбу.

Вопросы в косвенной речи

Если прямая речь содержит общие вопросы, то такие предложения в косвенную речь будут вводиться союзами *whether* / *if* (ли) (табл. 4.13):

Таблица 4.13

Direct Speech (прямая речь)	Indirect Speech (косвенная речь)
He asks, "Do you like these colours?" (Он спрашивает: «Тебе нравятся эти цвета?»)	He asks whether I like these colours. (Он спрашивает, нравятся ли мне эти цвета.)

Если прямая речь в английском языке содержит специальный вопрос, то он вводится в косвенное предложение союзом, идентичным вопросительному слову, с которого начинается предложение. Несмотря на то, что вопросительные предложения имеют обратный порядок слов, в косвенной речи сохраняется прямой порядок (табл. 4.14):

Таблица 4.14

Direct Speech (прямая речь)	Indirect Speech (косвенная речь)
She asks, "Where will you go?" (Она спрашивает: «Куда вы пойдете?»)	She asks where we will go. (Она спрашивает, куда мы пойдём.)

Избегание косвенной речи (табл. 4.15):

Таблица 4.15

Example	Transformation
He said, "Hello everyone!" (Он сказал: «Привет всем!»)	He greeted everyone. (Он поздоровался со всеми.)
She said, "Yes." (Она сказала: «Да».)	She agrees. / She confirms. (Она согласилась. / Она подтвердила.)
She says, "No." (Она говорит: «Нет».)	She doesn't agree (disagree). / She denies. (Она не соглашается. Она отрицает.)
He said, "I don't want to answer." (Он сказал: «Я не хочу отвечать».)	He refused to answer. (Он отказался отвечать.)

(abridged from: <https://speakenglishwell.ru/kosvennaya-rech-v-anglijskom-yazyke/>)

НЕПРАВИЛЬНЫЕ ГЛАГОЛЫ АНГЛИЙСКОГО ЯЗЫКА

Таблица 4.16

Base form	Past simple	Past participle	Перевод
A			
arise	arose	arisen	возникать, появляться
B			
be	was, were	been	быть
become	became	become	становиться, делаться
begin	began	begun	начинать
bend	bent	bent	сгибать, гнуть
bind	bound	bound	связать
blow	blew	blown	дуть
break	broke	broken	ломать
bring	brought	brought	приносить
build	built	built	строить
burn	burned / burnt	burned / burnt	гореть, жечь
burst	burst	burst	взрываться, прорываться

C			
can	could	could	мочь, уметь
cast	cast	cast	бросить, кинуть, вышвырнуть
catch	caught	caught	ловить, хватать, успеть
choose	chose	chosen	выбирать
cut	cut	cut	резать, разрезать
D			
dig	dug	dug	копать
dive	dove / dived	dived	нырять, погружаться
do	did	done	делать, выполнять
draw	drew	drawn	рисовать, чертить
dwell	dwelt / dwelled	dwelt / dwelled	обитать, находиться
F			
fall	fell	fallen	падать
find	found	found	находить
fit	fit	fit	подходить по размеру
forecast	forecast	forecast	предсказывать, предвосхищать
foresee	foresaw	foreseen	предвидеть
foretell	foretold	foretold	предсказывать, прогнозировать
freeze	froze	frozen	замерзать
G			
get	got	gotten / got	получать, достигать
give	gave	given	давать
go	went	gone	идти, ехать
grind	ground	ground	молоть, толочь
grow	grew	grown	расти
H			
hang	hung / hanged	hung / hanged	вешать, развешивать
have, has	had	had	иметь
hide	hid	hidden	прятаться, скрываться

hit	hit	hit	ударять, поражать
hold	held	held	держать, удерживать, фиксировать
I			
inlay	inlaid	inlaid	вкладывать, вставлять, выстилать
input	input / inputted	input / inputted	входить
K			
keep	kept	kept	держать, хранить
know	knew	known	знать, иметь представление (о чем-либо)
L			
lay	laid	laid	класть, положить
lead	led	led	вести, руководить, управлять
lean	leaned / leant	leaned / leant	опираться, прислоняться
leap	leaped / leapt	leaped / leapt	прыгать, скакать
learn	learnt / learnt	learnt / learnt	учить
leave	left	left	покидать, оставлять
let	let	let	позволять, предполагать
lie	lay	lain	лежать
light	lit / lighted	lit / lighted	освещать
lose	lost	lost	терять
M			
make	made	made	делать, производить, создавать
may	might	might	мочь, иметь возможность
mean	meant	meant	значить, иметь в виду
meet	met	met	встречать
misspend	misspent	misspent	неразумно, зря тратить
mistake	mistook	mistaken	ошибаться
misunderstand	misunderstood	misunderstood	неправильно понимать
O			
outgrow	outgrew	outgrown	вырастать из
output	output / outputted	output / outputted	выходить

outran	outran	outran	перегонять, опережать
overcome	overcame	overcome	компенсировать
overdraw	overdrew	overdrawn	превышать
overeate	overate	overeaten	объедаться
overfly	overflew	overflown	перелетать
overhang	overhung	overhung	нависать
overlay	overlaid	overlaid	покры(ва)ть
override	overrode	overridden	отменять, аннулировать
overrun	overran	overrun	переливаться через край
P			
partake	partook	partaken	принимать участие
prove	proved	proven / proved	доказывать
put	put	put	класть, ставить, размещать
Q			
quit	quit / quitted	quit / quitted	выходить, покидать, оставлять
R			
read	read	read	читать
rebuild	rebuilt	rebuilt	перестроить
recast	recast	recast	изменять, перестраивать
redo	redid	redone	делать вновь, переделывать
remake	remade	remade	переделывать
rerun	reran	rerun	выполнять повторно
resell	resold	resold	перепродавать
reset	reset	reset	возвращать
resit	resat	resat	пересиживать
retake	retook	retaken	забирать
rid	rid	rid	избавлять
S			
saw	sawed	sawed / sawn	пилить
see	saw	seen	видеть

seek	sought	sought	искать
send	sent	sent	посылать
set	set	set	ставить, устанавливать
shake	shook	shaken	трясти
show	showed	shown / showed	показывать
shrink	shrank / shrunk	shrunk	сокращаться, сжиматься
shut	shut	shut	закрывать, запирать, затворять
sink	sank / sunk	sunk	тонуть, погружаться (под воду)
slide	slid	slid	скользить
slit	slit	slit	разрезать, рвать в длину
speak	spoke	spoken	говорить
speed	sped / speeded	sped / speeded	ускорять, спешить
spill	spilled / spilt	spilled / spilt	проливать, разливать
split	split	split	расщеплять
spread	spread	spread	распространиться
strew	strewed	strewn / strewn	усеять, устлать
swell	swelled	swollen / swelled	разбухать
swim	swam	swum	плавать, плыть
swing	swung	swung	качать, раскачивать, вертеть
T			
take	took	taken	брать, взять
tear	tore	torn	рвать
tell	told	told	рассказать
think	thought	thought	думать
throw	threw	thrown	бросить
tread	trod	trodden / trod	ступать
U			
unbend	unbent	unbent	выпрямляться, разгибаться
undergo	underwent	undergone	испытывать, переносить
underlie	underlay	underlain	лежать в основе

understand	understood	understood	понимать, постигать
undertake	undertook	undertaken	предпринять
W			
wet	wet / wetted	wet / wetted	мочить, увлажнять
wind	wound	wound	заводить (механизм)
withdraw	withdrew	withdrawn	взять назад, отозвать
withhold	withheld	withheld	воздерживаться, отказывать
withstand	withstood	withstood	противостоять
wring	wrung	wrung	скрутить, сжимать
write	wrote	written	писать

(abridged from: <http://begin-english.ru/study/irregular-verbs/>)

APPENDIX B: GLOSSARY

GLOSSARY UNIT 1

1A. CAREER, SKILLS, GENERAL RESPONSIBILITIES

To describe site and deposits:

1. Deep mines – глубокие шахты
2. Surface (opencast) mines – шахты в открытом карьере
3. Quarries – карьеры
4. Mining fields – участки под разработку
5. Geological exploration – георазведочные работы
6. Remote location – удаленное местонахождение
7. Shipping area – площадка для комплектования грузов перед отправкой
8. Surface – поверхность
9. Inorganic substance – неорганическое вещество
10. Organic substance – органическое вещество
11. Chemical composition – химический состав
12. Distinctive property – отличительное свойство
13. Molecular structure – молекулярная структура
14. Exploration – разведка
15. Deposit – месторождение
16. Coal – уголь
17. Ore – руда
18. Metalliferous minerals – рудоносные минералы
19. Gangue – жильная / пустая порода
20. Aggregated rock – порода, состоящая из разнородных обломков
21. Associated rock – второстепенная / сопутствующая порода

To describe work, equipment and responsibilities:

22. Work on site – работать на территории шахты
23. Work shifts – рабочая смена / работать вахтовым методом
24. Design mine – проектировать шахту
25. Construct mine – строить шахту
26. Operate mine – руководить работой шахты
27. Supervise test drilling – руководить структурно-поисковым / разведочным бурением
28. Survey the proposed site – обследовать территорию месторождения
29. Plan timetable – планировать расписание
30. Improve mining system – улучшить способ разработки / систему горных разработок

31. Technical staff – инженерно-технический персонал
32. Use machinery and tools – машинное оборудование и инструменты
33. Assess land – оценивать землю
34. Relocate to a site – переместить на территорию разработки
35. Break up large groups of ore – раздробить крупные группы рудных формаций
36. Improve the structure of an underground tunnel – усовершенствовать строение подземного туннеля
37. Complete underground projects – завершить проекты подземной шахтной разработки месторождений
38. Collect mineral resources – забрать минеральные ресурсы
39. Maintain safety standards – поддерживать стандарты безопасности
40. Use industry-specific programs – использовать отраслевые программы
41. Remove from the ground – убрать с земли
42. Develop efficient operating plan – разработать эффективный производственный план
43. Take (extract) the material out of the ground – добывать ресурс из земли
44. Civil engineering – гражданское строительство
45. Find a way to a new underground area – найти путь к новой области шахты
46. Mechanical engineering – механика
47. Electrical engineering – электротехника
48. Maintain equipment – содержать оборудование в исправности
49. Satellite – спутник
50. Calculate – вычислять
51. Have extensive training at workplace – иметь интенсивную подготовку на рабочем месте
52. Return the mine to its natural state – рекультивировать шахту
53. Global positioning system data – данные глобальной системы позиционирования

To describe skills:

54. Communication skills – навыки коммуникации
55. Advanced technical skills – совершенное владение техническими навыками
56. Problem-solving skills – навыки решения проблем
57. Interpersonal skills – навыки межличностного общения
58. Teamwork skills – навыки командной работы

1B and 1C. APPLIED GEOLOGY AND GEOPHISICS

To describe research methods, objects and their properties:

1. Interior surface – внутренняя поверхность
2. Exterior surface – наружная поверхность, внешняя поверхность

3. Geological time – геологический возраст
4. Anticipate changes – предвидеть изменения
5. Deductive reasoning – дедуктивное рассуждение
6. Geological rates – геологические показатели темпа изменений
7. Environmental implications – последствия для окружающей среды; экологические последствия
8. Porosity of rocks – пористость пород
9. Anticipate – предвидеть
10. Mitigate the hazards – уменьшить опасность
11. Earthquakes – землетрясения
12. Slope failures – откосное разрушение; сползание откоса; оползание откоса
13. Volcanic eruptions – извержения вулканов
14. Exploration geophysics – разведочная геофизика
15. Petroleum exploration – разведка месторождений нефти
16. Mineral exploration – разведка полезных ископаемых, поиск полезных ископаемых
17. Physical properties – физические свойства
18. Density – плотность
19. Velocity – скорость
20. Ductility – восприимчивость к импульсным помехам, давлению и прочим воздействиям
21. Resistivity – удельное, электрическое сопротивление
22. Geological configurations – структурная конфигурация / структурная форма залегания горных пород
23. Hydrocarbons – углеводороды
24. Groundwater – грунтовая / почвенная вода
25. Fractures of rock formations – трещины в формации горной породы
26. The stratum or strata – слой или напластование
27. Arrangement – расположение

To describe jobs, activities, tools and schedule

28. Mining engineer – горный инженер
29. Petroleum geologist – геолог-нефтяник

To describe schedule and working conditions, tools and activities

30. Analyse geological log measurements – анализировать данные геологического каротажа
31. Take core samples – брать образцы керна
32. Collaborate with various specialists – сотрудничать с разными специалистами
33. Think in “three dimensional ways” – думать / видеть / анализировать в трехмерном пространстве

34. Seismic survey – сейсмическая разведка методом отраженных волн
35. Perform visual and acoustic monitoring – осуществлять визуальный и акустический мониторинг
36. Sound sensors – звуковые датчики
37. Examine the size and shape of land masses – исследовать размер и форму суши
38. Study magnetic fields – изучать магнитные поля
39. Surveys an oil concession on the shore – анализировать нефтяную концессию на берегу
40. Study bodies of water – изучать водоемы
41. Use gravimeters for studying the earth's gravitational pull – использовать гравиметры для изучения гравитационного притяжения Земли
42. Work in the field / outdoors – работать в поле / вне офиса
43. Work in the office – работать в офисе
44. Use microscopes – использовать микроскопы
45. Predict the subsurface – прогнозировать изменения в подповерхностном слое
46. Look at porosity – смотреть на пористость породы
47. Interpret geophysical information – интерпретировать геологическую информацию
48. Estimate fuel amounts – оценивать объем топлива
49. Implement drilling strategies for extraction – приводить в действие стратегии бурения
50. Perform geochemical analysis – проводить геохимический анализ
51. Use ground-based sonar – использовать наземный гидролокатор
52. Discover reservoirs – обнаруживать породы-коллекторы
53. Determine the location and amount of combustible fuel in sediments on land or in the ocean – определять местоположение топлива в слоях-седиментах на суше и в океане
54. Plan programmes for exploration of sites for oil, gas, water, minerals – планировать программы разведки залежей нефти, газа, воды и минералов
55. Survey and map geologically promising sites – анализировать и создавать карту перспективных мест для геологической разработки
56. Collect and record samples and data from test sites – собирать и вести учет образцов и данных с испытательных площадок / полигонов
57. Work shifts – работать по сменам / вахтовым методом
58. Work in remote locations – работать в отдаленных местах

To describe skills:

59. Communication skills – навыки коммуникации
60. Advanced technical skills – совершенное владение техническими навыками
61. Problem-solving skills – навыки решения проблем
62. Interpersonal skills – навыки межличностного общения

63. Teamwork skills – навыки командной работы
64. Skills in informational geographic systems – навыки работы с географическими информационными системами
65. Skills in 4-D visualisation of geological features and processes – навыки 4d-визуализации геологических особенностей поверхности и протекающих геологических процессов

GLOSSARY UNIT 2

2A. SEDIMENTARY ROCKS

To describe the type of sedimentary rock:

1. Clastic (fragmental) – обломочный / кластический
2. Crystalline – с кристаллической структурой
3. Bioplastic – биокластический
4. Conglomerate – конгломерат (смесь разнородных пород)
5. Breccia – брекчии
6. Sandstone – песчаник
7. Siltstone – алеврит
8. Shale – сланец
9. Rock salt – каменная соль
10. Rock gypsum – природный гипс; каменный гипс
11. Dolostone – доломит
12. Limestone – известняк
13. Bituminous coal – битуминозный уголь
14. Detrital rock – обломочная горная порода
15. Chemical rock – химическая горная порода
16. Stalagmites – сталагмиты
17. Stalactite – сталактиты
18. Clastic rock – обломочная порода осадочного отложения
19. Cave formations – вторичные минеральные отложения, пещерные отложения

To describe particle size and shape:

20. Clay-sized – размером с зерно глины
21. Silt-sized – размером с частицу ила
22. Sand-sized – размером с частицу песка
23. Pebble-sized – размером с гальку
24. Cobble-sized – размером с булыжник
25. Boulder-sized – размером с валун
26. Angular – угловатый

- 27. Sub-angular – с притупленными углами
- 28. Rounded – округлый
- 29. Sub-rounded – полуокруглый
- 30. Well-rounded – обтекаемый, окатный
- 31. Coarse – крупнозернистый
- 32. Very coarse – очень крупнозернистый
- 33. Fine – мелкозернистый
- 34. Very fine – очень мелкозернистый
- 35. Medium – среднего размера
- 36. Microscopic – микроскопический

To describe location and source of rocks:

- 37. On the bottom of different bodies of water (oceans, lakes) – на дне водоемов (океанов, озер)
- 38. On land – на земле
- 39. On the floor of the caves – пол пещеры
- 40. On the ceiling of the cave – свод пещеры
- 41. Boulders – валуны, глыбы, булыжники
- 42. Mud – ил
- 43. Raw minerals – природные необработанные материалы / сырьевые материалы
- 44. Parts of plants and animals decay
- 45. Shells – моллюски
- 46. Calcium and carbonate ions – ионы кальция и карбоната
- 47. Marine animals – морские животные

To describe formation processes:

- 48. Lithification – литификация / уплотнение
- 49. Cementation – цементация
- 50. Precipitation – преципитация / осаждение
- 51. Erosion – эрозия
- 52. Weathering – выветривание
- 53. Compaction – спекание
- 54. Transportation – перенос / нанос
- 55. Deposition – отложение / напластование
- 56. Sedimentation – осаждение / седиментация

2B. WEATHERING OF ROCKS

- 1. Physical weathering – физическое выветривание
- 2. Biological weathering – биологическое выветривание
- 3. Chemical weathering – химическое выветривание

4. Breakdown – распад / разрушение
5. Freeze-thaw – замораживание – оттаивание
6. Seep into cracks – просачиваться в расщелины
7. Expand – расширяться
8. Mountain regions – горные местности
9. Contraction of the surface layer of rocks – сжатие поверхностного слоя горных пород
10. React with the mineral grains in rocks – реагировать с зернами минералов в скалах
11. Form new minerals (clays) and soluble salts – образовывать новые минералы (глины) и растворимые соли
12. Damp climates – влажный климат
13. The production of soils – формирование почв
14. Removal of rock in solution by acidic rainwater – вымывание породы раствором кислой дождевой воды
15. Give iron-rich rocks a rusty-coloured weathered surface – придать богатой железом породе вид ржавой выветренной поверхности
16. Put down roots through joints or cracks in the rock – пустить корни через стыки и трещины в породе
17. Bore into rocks – проникать в породу
18. Scrap away the grains – соскребать зерна горных пород
19. Secrete acid to dissolve the rock – выделять кислоту для растворения породы
20. Produce chemicals – производить химические вещества
21. Algae – водоросли
22. Lichens – лишайники
23. Break down large rocks into smaller ones – разламывать большие формации пород на более мелкие
24. Transform boulders into sediments – превратить гальку в осадки (наносы – твердые частицы)
25. Wear rocks away – стереть горную породу
26. Pass through bedrock – проникнуть через коренную подстилающую породу
27. Leave mineral deposits behind – оставить после себя минеральные отложения
28. Evaporate and leave calcium carbonate behind on the ceiling – испариться и оставить карбонат кальция на своде пещеры
29. Be compacted into rocks – быть уплотненным / связанным / сцепленным в горную породу
30. Weight of overlying sediments – вес вышележающих слоёв осадочных пород
31. Formed from broken up pieces of rocks – быть сформированным из обломков горных пород

32. Earthquake – землетрясение
33. Be exposed to the elements – быть открытым для воздействия элементов / подвергаться воздействию элементов
34. Be exposed to air – подвергаться воздействию воздуха
35. Rocks tumbling – падение камней
36. Changes the composition of the rock – менять состав породы
37. Come into contact with rainwater – контактировать с дождевой водой
38. Get washed away – вымываться
39. Climate-dependent – зависимый от климата
40. Rock weathering rates – скорость выветривания
41. Propagate through – распространяться через
42. Propagate fractures under loading – приводить к распространению трещин под воздействием большой нагрузки (давления на поверхность)
43. Generate cracks – производить расщелины
44. Environmental stresses – природные неблагоприятные условия
45. Existing flaws in rock – существующие механические повреждения в породе

2C. IGNEOUS ROCKS

To describe igneous rocks formation:

1. Cooling – охлаждение
2. Be cooled beneath the surface – быть охлажденным под поверхностью
3. Solidification – отвердевание / кристаллизация
4. Force itself through – протолкнуть себя через
5. Intrude through the crust – проникнуть сквозь земную кору
6. Intrude between the layers – проникнуть между слоями
7. Crack / fault in the rock – расщелина / разлом / сдвиг в породе
8. Make up rocks – входить в состав горных пород
9. Be surrounded by the soil – быть окруженным почвой
10. Surface exposure – поверхностное обнажение
11. Eject – испускать / извергать
12. Erupt – извергать(ся)
13. Cool – охлаждать
14. Harden – делать твердым / затвердевать
15. Float – плавать / всплывать
16. Extinct volcano – потухший / спящий вулкан
17. Perplexed geologists – озадаченные геологи
18. Plate tectonics – тектоника плит
19. Mechanism of fracturing – механизм разрыва пласта
20. Flat-lying volcanic eruptions – плоско залегающие осадения вулканических извержений

21. Deep-seated movement of molten rock – глубинное движение расплавленной породы
22. Bedrock – коренная подстилающая порода
23. Geochemical makeup – геохимический состав
24. Valley floor rock – коренная порода на дне долины
25. Weathered rock – выветренная порода
26. Intergranular pores – межзерновые поры
27. Silica-rich – с высоким содержанием силикатов / кремнезёма
28. Viscosity – вязкость
29. Melt – таять
30. Lithospheric mantle – литосферная мантия
31. Melting point – точка плавления
32. Constituent rocks – составляющая горной породы

To describe igneous bodies:

33. Volcanic neck – жерловина, столбовидное тело
34. Sill – сил; пластовая интрузия
35. Dike – дайка
36. Stock – шток
37. Batholith – батолит
38. Laccolith – лакколит
39. Formed by congelation of lava – сформированный застыванием лавы
40. Classic shield-type volcano – щитовой / щитовидный вулкан

To describe types of rocks and their composition:

41. Igneous rocks – магматические породы
42. Extrusive rock – экструзивные породы
43. Intrusive rock – интрузивные породы
44. Intermediate rocks – промежуточные породы
45. Basic rocks – основные породы
46. Ultramafic rocks – ультрамафические породы
47. Mafic rocks – мафические породы
48. Composition of rocks – состав горных пород
49. Basalt formation – базальтовая формация
50. Mantle – мантия
51. Lava flows – потоки лавы
52. Basaltic lava – базальтовая лава
53. Silica content – содержание кремнезёма
54. Frothy volcanic rock – пенная вулканическая порода
55. Conchoidal fracture – раковинчатый излом; камневидный излом; раковинчатый излом

56. Sodium – натрий
57. Potassium – калий
58. Quartz – кварц
59. Feldspar – полевоы шпат
60. Rhyolite – риолит
61. Granite – гранит
62. Plagioclase feldspar – плагиоклаз
63. Diorite – диорит
64. Andesite – андезит
65. Basalts – базальты
66. Gabbro – габбро
67. Olivine – оливин
68. Pyroxene – пироксен
69. Pumice – пумицит / пемза
70. Mica – слюда
71. Hornblende – роговая обманка
72. Obsidian – обсидиан
73. Rocks beds – пласт каменной породы; скалистое основание; каменное основание

2D. METAMORPHIC ROCKS

To describe types of metamorphism:

1. High-grade metamorphism – высокотемпературный метаморфизм
2. Shock metamorphism (impact metamorphism) – импактный метаморфизм
3. Hydrothermal metamorphism – гидротермальный метаморфизм
4. Contact metamorphism – контактовый (контактово-термальный) метаморфизм
5. Regional metamorphism – региональный метаморфизм

To describe metamorphic rocks:

6. Hornfels – роговик
7. Slate – сланец
8. Marble – мрамор
9. Quartzite – кварцит
10. Be squished / folded – быть сжатым / смятым в складку
11. A platy or sheet-like structures – пластинчатые или листовые структуры
12. Mineral-rich fluids – богатая минералами жидкость
13. Denser, compact rocks – плотные породы
14. Morphic rocks – морфическая порода
15. Mechanically deformed – механически деформированные
16. Slates and gneisses – сланцы и гнейсы

To describe metamorphic processes and conditions:

17. Gives the rock a striped appearance – создать полосы на породе
18. Slaty cleavage – кливаж сланцеватости / сланцеватость
19. Be baked by the heat – спекаться под воздействием высокой температуры
20. Be created by rearrangement of mineral components – быть созданным перегруппировкой минеральных компонентов
21. Be created by reactions with fluids – быть созданным реакциями с жидкостями
22. Enter the rocks / intrude into the rocks – проникать в породы
23. Produce textures – создавать текстуры горных пород
24. Tectonic forces – тектонические силы
25. Be buried to depths of – быть погруженным / погребенным на глубину
26. Be crushed and pulverized – быть раздавленным и измельченным
27. The shearing – гидродинамическое фрагментирование / плоскость разрыва
28. Along a fault zone – вдоль зоны разрыва
29. Friction of sliding along shear zone – трение от скольжения по зоне сдвига
30. Occur in eroded mountain ranges – встречаться в эродированных горных хребтах
31. Collide – сталкиваться
32. Push rocks to deeper levels – проталкивать горную породу на глубину
33. Produce compressional stresses in the rocks – производить давление в породе
34. Occur in the cores of fold / thrust mountain belts – встречаться в кернах складок / горных поясов
35. Be subjected to metamorphism – подвергаться метаморфизму
36. Stress conditions – неблагоприятные условия
37. Shallow levels in the crust – поверхностные уровни в земной коре
38. Shows no foliation – не демонстрирует расслоения
39. Heated by the magma – нагреваться магмой
40. Igneous intrusions – вулканическая интрузия
41. Metamorphic or contact aureole – метаморфический или контактный ореол
42. Relative temperature – относительная температура
43. Undergo prograde metamorphism – претерпеть прямой метаморфизм
44. Continental collisions or subduction – континентальное столкновение и субдукция (зона на границе литосферных плит)
45. Changes in mineral assemblage – изменить минеральную ассоциацию

GLOSSARY UNIT 3**3A. FOSSIL FUELS*****To describe types of fossil fuels and their derivatives:***

1. Fossil fuels – ископаемое топливо
2. Oil – нефть

3. Natural gas – природный газ
4. Coal – уголь
5. Solid, liquid and gaseous fuels – топливо в твердом, жидком и газообразном состоянии
6. Wood – древесина
7. Peat – торф
8. Bituminous lignite – битумный бурый уголь
9. Diesel – дизельное топливо
10. Liquefied petroleum gas – сжиженные углеводороды
11. Paraffin wax – парафиновый воск
12. Petrol – бензин
13. Lubricating oil – смазочные масла / машинные масла
14. Natural gas – природный газ
15. Colourless and odourless – без цвета и без запаха

To describe processes:

16. Water power and atomic energy – гидро- и атомная энергия
17. The decay of organic materials – разложение органического материала
18. Be accumulated in the geologic past – быть накопленным в прошлом
19. Evidence of past life – свидетельство прошлой жизни
20. The footprints of ancient animals – следы древних животных
21. Be found in sedimentary rocks – быть обнаруженным в осадочных породах
22. Be abundant in mudstone, shale and limestone – быть в изобилии в аргиллите, сланце, известняке
23. Be natural and manufactured – быть природного и промышленного происхождения
24. Sink to the bottom of the ocean – опускаться на дно океана
25. Be obtained by heating coal in the absence of air – быть полученным путем нагревания угля в условиях отсутствия воздуха
26. Mix with organic materials – перемешиваться с органической материей
27. To form an organic-rich mud – образовывать богатый органическими веществами ил
28. To form an organic shale – образовывать органический сланец
29. Be decomposed by bacteria – быть разложенным бактериями
30. Consist of elements – состоять из элементов
31. To replenish – пополнять
32. Difficult to replace – трудно заменить
33. Soil – почва
34. Be made up – состоять из
35. Present in the low-lying wetlands – присутствует в низинных водно-болотных угодьях

36. Combustion – горение
37. Carbonization – карбонизация
38. Get compressed – стать спрессованным
39. Get converted into coal – превратиться в уголь
40. Be settled at the bottom of the sea – осесть на дне моря
41. Harvesting of fossil fuels – добыча ископаемого топлива

To describe practical uses:

42. Widely utilized in the home – широко применим в домашнем хозяйстве
43. Promising source of natural resources – перспективный источник природных ресурсов
44. Non-renewable sources of energy – невозобновляемые энергетические ресурсы
45. To obtain derivatives like coke, coal tar, and coal gas – получать производные, такие как кокс, каменно-угольная смола и угольный газ
46. Petroleum refining – переработка нефти
47. Be used at homes for cooking – использоваться для приготовления пищи
48. Be used as a starting material in chemicals and fertilizers – использоваться в качестве исходного материала в химических веществах и удобрениях
49. Generate a large amount of electricity – генерировать большое количество энергии
50. Be cost effective – быть рентабельным
51. Emit carbon dioxide when burnt – выделять углекислый газ при сгорании
52. Source of pollution – источник загрязнения
53. Contributed to global warming – вносить вклад в глобальное потепление
54. Be replaced by – быть замещенным

3B. COAL AND ITS CLASSIFICATION

To describe properties of coal and coal classification:

1. Flammable in nature – легко воспламеняющийся (по своей природе)
2. Hard rock – твердая порода
3. Hard and glossy in nature – твердый и глянцевый (по своей природе)
4. Have the highest heating value – иметь высокую теплотворную способность
5. Solid fossil fuels – твердое ископаемое топливо
6. Ignition property – свойство воспламеняемости
7. Remains of dead vegetation – остатки сгнившей растительности
8. Sources of heat and light – источник тепла и света
9. Be divided into four types – быть разделенным на четыре типа
10. Absorbent property – водопоглощающие свойства
11. Carbon content in – содержание углерода в
12. Ignition rate – скорость возгорания

13. Coal deposits – залежи угля
14. Chemical analysis – химический анализ
15. Physical tests – физический тест
16. Select chemical and physical properties – отобрать химические и физические свойства
17. Clean coal – чистый уголь (уголь без примесей)
18. Measure of a coal's age – измерение возраста угля
19. Consists of vitrinite – состоять из витринита
20. Carbonaceous material – углеродистый материал
21. Peat-like material – похожий на торф материал
22. Become darker in color and harder in texture – становиться темнее и тверже по структуре
23. Sub-bituminous coal – полубитуминозный уголь
24. Anthracite – антрацит
25. High, medium and low-volatility – высокая / средняя / низкая летучесть
26. Final maturation stage of coal – заключительная стадия созревания угля / углефикации
27. Burn with a smokeless, blue flame – гореть бездымным синим пламенем
28. Give-off intense heat – выделять тепло
29. Moisture – влажность
30. Ash – пепел / зола
31. Inorganic residue – неорганический осадок
32. The presence of petrological components – присутствие петрологических компонентов
33. Be based on maceral content – основанный на измерении содержания минеральных компонентов
34. Clarain, durain, fusain and vitrain – кларен, дюрен, фузейн и витрейн (литологические типы углей)
35. Impurities – примеси

To describe coal formation:

36. Be formed from the remains of plants – сформироваться из останков растений
37. Flooding – затопление
38. Get buried under the soil – быть погребенным под слоем почвы
39. Get deposited over – отложиться над
40. Be converted to coal – преобразовываться в уголь
41. Be decomposed into organic matter – быть переработанным в органический материал
42. Be subjected to high temperature and pressure – подвергаться воздействию высокой температуры и давления

To describe household and industrial uses:

43. Used as a fuel in steam-electric power generation – использовать в качестве топлива для пароэнергетических установок
44. To discover and use coal – обнаружить и использовать уголь
45. Commercial mining – добыча горных пород в коммерческих целях
46. Heat and power applications in manufacturing industries – применение в целях отопления и генерации энергии в индустриальных целях
47. Be used for residential and commercial purposes – использовать в жилищных и коммерческих целях

3C. ALTERNATIVE SOURCES OF ENERGY***To describe different alternative sources of energy used in the world:***

1. Alternative sources – альтернативные источники
2. To generate power – производить энергию
3. Be broken down into – быть разделенным / разбитым на
4. Renewable energy – возобновляемая энергия
5. Non-renewable – невозобновляемая энергия
6. Sustainable development – устойчивое развитие
7. Naturally replenished – естественное пополнение
8. Limited supply – ограниченные запасы
9. To run out – завершаться, заканчиваться
10. “Dirty” fuels – загрязняющие окружающую среду виды топлива

To describe Solar Energy:

11. Solar power – солнечная энергия
12. To harvest – извлекать (собирать, накапливать)
13. Collector panels – коллекторные панели для получения энергии
14. To be turned into – быть превращенным в
15. Solar fields – местность, на которой расположены солнечные панели
16. To gather power – накапливать энергию
17. To charge substations – заряжать подстанции
18. Issue with solar energy – проблемы, возникающие при использовании энергии солнца
19. Geographical range – географические границы (рамки)

To describe Wind Energy:

20. Wind power – энергия ветра
21. New innovations – инновации
22. Wind farms – ветровые электростанции
23. To appear – появляться
24. Common sight – обычное явление

- 25. To require high investment – требовать больших вложений
- 26. To affect – оказывать влияние

To describe Geothermal Energy:

- 27. Geothermal energy – геотермальная энергия
- 28. Beneath the earth – в недрах земли
- 29. Sustainable – постоянный, устойчивый
- 30. Environmentally friendly – экологически безопасный для окружающей среды
- 31. Continuously – постоянно, непрерывно
- 32. To heat up – нагреваться, накаляться, перегревать
- 33. To produce steam – получать (производить) пар
- 34. Power the generators – питание генераторов
- 35. The rotating turbines – вращение турбин

To describe Hydrogen Energy:

- 36. Hydrogen energy – энергия водорода
- 37. The most common – наиболее распространенный
- 38. To be available – быть доступным
- 39. Tremendous source – важнейший источник
- 40. Power ships – энергия для движения кораблей
- 41. Power rockets – ракетное топливо
- 42. Be produced on demand – производить по требованию
- 43. Leave a toxic emissions – оставлять токсический след; токсические выбросы

To describe Wave Energy:

- 44. Wave power – энергия волн
- 45. Techniques for transforming – технологии для преобразования
- 46. Dam-like structures – сооружения в виде плотин
- 47. To cause no harm – не причинять вреда
- 48. To be harnessed – использоваться
- 49. Coastal regions – прибрежные регионы
- 50. To reduce its dependence – сократить зависимость
- 51. To damage the marine ecosystem – угрожать морской экосистеме
- 52. Source of disturbance – источники загрязнения
- 53. To depend on wavelength – зависеть от силы волны

To describe Hydroelectric Energy:

- 54. Hydroelectric power plant – гидроэлектростанция
- 55. Rely on hydropower – полагаться на гидроэнергетику
- 56. Major dams – крупные гидротехнические сооружения
- 57. To turn generators – для вращения генераторов

58. Non-polluting – чистый (не производящий выбросов)
59. To entail no waste – для недопущения потерь
60. The aging of the dams – техническая усталость плотины
61. To remain functional and safe – обеспечить безопасное функционирование; оставаться в рабочем безопасном состоянии
62. Drain on the world's water supply – истощение запасов воды
63. Drinkable water – питьевая вода
64. To consume the water – потреблять воду

GLOSSARY UNIT 4

4A. PROSPECTING

To describe sites and deposits:

1. Aggregated rock – агрегированная горная порода
2. Alluvium – аллювий
3. Associated rock – сопутствующая горная порода
4. Borehole – ствол скважины
5. Carbon content – содержание углерода
6. Chemical composition – химический состав
7. Coal – уголь
8. Colluviums – коллювий
9. Debris – обломки
10. Deep mines – глубокие шахты
11. Deposit – залежь
12. Distinctive property – отличительное свойство
13. Erratic boulders – неустойчивые валуны
14. Gangue minerals – жильные минералы
15. Geological exploration – геологическая разведка
16. Igneous intrusion – магматическая интрузия
17. Inorganic substance – неорганическое вещество
18. Metalliferous minerals – металлосодержащие минералы
19. Mining fields – горнодобывающие области
20. Molecular structure – молекулярная структура
21. Ore – руда
22. Organic substance – органическое вещество
23. Outcrop – обнажение, выход на поверхность
24. Permafrost – вечная мерзлота
25. Phosphates – фосфаты
26. Quarries – карьеры
27. Remote locations – удаленное местоположение

- 28. Shipping area – территория погрузки
- 29. Solifluction – солифлюкция
- 30. Striation – бороздчатость
- 31. Sulphur – сера
- 32. Surface – поверхность
- 33. Surface opencasts – наземные карьеры
- 34. Survey – обследование, съемка
- 35. Tin ore – оловянные руды
- 36. Value – ценность
- 37. Wolframite – вольфрамит

To describe work, equipment and responsibilities:

- 38. Geochemistry – геохимия
- 39. Geomorphology – геоморфология
- 40. Preliminary investigation – предварительная разведка
- 41. Prospecting – исследование
- 42. Stratigraphy – стратиграфия
- 43. To construct mine – строить шахту
- 44. To design mine – проектировать шахту
- 45. To operate mine – руководить работой шахты
- 46. To supervise test drilling – руководить структурно-поисковым (разведочным) бурением
- 47. To survey the proposed site – обследовать территорию месторождения
- 48. Trenching – прокладывание канав

4B. EXPLORATION OF MINNERAL DEPOSITS

To describe site and deposits:

- 1. Basement terrain – подземные недра
- 2. Bedrock geology – геология коренных пород
- 3. Brownfield – ранее использованное месторождение
- 4. Buried deposits – подземные залежи
- 5. Clay – глина
- 6. Copper ore – медная руда
- 7. Diamonds – алмазы
- 8. Exposure – выход на поверхность, обнажение
- 9. Fertilizer mineral – минеральные удобрения
- 10. Gemstones – драгоценные камни
- 11. Geochemical samples – геохимические пробы
- 12. Grade of crust – разновидность покрывающего грунта
- 13. Greenfield – новое месторождение, разрабатываемое «с нуля»
- 14. Iron ore – железная руда

15. Key driver – главный двигатель
16. Limestone – известняк
17. Mineral exploring – поиск полезных ископаемых
18. Molybdenum – молибден
19. Near-surface deposits – неглубоко залегающие отложения
20. Non-ferrous minerals – руды цветных металлов
21. Oil shale – нефтеносный сланец
22. Opals – опалы
23. Ore body – рудное тело
24. Polarization – поляризация
25. Polymetallic sulphides – полиметаллические сульфиды
26. Power grid – единая энергосистема
27. Raw materials – сырьевые материалы, сырье
28. Sapphires – сапфиры
29. Total mining district – вся территория горнодобывающего района
30. Zinc ore – цинковая руда

To describe work, equipment and responsibilities:

31. Auger – бур, шнек, сверло
32. Collection of information – сбор информации, сбор данных
33. Electrical resistivity of the ground – электрическое сопротивление грунта
34. Exploration – разведка месторождения с попутной добычей
35. Exploration company – разведывательная компания
36. Exploration techniques – технологии разведки
37. Extractive operation – операция по добыче (полезных ископаемых)
38. Feasibility study – геолого-экономическая оценка
39. Gamma-ray spectrometry – гамма-спектрометрия
40. Geophysical datasets – наборы геофизических данных
41. Good will – денежная оценка предполагаемой прибыли
42. Hand drill – ручной бур
43. Initial flow sheet – первоначальная техническая схема
44. Magnetic spectrometry – магнитная спектрометрия
45. Multidisciplinary data generation – многопрофильное генерирование данных
46. Reconnaissance – исследование, рекогносцировка, инспекционное обследование
47. Resistivity spectrometry – спектрометрия удельного сопротивления
48. Resource expansion project – проект по расширенному поиску ресурсов
49. Structural data – структурные данные
50. Technical inputs – технические материалы
51. To design drill programs – разрабатывать программы по бурению

- 52. To search for – проводить изыскательные работы
- 53. Wall logging program – программа каротажа

4C. MINING AND THE ENVIRONMENT

To describe different mining effects on the environment:

- 1. Negative effect – негативное влияние
- 2. To result in – приводить к
- 3. To dispose of waste – утилизировать отходы производства
- 4. Properly – должным образом
- 5. To reduce an impact – уменьшить воздействие
- 6. To be careful – быть внимательным; соблюдать осторожность
- 7. To harm the environment – наносить вред окружающей среде
- 8. Environmental protection group – группа по охране окружающей среды
- 9. To release fewer pollutants and contaminants – выбрасывать меньшее количество загрязняющих и отравляющих веществ
- 10. Coal fire – возгорание угля
- 11. Deforestation – вырубка лесов
- 12. Decline in biodiversity – сокращение биоразнообразия
- 13. Improved system – улучшенная система
- 14. Safe disposal of waste – безопасная утилизация отходов
- 15. To prevent the hazardous effects – предотвращать риски
- 16. Hazardous by-products – опасные побочные продукты
- 17. Mineral processing – переработка полезных ископаемых
- 18. Contaminating groundwater – загрязнение грунтовых вод
- 19. Siltation arc – дуга заиливания
- 20. To avoid problems – предотвращать возникновение проблем
- 21. Geological failures – провалы в грунте
- 22. Sinkholes and erosion – разрушение и эрозия почвы

To describe how mining companies and governments solve the problem of preserving the environment:

- 23. Environmentally-responsible manner – экологически ответственный способ (проведения работ)
- 24. To preserve the environment – сохранять окружающую среду
- 25. Depression or hole in the ground – углубления или отверстия
- 26. To implement a number of changes – осуществить ряд изменений
- 27. To design tailing ponds – проектировать хранилища для отходов (шлака)
- 28. To spill – проливать, разливать
- 29. The proper storage of coal – безопасно хранить уголь
- 30. Surface and subsurface mining – открытые и подземные горные работы
- 31. Mining legislation – законодательство в горной промышленности

32. Zero-Impact Mining – проведение горных работ без вреда для окружающей среды
33. To supply the minerals – обеспечивать минералами
34. Side effects – побочные эффекты
35. The challenges of mining – вызовы горнодобывающей промышленности
36. To run the computer – запустить (включить) компьютер
37. Copper conductors – медные провода
38. Scouring powder – чистящий порошок
39. Prosthetics – протезы
40. To do more with less – производить большее количество продукции из меньшего количества сырья
41. Acid drainage – кислотный дренаж
42. Sulfides – сульфиды
43. Sulfur – сера
44. Waste rock – пустая порода, отходы, шлак
45. Leach into the kind – выщелачивание
46. The movement of rock and soil – движение пород и почвы
47. Holes and piles of rock – ямы и груды камней, отвалы
48. Naphazard jumble – беспорядочные нагромождения

To describe why the world needs mining products:

49. Recycling – переработка отходов
50. To recover valuable metals and minerals – добывать ценные металлы и минералы
51. To keep people alive – сохранять человеческие жизни
52. Economic benefit – экономическая выгода
53. Willingly – добровольно, без принуждения
54. Milling – измельчение, дробление, обогащение (пород)
55. Waste sulfur – отходы серы
56. The manufacturing industry – обрабатывающая промышленность
57. Pavement aggregate – заполнитель дорожного покрытия
58. Directional drilling – направленное (наклонное) бурение
59. Laparoscopic surgery – лапароскопическая хирургия
60. Low impact perspective – перспектива минимального воздействия на окружающую среду
61. Post-recovery uses – повторное использование
62. To do more with less – производить большее количество продукции из меньшего количества сырья
63. Environmental Certification Agency – Агентство экологической сертификации
64. To have faith in the outcome – верить в решение (проблемы) / верить в результат
65. To turn potential problems into assets – превращать потенциальные проблемы в будущие доходы

APPENDIX C: SPEAKING TOPICS

Give a talk on career in mining industry

Remember to say:

- ▶ what knowledge is necessary to start the career in mining;
- ▶ what typical workplaces for miners are;
- ▶ what activities a miner can perform at work;
- ▶ what skills should you possess to be successful at a workplace.

Give a talk on sedimentary rocks

Remember to say:

- ▶ what geological processes lead to the creation of sedimentary rocks;
- ▶ where sedimentary rocks can be found;
- ▶ what two categories sedimentary rocks are organized into;
- ▶ how sedimentary rocks are classified according to their texture.

Give a talk on weathering of rocks

Remember to say:

- ▶ what types of weathering are (physical / mechanical, chemical and biological weathering);
- ▶ how each type of weathering occurs;
- ▶ what weathering effects are observed around the world;
- ▶ what could affect the rate of weathering.

Give a talk on igneous rocks

Remember to say:

- ▶ how igneous rocks are formed;
- ▶ what igneous bodies you know;
- ▶ what categories igneous rocks are organized into (according to the structure and composition);
- ▶ where igneous rocks are used.

Give a talk on the main mining methods

Remember to say:

- ▶ what mining methods and techniques you know;
- ▶ what the reasons for choosing certain methods are;
- ▶ what an open pit mining method is for;
- ▶ what an underground mining method is for.

*Give a talk on geological prospecting***Remember to say:**

- ▶ how 'geological prospecting' is defined;
- ▶ what the difference between direct and indirect methods is;
- ▶ what conditions a prospector must take into account;
- ▶ what methods and operations prospectors use while exploring.

*Give a talk on energy sources***Remember to say:**

- ▶ what types of energy sources you know;
- ▶ what renewable energy sources are;
- ▶ what non-renewable energy sources are;
- ▶ how alternative energy sources are being created these days.

*Give a talk on energy sources in Russia***Remember to say:**

- ▶ what the most used energy sources in Russia / Krasnoyarsk are;
- ▶ what pros and cons of using renewable energy source are;
- ▶ why we should save fossil fuels;
- ▶ what alternative sources of energy are beneficial for our country.

*Give a talk on mining and environment***Remember to say:**

- ▶ what environmental impact mining activities have;
- ▶ how mining companies can reduce their negative impact;
- ▶ what new mining methods are environmentally-friendly;
- ▶ how mining engineers can reduce the negative impact of mining.

*Give a talk on the future of mining***Remember to say:**

- ▶ what history mining technology has;
- ▶ what recent developments in mining technology are;
- ▶ how old mining techniques can be used;
- ▶ what future frontiers mining industry has.

APPENDIX D: HOME READING RECOMMENDATIONS

Домашнее чтение – вид деятельности, направленный на детальное изучение текста профессиональной направленности, извлечение информации по прочитанному и составление профессионально-ориентированного терминологического словаря.

Выбранный студентами текст для домашнего внеаудиторного чтения должен соответствовать следующим критериям:

- 1) быть написанным на английском языке (предпочтительно европейскими и американскими авторами);
- 2) быть написанным не позднее последних 5–7 лет;
- 3) быть опубликованным в научном издании (т. е. иметь выходные данные);
- 4) по жанру представлять собой научную статью или параграф из научной монографии;
- 5) соответствовать тематическому профилю дисциплины;
- 6) по объему быть не меньше, чем 8000 печатных знаков без пробелов.

На основе проработки текста профессиональной направленности студент составляет терминологический словарь, равный 50 терминологическим единицам, и обзор по прочитанному (review) объемом не менее, чем 250 слов.

Работа над внеаудиторным чтением профессиональной направленности представляет собой самостоятельный вид работы студента, которая завершается последующим обсуждением прочитанного на занятии в форме пересказа / презентации и сдачи профессионального словаря наизусть. Таким образом, итогом работы студента в семестре по формату домашнего чтения является: 1) профессиональный терминологический словарь; 2) обзор по прочитанному (review) и 3) беседа с преподавателем.

Представленная справочная информация и практикум в данном разделе направлены на решение следующих задач:

- 1) научить выделять в тексте профессионально ориентированную лексику и правильно ее переводить;
- 2) научить извлекать из текста профессионально значимую информацию и передавать главную мысль текста;
- 3) научить логично представлять последовательность прочитанного;
- 4) научить презентовать результаты прочитанного.

СОСТАВЛЕНИЕ СЛОВАРЯ ПРОФЕССИОНАЛЬНОЙ ЛЕКСИКИ

Для составления словаря профессиональной лексики необходимо иметь понимание того, что является термином. Чаще всего под термином понимается сло-

во и словосочетание, выражающее определённое специальное понятие, явление или предмет в определенной системе научного знания, т. е. при работе над составлением словаря нужно обращать внимание только на те слова и выражения, которые связаны непосредственно с тематической областью текста.

Приведем ниже некоторые определения термина:

«Термины – это слова специальные, **ограниченные своим особым назначением**; слова, стремящиеся быть однозначными как точное выражение понятий и называние вещей»

(abridged from: Реформатский, А. А. Введение в языковедение [Текст]: учеб. пособие / А. А. Реформатский. М., 2004.)

«Термин – слово или словосочетание **специального (научного, технического и т. п.) языка** для точного **выражения специальных понятий** и **обозначения специальных предметов**»

(abridged from: Климовицкий А. Я. Некоторые методологические вопросы работы над терминологией науки и техники // Современные проблемы терминологии в науке и технике. М.: Наука, 1969. С. 34)

«Термины – это не особые слова, а только **слова в особой функции**. В роли термина может выступать всякое слово, как бы оно не было тривиально»

(abridged from: Винокур Г. О. О некоторых явлениях словообразования в русской технической терминологии // Труды Московского института истории, философии и литературы. М.: ЛИТЕРА, 1939. Т. 5. Сборник статей по языковедению. С. 4)

Отправной точкой для поиска терминологии в тексте, как правило, считается тематическая область текста и его заголовок. Студентам рекомендуется прочитывать заголовок внимательно и выявить основные понятия статьи. Обычно такие понятия выражены существительными.

В процессе чтения и поиска терминологии исходя из базовых основных понятий и тематики текста также необходимо обращать внимание на разные терминологические сочетания:

N1 + N1 = the products details – данные изделия, **Vibration values** = значения вибрации, **Fastener's washer** – головка элемента, **application temperature** – рабочая температура;

N1 + Prep + N2 = search for oil – поиск нефти;

V + Prep + N = drill for oil – бурить, чтобы добыть нефть;

V + N1 = design a mine – разработать план шахты;

Adj + N = fine grains – мелкие зерна;

V + Adj + N = conduct a crime scene – проводить осмотр места преступления;

V + N + P + N – to provide evidence of the guilt – предоставить доказательство вины.

N = noun – существительное
Adj = adjective – прилагательное
Prep = preposition – предлог
V = verb – глагол
Adv = adverb – наречие

Отличительной чертой научно-технических текстов является наличие многосоставных терминов, таких как nuclear – powered closed – cycle gas turbine design, что будет переводиться как «проект газовой турбины, имеющей замкнутый цикл и работающей на ядерном топливе». Основная трудность при переводе таких терминов заключается в том, что их перевод не всегда можно найти в словарях.

В таких случаях при переводе рекомендуется применить правило «ряда», которое используется в том случае, если перед существительным представлена «цепочка определений».

Правило ряда:

«Если между артиклем (или другим определителем) и существительным, к которому он относится, стоит несколько существительных, они образуют цепочку определений. Существительное, к которому относится артикль, является по отношению к ним главным».

С последнего существительного, к которому относится артикль, следует начинать перевод, мысленно ставя после него вопрос «КАКОЙ?»

Отдельные случаи перевода терминов с использованием правила ряда:

Перевод существительных в роли определения:

a) прилагательными:

oil well – нефтяная скважина;

b) существительными в родительном падеже:

the exploration strategy – стратегия развития;

c) если определяющее существительное в данном значении употребляется только во множественном числе и без окончания приобретает другое значение:

the fines trap – ловушка для мелких частиц;

the fine trap – тонкая (красивая) ловушка.

Перевод прилагательных, причастий (причастия 1 и 2) и герундия внутри ряда нужно начинать с последнего слова, двигаясь с конца ряда к началу, при переводе следует оставить грамматическую форму среднего слова:

The rock-feeding system (feeding – Participle I) – Система (устройство), подающая(ее) горную породу.

(abridged from: http://testent.ru/index/nouns_imja_sushhestvitelnoe/0-680)

При составлении словаря не рекомендуется выносить отдельно прилагательные / наречия и глаголы – данные выражения можно представить в виде терминологических сочетаний. Например, прилагательные в составе терминологических сочетаний (*Adjective + Noun*). Термин типа (*Adjective + Noun*) нужно ставить в словарь только тогда, когда прилагательное является терминообразующим, **т. е. включает в себе научное, а не субъективное оценочное знание.**

Exploratory well – разведочная скважина

Beautiful rocks – красивая порода

В целях качественной работы в словарь не заносятся слова и выражения с прозрачной семантикой (о переводе можно догадаться по звучанию слов или по написанию: (*kilograms, seismic, energy*)). Если слово или словосочетание с прозрачной семантикой обретает иное значение в контексте, т. е. переводится нетривиально, то его можно включить в словарь.

Внеаудиторное чтение и составление словаря предполагает более глубокую проработку текста, поэтому словарь должен отражать специфику статьи (т. е. при составлении словаря нужно отталкиваться от содержания статьи – конкретных описываемых явлений и действий). Общеупотребительные и базовые слова и словосочетания конкретной научной сферы, рассмотренные в рамках занятий, настоятельно не рекомендуется включать в словарь отдельно (*geology, rocks, coal, mining*).

Однако они могут быть включены в словарь в составе разных словосочетаний на основе анализа узкоспециального прочитанного текста.

Словарь предоставляется по следующей форме:

№	English	Transcription (if needed)	Russian translation	English example	Russian translation of the example	Pp.
1	Hardening of the lava flows	[fləʊ]	Затвер- девание потоков лавы	Most basalts are volcanic in origin and were formed by the rapid cooling and hardening of the lava flows	Большинство базальтов вулкани- ческого происхож- дения образовались в результате бы- строго охлаждения и затвердевания потоков лавы	P. 7

При переводе терминов могут быть использованы следующие виды словарей:

- 1) двуязычные общие;
- 2) двуязычные отраслевые, составленные по алфавитно-гнездовому принципу;
- 3) толковые;
- 4) энциклопедические;
- 5) словари синонимов;

- 6) словари антонимов;
- 7) словари профессионального жаргона.

Также полезно читать литературу, написанную на языке оригинала и тематически эквивалентную ей на русском языке. Нежелательно использовать при прямом переводе такие средства машинного перевода, как Google translate / Yandex translate и пр. Такие источники могут быть полезны для общего ознакомления с текстом, но, как правило, они предоставляют неправильный или неточный перевод терминов, не учитывают такие константы, как смысл и многозначность текста.

Среди возможных источников словарей, находящихся в сети Интернет в свободном доступе, порекомендуем:

1. Алексеев М. А., Тимофеев П. П., Софиано Т. А. Англо-русский геологический словарь [Электронный ресурс]. – URL: <https://lithology.ru/system/files/books/slovar.pdf>.
2. Тютюкин Г. И. Англо-русские термины по гео-разведочным работам [Электронный ресурс]. – URL: https://vk.com/doc263070408_422117282.
3. Барон Л. И., Ершов Н. Л. Англо-русский горный словарь. Государственное издательство физико-математических литературы. М., 1958. 986 с.
4. Электронный словарь Wooordhunt [Электронный ресурс]. – URL: <https://wooordhunt.ru/word/word>.
5. Электронный словарь Reverso Context [Электронный ресурс]. – URL: <https://context.reverso.net/%D0%BF%D0%B5%D1%80%D0%B5%D0%B2%D0%BE%D0%B4>.

Для поиска текстов для чтения могут быть использованы следующие сайты научной литературы:

1. Taylor & Francis Online [Электронный ресурс]. – URL: <https://www.tandfonline.com>.
2. The Royal Society of Chemistry's Journals, Books and Databases [Электронный ресурс]. – URL: <https://pubs.rsc.org>.
3. Cambridge core [Электронный ресурс]. – URL: <https://www.cambridge.org/core>.
4. Springer link [Электронный ресурс]. – URL: <https://link.springer.com>.
5. Science direct [Электронный ресурс]. – URL: <https://www.sciencedirect.com>.

СОСТАВЛЕНИЕ ОБЗОРА ПО ПРОЧИТАННОМУ ТЕКСТУ

В понимании смысла текста выделяется три этапа:

- 1) предтекстовый;
- 2) текстовый;
- 3) послетекстовый.

Предтекстовый этап работы заключается в активизации фоновых знаний, построении гипотез и снятии лексико-грамматических трудностей работы с тек-

стом. На данном этапе рекомендуется ознакомиться с названием статьи, с ее аннотацией и поработать над общим пониманием текста.

Вопросы для самопроверки на предтекстовом этапе:

1. Исходя из названия текста предположите, о чем он.
2. Изучите иллюстрации в тексте, предположите, что может быть изображено на иллюстрациях.
3. Подчеркните в тексте те слова и выражения, которые вы не знаете или не можете понять (в этом случае можно поработать со словарями или обратиться к преподавателю).

Работа на текстовом этапе сводится к прочтению текста статьи.

Вопросы для самопроверки на текстовом этапе:

1. Какие детали в каждом из абзацев текста вы можете отметить?
2. В чем состоит основная мысль прочитанного?
3. Какие вопросы вы могли бы задать автору статьи?

На послетекстовом этапе происходит написание обзора и его пересказ. Рекомендуется обратить внимание на фонетическую и интонационную сторону оформления высказывания. Хорошим упражнением для развития монологической речи является пересказ вслух или запись аудио- и видеофайлов выступления, так как они позволяют посмотреть на себя со стороны, проанализировать возможные ошибки.

(abridged from: Зими́на Е. А. Преподавание домашнего чтения на занятиях по немецкому языку с использованием информационно-коммуникационных технологий (из опыта работы в неязыковом вузе) // Научный диалог. Екатеринбург: Центр научных и образовательных проектов, 2018. № 8. С. 247–260)

КОНСТРУКЦИИ ДЛЯ НАПИСАНИЯ ОБЗОРА

Make a review of the article you've read (200–250 words).

INTODUCTORY PART – ВСТУПЛЕНИЕ

The title

1. The title of the article. – Название статьи.
2. The article is headlined... – Статья называется...
3. The headline of the article I have read is... – Статья, которую я прочитал, называется ...
4. It is (en)titled... – Она называется...

The author

5. The author(s) of the article is (are)... – Автор(ами) этой статьи является (являются)...

6. The article is written by... – Статья написана...
7. It is (was) published in... – Она (была) опубликована в...

The main idea of the article

8. The main idea of the article is... – Основная идея статьи заключается в том, что...
9. The article is about... – Статья о...
10. The article is devoted to... – Статья посвящена...
11. The article deals with... – Статья имеет дело с...
12. The article touches upon... – Статья затрагивает...
13. The purpose (aim, objective) of this article is to give... – Цель этой статьи – дать... (читателям определенную информацию о...) – (the readers some information on...)

MAIN BODY – ЦЕНТРАЛЬНАЯ ЧАСТЬ

1. In the first part of the article the author speaks about... – В первой части статьи автор говорит о...
2. The author shows... – Автор показывает...
3. The author defines... – Автор определяет...
4. The author underlines... – Автор подчеркивает...
5. The author notes... – Автор отмечает...
6. The author emphasizes (marks out, pints out)... – Автор выделяет...
7. First of all it is necessary to underline... – Прежде всего, необходимо подчеркнуть...
8. The author begins with the describing... – Автор начинает с описания...
9. According to the text... – Согласно тексту...
10. Further the author reports (says) that... – Дальше автор сообщает, что...

CONCLUSION – ЗАКЛЮЧЕНИЕ

1. In conclusion... – В заключении...
2. The author comes to the conclusion that... – В заключении автор приходит к выводу, что...
3. The author concludes by emphasizing the fact that... – Автор заканчивает выделением такого факта, как...
4. I find the article interesting. – Я нахожу, что статья интересна.
5. I consider the article important. – Я считаю, что статья важна.
6. I found the article of no value. – Я нахожу, что статья не имеет большой ценности.
7. The article holds much new for (to) me. – Статья содержит много нового для меня.

ПРАКТИКУМ ПО ВНЕАУДИТОРНОМУ ЧТЕНИЮ

Vocabulary

Упражнение 1. В терминологическом ряде выберите лишний термин, который не стоит заносить в словарь при наличии всех остальных в анализируемом тексте. Переведите термины:

1. Evaporate / vapour / toxic vapours / give off vapour / vapour cloud mitigation.
2. Toxic exposures / toxic gas / toxic substances / toxic / toxicity.
3. Water saturated / water repellent / water tight / waterproof / water / water supply line / water production rate.
4. Core house / core axis / core / core barrel / core orientation.
5. Pore volume / pore water / pore / move upwards through pores / tiny pores.
6. Sample collection / take samples of core / samples / sample location / samples of checklists.
7. Shale rock / igneous rock / rock / rock porosity / bedrock / rock breaking / rock disintegrations / rock piece / rock hardness ration.
8. Gas ratio / gas tight / gas lift / gas cap / gas separator / gas / gas cut mud / gas cut fluid.
9. Load oil / oil tanker / oily / to pump oil out / into the reservoir / oil supply / oil / oil demand.
10. Pipeline control / pipe-joining / pipe-laying / pipeline route / pipeline.
11. Pressure tank / pressure / pressure drop / to withstand pressure.

Упражнение 2. Найдите формальные ошибки в представлении словаря профессиональной лексики:

1. Responded – отвечать.
2. Surrounding – окружающий.
3. Successfully – успешно.
4. This methods have been rejected – методы были отвергнуты.
5. Receiving – получать.
6. Widely – широко.
7. Into commercial quantities – в промышленных количествах.
8. During the vast expanse of geological time – на протяжении всего геологического времени.

Упражнение 3. Проанализируйте список слов. Какие правила составления профессионального словаря не были соблюдены студентами?

A)

- | | |
|----------------------------|----------------------------|
| 1. Distinguish – отличать. | 3. The host rock – порода. |
| 2. Primary – первичный. | 4. Ore – руда. |

- | | |
|---|---|
| 5. Represent – представлять. | 12. The petrographic composition – петрографический состав. |
| 6. Predominant – преобладающий. | 13. Rare – редкий. |
| 7. The uppermost part of the crust of weathering – верхняя часть коры выветривания. | 14. The presence – присутствие. |
| 8. Variation – различие. | 15. Refining – очистка. |
| 9. Insignificant – незначительный. | 16. Exploration – разведка. |
| 10. Exploration well – разведывательная скважина. | 17. Influence – влияние. |
| 11. Alteration – изменение. | 18. Mineralization – минерализация. |
| | 19. Conclusions – вывод. |

В)

- | | |
|---|--|
| 1. Another – другой. | 10. Differs sufficiently – отличается достаточно сильно. |
| 2. Associated / related – связанный с чем-то / связанный. | 11. Detect – обнаружить. |
| 3. artificially / artificial – искусственно. | 12. Developed – развитый. |
| 4. Because of – из-за. | 13. Employed – задействованный. |
| 5. Capable – способный. | 14. Force – сила. |
| 6. Coverage – покрытие / охват. | 15. Generally – обычно. |
| 7. Compared with – по сравнению с. | 16. Gravitational attraction – гравитационная привлекательность. |
| 8. Conductivity – проводимость. | 17. Investigations – расследования. |
| 9. Devise – разрабатывать. | 18. Inexpensive – недорогой. |

Упражнение 4. Выделите основные термины в названии следующих статей:

1. Montone P., Mariucci T. M. Constraints on the Structure of the Shallow Crust in Central Italy from Geophysical Log Data // Scientific Reports. 2020. № 3834. Pp. 145–154.
2. Bormann P. Shallow source body waves and travel times at teleseismic distances // New Manual of Seismological Observatory Practice 2 (NMSOP2). Potsdam: Deutsches GeoForschungsZentrum GFZ, 2012. Pp. 1–105.
3. Engdahl E. R. 3-D models and their use in event location // Phys. EarthPlanet. Interiors, 2001. Pp. 205–219.
4. Bormann P. Synthetic seismograms and waveform modelling // New Manual of Seismological Observatory Practice 2 (NMSOP2). Potsdam: Deutsches GeoForschungsZentrum GFZ, 2012. Pp. 15–27.
5. Henniges J, Götz J. New Methods in Geophysical Exploration and Monitoring with DTS and DAS // Proceedings, EAGE/DGG Workshop on Fibre Optic Technology in Geophysics. Potsdam, Germany, 2017. Pp. 235–248.

6. Delgado-Rodríguez O. Characterization of Hydrocarbon-Contaminated Sites Based on Geoelectrical Methods of Geophysical Exploration. IntechOpen, 2018. 324 p.

Упражнение 5. Найдите ошибки и неточности в переводе терминологии. Какой принцип был нарушен при переводе?

Тематика статьи: The propagation of a seismic disturbance through a heterogeneous medium.

1. The packet of energy – пакет энергии.
2. The envelope of the wave packet – огибать волну пакета энергии.
3. Love waves – любовные волны.
4. Harmonic motions – гармонические движения.

Тематика статьи: Copper ore deposits.

5. Oxidized ore – окисляющая руда.
6. The host rock – порода.
7. The zone of intense weathering – зона сильного действия погоды.

Тематика статьи: Gas logging.

8. Gas logging – газовый журнал.
9. Well sinking – хорошо тонущий.
10. The completion of all work on the well – завершение всех работ в колодце.

Упражнение 6. Прочитайте отрывок из научной статьи и выделите терминологические сочетания по формату, обращая внимание на заголовок отрывка. Переведите выбранные термины:

- ▶ N + N + (N)
- ▶ N + of + N
- ▶ N1 + Prep + N2
- ▶ V + N1
- ▶ Adj + N
- ▶ V + Adj + N
- ▶ V + N + P + N

Hybrid wireline cable deployment

“In already existing wells or cases when the completion type makes permanent installation to the target depth difficult, a cable can also be lowered down inside the casing or tubing. When using distributed methods, one of the main advantages over classical wireline logging operations is that also very long profiles can be monitored simultaneously without tool or cable movement. As the repertoire of fiberoptic sensors is currently still limited, a hybrid wireline logging system additionally allowing for deployment of classical electric tools like gamma-ray or casing-collar-locator for depth correlation has been developed. This system was used for flow profiling during a

production test in a 4.300 m deep well at the Groß Schönebeck site, revealing important information on the reservoir behaviour of this enhanced geothermal system.”

(abridged from: Henninges J, Götz J. New Methods in Geophysical Exploration and Monitoring with DTS and DAS // Proceedings, EAGE/DGG Workshop on Fibre Optic Technology in Geophysics. Potsdam, Germany, 2017. Pp. 235–243)

Reading

Упражнение 7. Прочитайте аннотацию статьи и выделите незнакомые вам термины.

“Electrical methods are effective tools for the characterization of oil-contaminated sites and are applied in defining the geometry of the contaminated plume and in designing the remedial process. The optimal methodology integrates geoelectric methods, data processing, and interpretation techniques. Electromagnetic profiling is a reliable and fast method used to provide the configuration of oil-contaminated plume from apparent resistivity map and used to guide the subsequent electrical resistivity tomography survey. From advanced field work methods, data processing, and interpretation procedures, electrical resistivity tomography survey provides the three-dimensional (3D) configuration of the contaminated plume, migration pathways, location of active contaminated sources, and information about lithology.

For separate contaminated and clean zones, a petrophysical modeling is used for the calculation of soil resistivity based on groundwater salinity. Taking the pore-water salinity value into account, an inversion algorithm recalculates resistivity maps into maps of clay content, porosity, and cation exchange capacity, allowing a more accurate determination of the volume of contaminated soil. From clay content data, hydraulic conductivity values are calculated for determining the groundwater vulnerability due to vertical migration of contaminants from upper layers. The optimal geoelectric methodology is an efficient procedure to assess hydrocarbon-contaminated sites, with emphasis on large sites with deeper groundwater table.”

(abridged from: Delgado-Rodríguez O. Characterization of Hydrocarbon-Contaminated Sites Based on Geoelectrical Methods of Geophysical Exploration. IntechOpen, 2018. 324 p.)

Writing

Упражнение 8. Ответьте на следующие вопросы, затем перескажите аннотацию, используя конструкции для написания обзора статьи.

- | | |
|---|---|
| 1. Who are the authors of the article? | 5. What are the methods of investigation? |
| 2. What is the aim of the articles? | 6. Are there any steps of the research? |
| 3. What are the main notions of the article? | 7. What are the conclusions? |
| 4. What are the main objects of the investigations? | |

APPENDIX E: TIPS FOR EFFECTIVE PRESENTATIONS

Обычно презентации подразделяются на три части, за которыми следуют вопросы слушателей: introduction, body, conclusion, questions.

Вступительная часть презентации (introduction) открывается обращением к слушателям, знакомством со слушателями и представлением предмета своей презентации, обозначением ее структуры (плана своей речи), инструктированием слушателей по вопросу времени, когда выступающий сможет ответить на вопросы (во время презентации или в конце презентации).

Welcoming	Good morning, ladies and gentlemen. Good morning gentlemen. Good afternoon everybody.
Introducing yourself	Let me introduce myself – Позвольте представиться... My name is – Меня зовут...
Introducing your subject	I'm going to talk today about... – <i>Я буду говорить сегодня о...</i> The purpose of my presentation is to introduce our... – <i>Цель моей презентации – представить наше...</i> The topic of my presentations is – <i>Тема моей презентации...</i>
Structure	To start with I'll describe the progress made this year. – <i>Для начала я опишу...</i> Then I'll mention some of the problems we've encountered and how we overcame them. – <i>Я упомяну несколько проблем, с которыми мы столкнулись, и расскажу, как мы их преодолели.</i> After that I'll consider the possibilities for... – <i>После этого я рассмотрю все возможности для...</i> Finally, I'll summarize my presentation (before concluding with some recommendations). – <i>В конце я подытожу основные идеи своей презентации (прежде чем перейти к заключению и рекомендациям)</i>
Instructions for questions	Do feel free to interrupt me if you have any questions. – <i>Можете прерывать меня в процессе презентации, если у вас возникнут вопросы.</i> I'll try to answer all of your questions after the presentation. – <i>Я попробую ответить на ваши вопросы после презентации.</i> I plan to keep some time for questions after the presentation. – <i>Я планирую оставить время для вопросов после презентации.</i>

Основная часть (body) выступления должна быть логически структурирована и поделена на части. Информацию в основной части рекомендуют снабжать заголовками, иллюстрациями, деталями. Однако нужно помнить, что не рекомендуется выносить большое количество текста на слайды.

TRANSITIONS AND EXAMPLES	
A good example of...	Хороший пример (того как)...
A key factor...	Ключевой фактор...
If you look at this slide...	Если Вы посмотрите на данный слайд...
Let's now look at...	Давайте посмотрим на...
I'd now like to move on to the next part...	Я бы хотел сейчас перейти к следующей части...
This leads me to my next point, which is...	Это приводит к следующему пункту / части, которая...
Turning our attention now to...	Обращая наше внимание на...

В **заключительной части** (conclusion) презентации подытоживаются все аспекты выступления, делается вывод, выражается мнение и даются рекомендации (если таковые нужны), выражаются слова благодарности слушателям, предоставляются ответы на вопросы слушателей.

Conclusion	In conclusion,... – <i>В заключении...</i> Now, to sum up... – <i>Подытожим...</i> So let me summarise/recap what I've said. – <i>Позвольте мне обозначить основные моменты того, что я сказал.</i> Finally, may I remind you of some of the main points we've considered. – <i>Наконец, позвольте напомнить вам основные рассмотренные в презентации моменты.</i>
Recommendations	In conclusion, my recommendations are... – <i>В заключение, мои рекомендации таковы...</i> I therefore suggest/propose/recommend the following strategy. – <i>Я, таким образом, предлагаю / рекомендую следовать.</i>
Audience	Many thanks for your attention. – <i>Большое спасибо за ваше внимание.</i> May I thank you all for being such an attentive audience. – <i>Разрешите поблагодарить вас всех за то, что вы очень внимательно отнеслись к моей презентации.</i>
Questions	Can I answer any questions? – <i>Могу ли я ответить на ваши вопросы?</i> Are there any questions? – <i>Имеются ли какие-либо вопросы?</i> Do you have any questions? – <i>У вас есть вопросы?</i> Are there any final questions? – <i>Есть ли какие-либо заключительные вопросы?</i>

(abridged from: Анастасова Е. В., Воног В. В. Английский язык. Деловая этика: учеб. пособие / Сиб. федер. ун-т. Красноярск : СФУ, 2011. С. 65–66)

ПРАКТИКУМ ПО ПОДГОТОВКЕ ПРЕЗЕНТАЦИИ

Vocabulary

Exercise 1. Match 1–7 to a–g to make collocations.

- | | |
|-----------|--------------|
| 1. Invite | a) summarise |
| 2. Let me | b) with |
| 3. Have | c) some time |
| 4. Sum | d) free |
| 5. Start | e) questions |
| 6. Keep | f) up |
| 7. Feel | g) look at |

Exercise 2. Put the words in the correct order.

- is / I'm / what / to say / trying
- before / move on / sum that up / we / to / let me / try and / just
- I / presented / so far, / have
- End / saying / me / by / let
- like / I'd / in conclusion / to say
- like to / by emphasising / to finish / I'd
- last / about 20 minutes / my / will / presentation
- questions / will be / at the end / to ask / of my talk, / a chance / there
- any / at the end of / I'll be / to answer / happy / my presentation / you have / questions

(abridged from: <https://www.eapfoundation.com/speaking/presentations/language/#:~:text=The%20language%20for%20presentations%20involves,which%20help%20understand%20the%20structure.&text=The%20structure%20of%20a%20presentation,body%2C%20conclusion%2C%20and%20Q%26A>)

Reading

Exercise 3. Read the tips and classify them into two columns.

Bad tips	Good tips

- Actively gesticulate when the presentation goes on, the attention of listeners will concentrate on your hands but not on what you are talking in this case.
- Be interesting and entertaining.
- Choose what you think is most essential to cover or most interesting to your specific audience.
- Estimate the intelligence and knowledge of my audience.
- Focus on a few key points.
- Forget about presentation, just don't prepare at all.

7. Instead of being scared of tough questions, you should think that they have offered a tough question because they have been listening. Praise the questions.
8. Interest the audience in order to they want to find more information after my speech.
9. Keep in mind the time limit!
10. Keep it simple and short.
11. Laugh at a mistake instead of apologizing. Jokes is consistently appropriate is when you make a mistake.
12. Minimize hand movement.
13. Neutral colours for the presentation, do not use bright red for the background. It is distracting.
14. Practice in front of friends and family.
15. Put tons of information on each slide and make sure that flip through the slides quickly.
16. Rehearse my speech and exclude not very important things in advance to stay within my time limit at a conference.
17. Repeat key insights. Repetition is great.
18. Speak in complex sentences, you'll just look boring.
19. Speak monotonously. Speaking in monotones is sleep inducing.
20. Stay within your time limit.
21. The worst thing is to put your hands in your pocket.
22. Use examples.
23. Use handouts during my presentation.
24. Use large fonts.
25. Use slide with "thanks", this is a good way to end your presentation.
26. Think how your work might interest the other scientists.
27. Write short, declarative sentences.

(abridged from: <https://www.youtube.com/watch?v=6-WD4X4IKEs>)

Listening

Exercise 4. Go to TED talks website on the topic of geology <https://www.ted.com/topics/geology>. Choose any topic that you like and analyse the talk. Present the results of your analysis in the chart below.

Language for the introductory part	Language for the main body	Language for the conclusion	Your recommendations to improve the speech
------------------------------------	----------------------------	-----------------------------	--

Writing and Speaking

Exercise 5. Write a short presentation talk on any of these topics. Give a talk in groups of three. Divide your talk into three parts: Introduction, Body and Conclusion. Use language patterns for a successful permutation (see pp. 315–317):

1. Earthquakes and plate tectonics.
2. Agents of metamorphism (heat, pressure, water).
3. Geophysical surveys.
4. Exploration of mineral deposits.
5. Alternative sources of energy.
6. Renewable and non-renewable resources.
7. Weathering, erosion transportation, deposition, lithification parts of the rock cycle.
8. Rates of geological processes.
9. Types of plutonic bodies (dykes, sills, stocks).
10. Diverse effects of mining activity.

(abridged from: <https://web.viu.ca/earle/geol111/main-topics-2004.htm>)

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