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NATIONAL TECHNICAL UNIVERSITY OF UKRAINE
“IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE”

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PROFESSIONAL ENGLISH FOR FUTURE MINING ENGINEERS

Recommended by Igor Sikorsky KPI Methodological Council
as a study e-book for graduate students of specialty
184 “Mining”

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The Study Electronic Book

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Professional English for Future Mining Engineers

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ABSTRACT. This study e-book is recommended for classroom and independent work with graduate students of the Institute of Energy Saving and Energy Management, Igor Sikorsky KPI. The main goal of the publication is to develop English communicative skills in speaking, listening, reading, writing, as well as developing and improving translation skills. The book consists of five units and four appendices and comprises real professional themes for teaching future mining engineers. In addition, there are supplementary texts useful for group work. This e-book corresponds to the requirements of the study program of credit modules within the discipline “Foreign Academic Language”.

CONTENT

PREFACE

The study electronic book *Professional English for Future Mining Engineers* is purposed for future mining engineers who study English as a foreign language at tertiary level. It is intended to help learners improve their competence in all communication skills: speaking, reading, listening, writing, translation.

Professional English for Future Mining Engineers consists of five units and four appendices. The authentic texts cover the basic topics for mining engineers: a career in mining, automation technologies, safety and hazards in mining, underground construction etc. Each section includes authentic texts and a set of different exercises for developing speaking, listening, writing and translation skills. The appendices contain a grammar guide, recommendations for essay writing, making presentations and video scripts. Each unit includes a supplementary text for the development of sociocultural competence. All the texts are taken from up-to-date specialised textbooks, technical journals and online sources. The exercises and creative tasks are developed by the authors. Information-rich cognitive material and a variety of lexical tasks will help to increase students' motivation to learn English during in-class activities, group projects and homework assignments.

While developing the material, we have shared a lot of experience with students, colleagues and friends. We appreciate their participation, suggestions and comments, and hope that you will also share that pleasure working on the course.

Recommended for classroom activities and independent work for the fifth-year students of the Energy Saving and Energy Management Institute at Igor Sikorsky KPI.

We hope that this book will be practical and motivating for your students.

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UNIT 1. MINING ENGINEERING

"Everyone knows that we're doing a science experiment with Earth. And the No. 1, No. 2, No. 3, No. 4 contributors to it are the mining and burning of coal. - Robert F. Kennedy, Jr.

LEAD IN

1. Look through the short article below describing the requirements needed to become an engineering specialist. What qualities are prioritized? What skills does a modern engineer need? What do you have to do to develop the required qualities?

The Engineer should be *a critical thinke*r and *have a sound subject knowledge* of mathematics and physics *to identify and solve engineering problems.* You must also possess a certain *level of creativity* to present innovative solutions and improvements to technical processes. The successful candidate will be able to effectively *communicate ideas*, *make recommendations, and negotiate* project details with their team, subcontractors, and clients.

2. Study the list of responsibilities of a modern mining engineer. Think about the qualification and expertise he should possess. Discuss in groups and present your opinion.

Responsibilities and skills of a mining engineer

Responsibilities	**Skills**
undertaking feasibility studies	problem-solving
preparing plans for mines	analytical skills
overseeing major construction projects	teamwork skills

ensuring that operations run smoothly	interpersonal skills
overseeing the health and safety of the site	strong technical skills
providing consultancy and advice on mining and mineral extraction projects	confidence
monitoring activities underground	IT skills
undertaking feasibility studies	independent study

READING and VOCABULARY

1. Study the words given below and make sure you know their meaning.

to manage	intricacy	unrusted
open pit	to expand	humming
consequences	blasting	mill
drilling	schedule	to face
purchase	facility	essence

2. Read the text and answer the questions after the text.

WHAT DO MINING ENGINEERS DO

Mining engineers spend most of their time in meetings, listening to consultants and staff and making hard decisions about the mine they work for or manage.

When they are not in meetings, the mining engineers drive around the open pit or descend the underground workings where they walk around to see if things are going as they should. And if things are not going as they should, they talk to the people who are supposed to be making things go properly. The mining engineers remind them of their duty and the consequences of failing to live up to their commitments.

Sometimes the mining engineers leave the mine and go to the office building in some distant city where the head office is located. There they meet with even more senior mining engineers, accountants, and lawyers to discuss the legal and financial

operation of the mine they manage. Then they go to a fine restaurant for supper and a night in an expensive hotel to fly back, first-class, to the mine the next day.

The variety of challenges lie in the diversity of topics and issues the mining engineer will face each day in those meetings and round-the-mine travels. Today the mining engineer will be faced with a decision to purchase or not to purchase land next to the mine where there may or may not be additional ore to expand the mine. The next day the mining engineer will be asked by the chief exploration geologist for an increase in budget to enable more drilling to be undertaken on the land that was purchased the day before.

To check if the mill superintendent really does need new equipment, the mining engineer takes a trip to the mill. He has never really understood the intricacies of this mill and he knows the mill super is smarter than he is and has been around a lot longer. They banter good-naturedly for a while. They walk around the equipment which all seems unrusted and humming. The mining engineers that I write of here, may have studied, like most engineers, basic maths, physics, chemistry, and calculus. Then a few courses in basic mining theory: what makes an underground mine; the essence of open pits; basic blasting theory; and maybe a bit of finance and accounting. Maybe a short course on environmental studies, social policy, sustainable propaganda, and community relations.

The mining engineer, however, is the boss, the mine manager, the chief mine planner, the executive officer, the primary decision-maker. The mining engineer aim is to leave the management of the mine to a younger soul and move up the ladder to head office. There he will face new challenges: buying and selling mines, negotiating deals, and setting budgets and schedules.

Some mining engineering graduates go on to do a masters degree—and then go into consulting. Their work is critical to mine safety, and their publications (which I read avidly) are impeccable and impressive. These are a small part of the mining engineering fraternity. They prove the immense diversity of mining engineering pursuits and endeavours. They demonstrate that if you choose to study mining engineering, that is only the beginning. Once graduated, there is an infinite variety of

opportunities just waiting for you to choose a lifestyle that suits your instincts, interests, abilities, and lifestyle choices.

Keep in mind that you do not have to study mining engineering to enter the mining industry. You could become a civil engineer and develop mining infrastructure: the roads, bridges, shafts, structures, and tailings facilities that are key to mining. You could become a mechanical engineer: manage the shovels, the trucks, the crushers, and spreaders, and the pipes and pumps of the mine. You could become a chemical, process, or metallurgical engineer and oversee the extraction of minerals from the ore. Or become an environmental engineer and take care of air quality, surface water and groundwater quality and all the other potential impacts of a mine on its surroundings.

Mining and geological engineers typically do the following:

- Design open-pit and underground mines;
- Supervise the construction of mine shafts and tunnels;
- Devise methods for transporting minerals to processing plants;
- Prepare technical reports for miners, engineers, and managers;
- Monitor mine production to assess the effectiveness of operations;
- Provide solutions to problems related to land reclamation, water and air pollution, and sustainability;
- Ensure that mines operate in safe and environmentally sound ways.

Geological engineers search for mineral deposits and evaluate possible sites. Once a site is identified, they plan how to extract metals or minerals in environmentally sound ways. Mining engineers often specialize in one particular mineral or metal, such as coal or gold. They typically design and develop mines and determine the best way to extract metal or minerals to get the most out of deposits.

Some mining engineers work with geoscientists and metallurgical engineers to find and evaluate ore deposits. Other mining engineers develop new equipment or direct mineral-processing operations to separate minerals from dirt, rock, and other materials.

Mining safety engineers use best practices and their knowledge of mine design to ensure workers' safety and to maintain compliance with state and federal safety regulations. They inspect the walls and roofs of mines, monitor the air quality, and examine mining equipment for possible hazards.

Engineers who hold a master's or a doctoral degree may teach engineering at colleges and universities.

Adapted from https://www.mining.com/web/what-do-mining-engineers-do/

1. Who is a mining engineer?
2. What are the responsibilities of mining engineers?
3. With what problems are mining engineers faced with today?
4. What courses do mining engineers study?
5. What are the duties of a mining engineer?

INCREASE YOUR VOCABULARY

1. Match the synonyms.

1)	to remind	a)	to come after
2)	to locate	b)	diversity
3)	to purchase	c)	to bring to mind
4)	impressive	d)	to select
5)	to pursuit	e)	effective
6)	to demonstrate	f)	to acquire
7)	to choose	g)	to designate
8)	variety	h)	to show

2. Match the words with their definitions.

1)	staff	a)	be in charge of a company
2)	to manage	b)	a person who practices or studies law
3)	consequences	c)	a set of circumstances that makes it possible to do something
4)	accountant	d)	an engineer who designs and maintains

			roads, bridges etc.
5)	lawyer	e)	a result of an action
6)	humming	f)	make a low, continuous sound like that of a bee
7)	opportunity	g)	space or equipment necessary for doing something
8)	lifestyle	h)	how a person or group lives
9)	civil engineer	i)	all the people employed by a particular organization
10)	facilities	j)	a person whose job is to keep or inspect financial accounts

3. Match English collocations with the Ukrainian translation.

1)	mining engineer	a)	головний геолог-розвідник
2)	make a decision	b)	подорож по шахті
3)	office building	c)	прийняти рішення
4)	round the mine travel	d)	вибір способу життя
5)	chief exploration geologist	e)	виконавчий директор
6)	blasting theory	f)	гірничий інженер
7)	executive officer	g)	той, хто приймає рішення
8)	mine safety	h)	теорія вибуху
9)	decision-maker	i)	адміністративна будівля
10)	lifestyle choice	j)	безпека шахти

4. Match and explain.

1)	open pit	a)	a person which may manage any phase of mining operations;
2)	mining engineer	b)	a device used for spreading or scattering a substance over a wide area;
3)	underground mining	c)	cosmological theory about the early stage of the evolution of the universe;
4)	blasting theory	d)	a tool used for moving coal, earth, snow or other material;

5)	shovel	e)	a tube of metal, plastic, or other material used to convey water, gas, oil, or other fluid substances;
6)	big bang	f)	a surface mining technique of extracting rock or minerals from the earth by their removal from an open pit or borrow;
7)	crusher	g)	used to extract ore from below the surface of the earth;
8)	spreaders	h)	a machine designed to reduce large rocks into smaller rocks, gravel, or rock dust;
9)	pipe	i)	he controlled use of explosives and other methods to break rock for excavation.

5. Finish the sentences about the work and duties of a mining engineer.

1. When they are not in meetings, the mining engineers drive around the open pit or descend the underground sites where _____.
2. The duties of a mining engineer are _____.
3. The work of a mining engineer is critical to _____.
4. The mining engineers aim is _____.
5. A mining engineer' duty is to ensure the safety of _____ .

TRANSLATION

Translate the following sentences into English.

1. Гірничі інженери об'їжджають відкритий кар'єр, або спускаються під землю, де вони проводять огляд, щоб побачити, чи йдуть справи належним чином.
2. На сьогодні гірничі інженери повинні вміти приймати рішення про придбання землі для подальшого розширення шахт.
3. Гірничий інженер повинен отримати знання з таких базових дисциплін: математика, фізика, хімія та креслення.
4. Гірничий інженер є керівником шахти, її головним планувальником, виконавчим директором та головним керівником.
5. Деякі випускники гірничої спеціальності отримують ступінь магістра, а

потім ще беруть додатковий курс з консалтингу в гірничодобувній промисловості.

6. Вони впроваджують величезну різноманітність інженерних розробок і досягнень.
7. Ви могли б стати інженером-механіком: керувати екскаватором, вантажівками, подрібнювачем, розпилювачем, трубами і насосами шахти.
8. Інженер з охорони навколишнього середовища піклується про якість поверхневих вод та якість підземних вод, а також про всі інші потенційні впливи шахти на навколишнє середовище.
9. Геоінженери проводять більшу частину часу на зустрічах, слухаючи консультантів і співробітників, приймаючи важливі рішення щодо роботи чи управління шахтою.
10. Вони зустрічаються зі старшими інженерами, бухгалтерами, і юристами, щоб обговорити правові та фінансові операції шахти, якою вони керують.

GRAMMAR REVISION

1. Remember the main types of conditionals (see Appendix A. Conditionals). Find and correct the mistakes in the following conditional sentences. Two sentences have no mistakes.

1. If we were to increase the salaries that we paid our police force, the level of protection would not necessarily have improved. _____
2. Stricter discipline in schools is only a viable proposition if parents will be prepared to reinforce it in the home. _____
3. Had these measures been taken ten years ago, when they were first suggested, we would be seeing the benefits now. _____
4. If it was not the intervention of social workers, many more domestic disputes would occur. _____
5. Even if children had a stricter upbringing, some of them will still turn to crime. _____

6. Should the government go ahead with its plans to lower the school-leaving age, there would be a massive rise in the number of unemployed teenagers._____

7. If children will be more severely punished for the first offence, then the situation might improve. _____

8. If they are not being prepared to do anything about it, then they must face the consequences of their negligence. _____

9. If the current trend for automation continues, then factory workers throughout the country could lose their jobs. _____

10. Only if action is taken now we will avoid a catastrophe. _____

2. Put the phrases in correct order to make if-sentences.

1. do some reading difficult to understand will find them before lectures you if don't

2. on your fees now, you get a discount if you enrol the second semester and pay for

3. if you go get a chance content with other students to tutorials, you to discuss course

4. to your lecture, he'll if you talk whether you can let you know on other assignment have an extension

5. learning style is if a student's not that important motivation is strong, their

3. Now read the passages and for questions (1-18) decide which answer (a, b, c or d) fits in each gap.

The Most Loving Job in the World

For somebody who has never experienced the dubious 1)_____ of working in a factory, it is nearly impossible to explain the boredom and monotony that such toil 2)_____. For stretches of eight hours at a time, one stands in a particular spot and does 3) _____ the same thing over and over again. Perhaps it is your assigned job to tighten a bolt, or maybe it 4) _____ to you to ensure that the label is on straight on one of the infinite numbers of bottles that pass by your station on the way to the packaging room. Whatever the case maybe, such 5) _____ are little more than plain

drudgery. The noise level is such that it is pointless attempting to engage your fellow 6) _____ in any type of conversation.

1	a) fun	b) pleasure	c) glee	d) happiness
2	a) invokes	b) incurs	c) ensues	d) entails
3	a) exactly	b) precise	c) accurate	d) perfect
4	a) comes	b) seems	c) brings	d) falls
5	a) deeds	b) works	c) tasks	d) errands
6	a) associates	b) partners	c) counterparts	d) workers

Highly Recommended

Scott Smith worked for me at Atmos Technologies for three years as a 7) ____ technical instructor. I am writing this letter to confirm that his recent 8) _____ from Atmos was not in any way 9) _____ to his performance, and to highly recommend him as an employee with your organization. Scott is a 10) _____highly-skilled technical instructor, worthy of at least a senior or management position. He has 11) _____ insight into the learning process, and is an expert in needs analysis, project management and course development. Scott's in-depth product knowledge, unique instructional techniques, and excellent interpersonal 12) ____ have made him consistently popular with both his students and colleagues. Should conditions change, I would not hesitate to hire him back.

7	a) major	b) senior	c) superior	d) higher
8	a) expulsion	b) exclusion	c) departure	d) dislodgement
9	a) tied	b) attached	c) coupled	d) joined
10	a) conscious	b) conscientious	c) consistent	d) consigned
11	a) sharp	b) keen	c) jagged	d) ardent
12	a) abilities	b) skills	c) capabilities	d) talents

3. Fill in the gaps with the words given below.

1. The manager was unable to attend the meeting, so the assistant manager acted as the _____.

A. head B. chair C. director D. chief

2. The _____ of police has refused to comment on the matter of increased violence in schools.

A. master B. captain C. head D. chief

3. For advice concerning their dissertation, students should consult their _____.

A. supervisor B. governor C. dean D. foreman

4. To arrange your holiday leave you need to see the _____ of your department.

A. chief B. head C. leader D. boss

5. The _____ of the Liberal party has resigned due to ill health.

A. chief B. manager C. director D. leader

6. The _____ decided not to film the scene that morning because the sky was too cloudy.

A. foreman B. director C. manager D. chief

7. You will have to be more punctual if you want to continue working in this factory, said the _____.

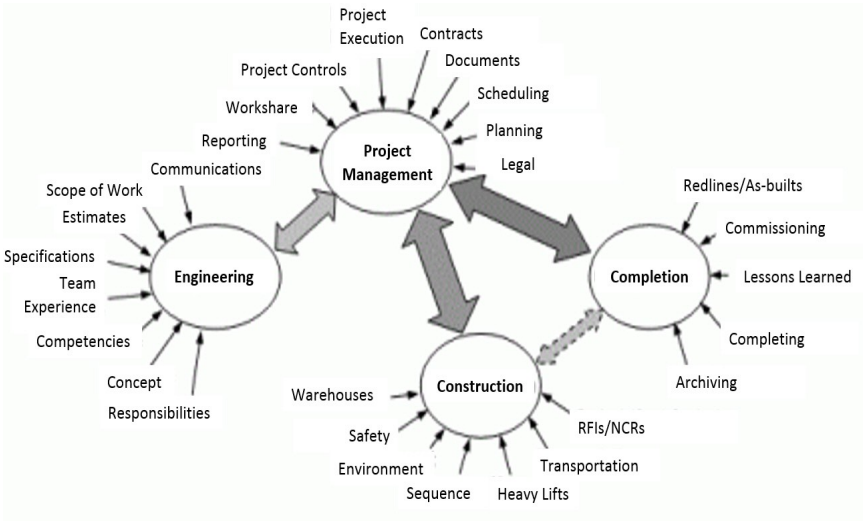
A. foreman B. principal C. curator D. warden

8. Rawlinson was obviously not pleased when the _____ substituted him in the 67th minute of the match.

A. director B. manager C. supervisor D. commander

🗣 **SPEAKING**

Do you know what the mind map is? Who can create a mind map, what information should be included into it? Study the mind map given below. Give the title to it. What does it describe?



LISTENING

HOW SAFE IS THE MINING INDUSTRY?

1. Explain the meaning of the following terms. Basing on this vocabulary try to predict what this video will be about.

Expose to risks, energy cost, maintenance system, preserve air quality, energy consumption, remote mines.

2. Watch the video <u>How SAFE is the MINING industry?</u>

(https://www.youtube.com/watch?v=4pb_dNqM3Fk) and say about the challenges in mining).

3. Answer the questions.

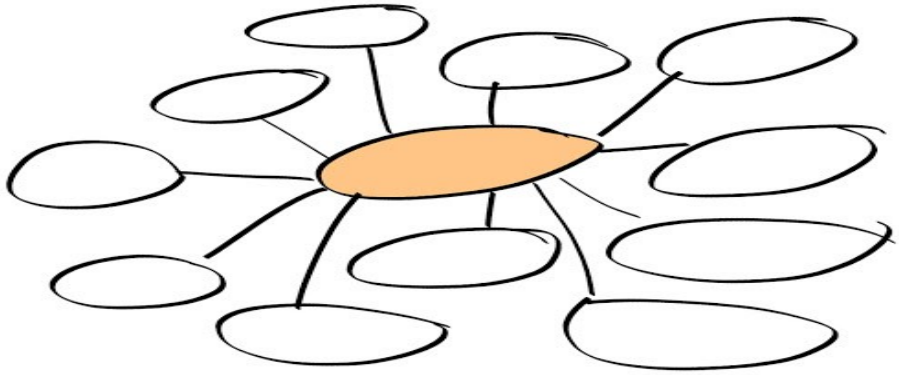
1. How is the rate of mining accidents estimated?
2. What can do this industry much safer?
3. What does the notion ‘safety culture’ imply?

4. How do the terms ‘safety’ and ‘technologically advanced’ correlate in mining?

5. What are the standard safety measures in mining?

WRITING

Imagine that you are a HR manager in a transnational company and you are to submit a profile of a mining engineer that is suitable to take the position in your company. Draw a mind map of mining engineer qualities and describe it. Write an essay (200-220 words). See Appendix B about essay writing.



SUPPLEMENTARY TEXT
MINING’S CONTRIBUTION TO CIVILIZATION

Vocabulary:

endeavour — прагнення, спроба

encompass — включати, охоплювати

occur - траплятися

utilitarian - практичний

milestone — віха, риса

incentive - стимул

abundance - достаток

bold manoeuvre — сміливий, зухвалий маневр

windfall profit — неочікуваний прибуток

Mining may well have been the second of humankind's earliest endeavours—granted that agriculture was the first. The two industries ranked together as the primary or basic industries of early civilization. Little has changed in the importance of these industries since the beginning of civilization. If we consider fishing and lumbering as part of agriculture and oil and gas production as part of mining, then agriculture and mining continue to supply all the basic resources used by modern civilization. From prehistoric times to the present, mining has played an important part in human existence. Here the term mining is used in its broadest context as encompassing the extraction of any naturally occurring mineral substances — solid, liquid, and gas — from the earth or other heavenly bodies for utilitarian purposes.

The history of mining is fascinating. It parallels the history of civilization, with many important cultural eras associated with and identified by various minerals or their derivatives: the Stone Age (prior to 4000 B.C.E.),the Bronze Age (4000 to 5000 B.C.E.), the Iron Age (1500 B.C.E. to 1780 C.E.), the Steel Age (1780 to 1945), and the Nuclear Age (1945 to the present). Many milestones in human history - Marco Polo's journey to China, Vasco da Gama's voyages to Africa and India, Columbus's discovery of the New World, and the modern gold rushes that led to the settlement of California, Alaska, South Africa, Australia, and the Canadian Klondike - were achieved with minerals providing a major incentive.

The abundance of minerals also provides a method of creating wealth. Minerals can be marketed on the open market, enabling the countries that possess them to obtain valuable currency from countries that do not. This generally results in the minerals-rich countries being the great civilizations of the world while the 'have-not' countries generally suffer from a lower standard of living.

The ability to use mineral resources as a means of creating wealth opens the possibility that a given country or countries will attempt to control the entire market in a particular mineral, that is, to create an economic cartel in that mineral. In 1973, the Organization of Petroleum Exporting Countries (OPEC) attempted to control oil prices in a bold manoeuvre to obtain windfall profits from the oil they produced. Although successful in the short run, the cartel eventually lost effectiveness because

of increased oil production elsewhere and difficulty in controlling their own member countries. For a few years, OPEC was successful at regulating petroleum prices in an awesome display of the value of possessing and producing some of the world's most valuable minerals. Other cartels have likewise been attempted. However, the greater freedom in international trade now makes such an attempt less likely to succeed.

Adapted from Introductory Mining Engineering /Howard L., Hartman. - 2nd edition.

1. Think and answer the questions to the text.

1. What is the place of mining in the modern world?
2. Why does the author call mining an incentive in the world's history?
3. What was the purpose of an economic cartel?
4. How is OPEC deciphered?
5. What are the functions and the purpose of OPEC?

2. Find information about OPEC and make a short presentation to the class. You may include information about the *purpose*, *history* of creation, *members*, *functions* and so on. You can retrieve it from the site https://www.opec.org/opec_web/en/publications/340.htm

UNIT 2. AUTOMATION IN MINING

"Automation applied to an inefficient operation will magnify the inefficiency." – Bill Gates.

LEAD IN

1. Have you already thought about your future job? What companies would you like to work?

2. Study the picture. How did an impression of the mining engineer profession change?

3. Think about the questions you might be asked at the job interview and how you should answer them. One is given to you as an example.

What challenges are you looking for in this position?

A typical interview question to determine what you are looking for your in next job, and whether you would be a good fit for the position being hired for, is "What challenges are you looking for in a position?"

The best way to answer questions about the challenges you are seeking is to discuss how you would like to be able to effectively utilize your skills and experience if you were hired for the job.

You can also mention that you are motivated by challenges, have the ability to effectively meet challenges, and have the flexibility and skills necessary to handle a challenging job.

You can continue by describing specific examples of challenges you have met and goals you have achieved in the past.

READING and VOCABULARY

1. Before reading the text discuss the role of automation technologies in modern society. What problems can the intensive application of automation technologies cause?

2. Name the most influential and crucial inventions in the engineering field. How did these inventions change everything around them?

3. *Study the following words in the box. Make sure you know them.*

requirements	unemployment	workforce
strive	machinery	devalue
precision	replacement	handicapped
accuracy	range	weaving loom
destroy	application	curse

4. Read the text and be ready to answer the questions.

AUTOMATION: BLESSING OR CURSE

Automation, robotization or industrial automation or numerical control is the use of control systems such as computers to control industrial machinery and processes, replacing human operators. In the scope of industrialization, it is a step beyond mechanization. Whereas *mechanization* provided human operators with machinery to assist them with the *physical* requirements of work, *automation* greatly reduces the need for human *sensory* and *mental* requirements as well. Automation plays an increasingly important role in the global economy and daily experience.

Engineers strive to combine automated devices with mathematical and organizational tools to create complex systems for a rapidly expanding range of applications and human activities.

There are still many jobs which are in no immediate danger of automation. No device has been invented which can match the human eye for accuracy and precision in many tasks; nor the human ear. Even the admittedly handicapped human is able to identify and distinguish among far more scents than any automated device. Human pattern recognition, language recognition, and language production ability are well beyond anything currently envisioned by automation engineers. Specialized hardened computers, referred to as programmable logic controllers (PLCs), are frequently used to synchronize the flow of inputs from physical sensors and events with the flow of outputs to actuators and events. This leads to precisely controlled actions that permit a tight control of almost any industrial process.

Social issues of automation

Automation raises several important social issues. Among them is automation's impact on employment. Indeed, the Luddites were a social movement of English textile workers in the early 1800s who protested against Jacquard's automated weaving looms — often by destroying such textile machines— that they felt threatened their jobs. Since then, the term *luddite* has come to be applied freely to anyone who is against any advance of technology.

Some argue automation leads to higher employment. When automation was first introduced, it caused widespread fear. It was thought that the displacement of human workers by computerized systems would lead to severe unemployment. In fact, the opposite has often been true, e.g., the freeing up of the labour force allowed more people to enter higher-skilled jobs, which are typically higher-paying. One odd side effect of this shift is that "unskilled labour" now benefits in many "first-world" nations because fewer people are available to fill such jobs. Some argue the reverse, at least in the long term. They argue that automation has only just begun and short-term conditions might partially obscure its long-term impact.

It appears that automation does devalue labour through its replacement with

less-expensive machines; however, the overall effect of this on the workforce as a whole remains unclear. Today automation of the workforce is quite advanced, and continues to advance increasingly more rapidly throughout the world and is encroaching on ever more skilled jobs, yet during the same period, the general well-being of most people in the world (where political factors have not muddied the picture) has increased dramatically. What role automation has played in these changes has not been well studied. One irony is that in recent years, outsourcing has been blamed for the loss of jobs in which automation is the more likely culprit.

Millions of human telephone operators and answerers, throughout the world, have been replaced wholly (or almost wholly) by automated telephone switchboards and answering machines (*not* by Indian or Chinese workers). Thousands of medical researchers have been replaced in many medical tasks from 'primary' screeners in electrocardiography or radiography, to laboratory analyses of human genes, sera, cells, and tissues by automated systems. Even physicians have been partly replaced by remote, automated robots and by highly sophisticated surgical robots that allow them to perform remotely and at levels of accuracy and precision otherwise not normally possible for the average physician.

https://psychology.wikia.org/wiki/Automation

Answer the following questions.

1. Why is automation so important in industry?
2. Can the use of automation technologies pose a danger for society?
3. What ethical dilemma does the use of automation rise?
4. What jobs are mostly subjected to the automation process?
5. What are the advantages and disadvantages the automation implementation?

5. Find English equivalents in the text.

Некваліфікована праця	Складні хірургічні роботи
Щоденний досвід	Вплив на безробіття
Автоматичні комутатори	Передова технологія
Діапазон застосування	Кваліфікований труд
Програмований логічний контролер	Довготривалий вплив

6. Explain the meaning of the following expressions.

Social issues

Human sensory and mental requirements

Computerized systems

Unskilled job

Sensory and mental requirements

Automation is a culprit of outsourcing

INCREASE YOUR VOCABULARY

1. Find synonyms in the text to the following words.

entire	to try	to recognize	to initiate	advanced.
endanger	vague	to benefit	to diminish	sharply

2. Choose the word or word combination to fill in the gaps.

1. Automation greatly _____ the need for human *sensory* and *mental* requirements.

a	reduces	b	produces	c	benefits

2. No device _____ which can match the human eye for accuracy and precision in many tasks;

a	is inventing	b	has been invented	c	has been inventing

3. Programmable logic controllers are frequently used to synchronize the _____ from physical sensors and events with the flow of outputs to actuators and events.

a	flow of inputs	b	flow of charts	c	synchronized data

4. Since then, the term *luddite* has come to be applied freely to anyone who is against any _____.

a	usage of computers	b	economic progress	c	advance of technology

5. Today automation of the workforce continues to advance increasingly more rapidly throughout the world and _____ on ever more skilled jobs.

a	is benefiting	b	is encroaching	c	is assailing

6. One irony is that in recent years, _____ has been blamed for the loss of jobs in which automation is the more likely culprit .

a	outsourcing	b	mechanization	c	luddites

3. You are given an extract from a speech made by a careers advisor to a group of students choosing their future courses of study at university. Complete the extract with the words from the box.

machines	develop	mechanical	electrical	civil

chemical	highway	production	physics	electronic

Every engineering student should have an understanding of maths, (a) _____and chemistry. His task is to work with pharmaceuticals, food, mineral processing and chemical manufacturing, so (b) _____ engineer is trained to understand, design, control, and investigate material flows. If you are happy with problem-solving and find projects such as the Tunnel Building and the Dam building interesting, (c)_____engineering may be for you. You will be able to produce creative designs while paying a due concern to the environment. If you are interested in road building, then you may decide to follow a specialized course in (d)_____ engineering. By studying (e)_____ and (f) _____engineering you learn about the design of complete systems, such as computers, controllers, power and transport systems. (g) _____engineers plan, design and (h)_____ a wide range of things: washing machines, heat pumps, tools, cars and spacecraft. Engineers cooperate with mechanical engineers to create new products at the right price, on time and in the correct quantity. As well as designing and selecting (i) _____and materials, their task is to organize people and finance.

TRANSLATION

1. Translate into English.

1. Існує багато професій, яким не загрожує автоматизація.
2. В гірничій промисловості автоматизоване тестове обладнання контролюється комп'ютером.
3. Автоматизація виробництва призведе до зростання рівня безробіття у всьому світі.
4. Автоматизація замінює людську працю на використання менш дорогих машин, устаткування.
5. Побічним ефектом автоматизації є поява поява можливості для робітників виконувати більш інтелектуальну та кваліфіковану роботу.
6. Остання група підземних об’єктів пов'язана безпосередньо з видобутком

корисних копалин, отримує значне поширення у добу бронзи.

7. Питання розвитку гірничої техніки і технологій становлять важливий компонент професійної освіти гірничого інженера.

8. Цікаві винаходи та технічні ідеї, дотичні до розробки корисних копалин, залишив у своїх рукописах Леонардо да Вінчі (перша конструкція екскаватора-драглайна, копальне колесо, бурильне обладнання, випробування рамних конструкцій тощо).

9. „Annales des Mines" – найстаріший науково-виробничий журнал світу гірничого профілю.

10. У XIX ст. гірничі інститути та академії стають осередками наукового розвитку.

2. Render the excerpt in English.

Роботи на виробництві набули поширення у кінці XX століття в зв'язку зі значним зростанням промислового виробництва. Великі об'єми продукції зумовили потребу у роботі, виконання якої перевищує об'єктивні людські можливості. Замість того, щоб залучити багато тисяч кваліфікованих робітників, на сучасних технологічних заводах працюють численні високоефективні автоматичні лінії.

Лідерами в розвитку подібних технологій виступають Японія, США, Німеччина, Швеція і Швейцарія. Промислові роботи поділяються на дві великі групи, які визначаються принципами управління:

автоматичні маніпулятори; пристрої, дистанційно керовані людиною.

GRAMMAR REVISION

Study the underlined examples in the text. What types of subordinate clauses are they? (See Appendix A. Relative Clauses).

1. Combine the sentences using a relative clause. Choose the correct relative pronoun from the table.

Subject	Object	Possessive

who	who/whom	whose
which	which	whose
that	that	-

1. There are many jobs. These jobs are not subjected to the automation process.
2. We require good engineers. Even they can be partly replaced by the robots.
3. Industrial automation can easily replace low-skilled workers. These workers are engaged in different branches of industry.
4. Use of an industrial automation caused worldwide changes. These changes are not studied well.
5. Automation makes people look for more skilled jobs. These jobs are usually highly paid.

2. Complete the sentences by filling in the gaps with

however	*whatever*	*whenever*	*whichever*	*whoever*	*whether*

1. I'm going to buy this new game release _____ may cost.
2. A mobile phone is useful because you can make calls _____ you are.
3. This diet bread is very special, because _____ you eat, you'll never get weight.
4. _____see my colleague, we can speak for hours.
5. I really don't care _____you leave or not; it's the same to me.
6. You can get to work by bus, by train or by car, _____transport you choose, it will take you about an hour.

🗣 SPEAKING

Imagine that you have to make a short presentation to the examination board on the most influential 20th century invention. Study the issue and present. You can include the following items in your presentation:

- ✓ *picture*
- ✓ *history of the invention*
- ✓ *application*

✓ *benefits.*

🔊 LISTENING

THE FUTURE OF MINE AUTOMATION

1. Explain the meaning of the following terms. Basing on this vocabulary, try to predict what this video will be about.

Expose to risks, energy cost, maintenance system, preserve air quality, energy consumption, remote mines.

2. Watch the video THE FUTURE OF MINE AUTOMATION (https://www.youtube.com/watch?v=WkR0NrjgWDo) and say about challenges in mining.

3. Choose appropriate words from the box and fill in the gaps. Watch the video again and check yourself.

Interfaces, production areas, overview, ore bodies control room, consumption

1. Mines are digging deeper and deeper to find _____.
2. Working safety must be improved, especially in underground _____.
3. Independent equipment and systems on the mining site has its own information and _____.
4. Islands of automation are separate pieces of information at screens, no _____.
5. Modern _____ allows people with different roles work together in the same place.
6. There mines where ventilation accounts for almost 50 % of energy _____.

4. Find the following information in the video.

Why is it difficult to find mine operators?

What are the challenges mining industries facing today?

What is the “islands of automation”?

WRITING

You work for the company producing home automation devices. Advertise the production goods of your company to the wholesaler. Suggest some practical applications of home automation technologies and how they can benefit our lives. Write a short essay (200 - 220 words).

SUPPLEMENTARY TEXT

MINING FOLKLORE

Vocabulary:

be prone to – мати схильність до;

enlightenment – просвітництво;

mishap – невдача, нещастя, аварія;

superstition – забобона;

grizzled – сивий, сірий;

to inhabit – населяти;

cave-in – обвал;

notorious – славнозвісний;

stem from – походити від;

imminent – неуникний;

to oxidize – окислювати;

garb – вбрання, одяг;

inevitably – неминуче.

It is natural when one considers the nature of mining, which is both dark and dangerous, that miners, especially those of previous eras, would be prone to superstitious notions concerning their underground working environment.

Indeed, this was most certainly the case during the Middle Ages, as many European miners, in particular, held a firm belief in the existence of underground creatures and spirits. The belief in such underground supernatural beings was,

especially before the age of science and enlightenment, most probably developed as a way of accounting for strange mishaps and accidents that sometimes occurred underground.

In British superstition and folklore, the most common mythical creature to inhabit underground mining areas was the Knocker. They were the underground equivalent of the Irish leprechauns, measuring about 2 ft in height, with a grizzled, but not misshapen, appearance. As these creatures inhabited underground mining areas, they were often depicted as wearing miniature versions of standard miner's garb. Their name was derived from the supposed knocking sound produced just before a rockfall or the caving-in of a roof.

Some miners believed that the Knockers were actually evil creatures and that the knocking noise was the sound of their hammering at walls and supports to cause the cave-ins. However, others believed that they were essentially well-meaning sprites and that the knocking was their way of warning the miners that a life-threatening collapse was imminent.

The other most notorious mining creature stemming from medieval superstitious beliefs is the Kobold. The Kobold is most prevalent in German folklore and stories of that underground creature were most common during the sixteenth century. Those creatures were usually invisible, but when they did materialise, they had the appearance of goblins. Medieval Germanic miners believed the Kobolds to be expert miners and metalworkers who could always be heard drilling, hammering and shovelling in distant areas of underground mines.

An interesting aspect stemming from the folklore of Kobolds relates to the discovery and naming of the chemical element cobalt. The story goes that, during the sixteenth century, European miners sometimes encountered what looked to be rich veins of copper or silver but was, in fact, ore rich in the element cobalt.

The first attempts at smelting these ores to produce metals such as copper or nickel failed, yielding powder instead. Also, because the primary ores of cobalt always contain arsenic, smelting the ore oxidised the arsenic content into the highly toxic and volatile arsenic oxide, which harmed the metalworkers and also decreased

the reputation of the ore for the miners. Because the miners and metalworkers had little understanding of this new element, they blamed the Kobolds for fooling the miners into taking worthless and harmful ore.

The miners tried to appease the underground goblins with offerings of gold and silver and by insisting that fellow miners treat them respectfully. However, the Kobolds took no notice of such acts of generosity and continued to fool the miners into exploiting that worthless ore. Inevitably, that ore began to be referred to as Cobalt, after the mythical creatures from whom they were thought to come.

It was only in 1735 that a Swedish chemist, George Brandt, isolated a substance from that particular ore and named it cobalt rex. Further research conducted during that century revealed that this was, in fact, a new element, which was, inevitably, named cobalt. Such rich mythical folklore is largely confined to medieval Europe and such superstitious beliefs have inevitably died out during the modern era.

Adapted from https://www.miningweekly.com/article/-1970-01-01-65

1. Answer the questions to the text.

1. What are the stems for mining superstitions?
2. What is the name of a supernatural creature in British mining traditions?
3. What is the name of a supernatural creature in German mining traditions?
4. What is the history of cobalt discovery?

2. Find interesting information about Ukrainian mining traditions and superstitions. Make a short presentation to the class.

Unit 3. MINING: SAFETY AND HAZARDS

"Working safely may get old, but so do those who practice it

LEAD IN

1. Think of the safety regulations while working with industrial equipment. What are they? Explain your partner the importance of following these safety regulations.

2. Do you know what these safety signs mean?

3. What/ Who is the main culprit of industrial accidents? Think about safety regulations applicable in the mining industry. Discuss with your partner. Complete the table.

The Health and Safety at Work	
Personal Protective Equipment at Work Regulations	
Provision and Use of Work Equipment Regulations	

READING and VOCABULARY

1. Read the subtitles of the text. How do you understand them?

Minimizing human error

A long way to zero?

Small things count.

Predict the main idea of the text basing on them.

2. Study the following words in the box and make sure you know their meanings.

denominator	worksite	circumstances
hazardous	injury	safety interlock
loader	accident	protrude
drilling	downtime	mine truck
occur	loss	vehicle

3. Now read the text and check if your predictions are correct.

MINIMIZING HUMAN ERROR

Human error is a common denominator in many accidents and incidents. But errors can be reduced with thoughtful design innovations on rigs, trucks and loaders.

The most hazardous situations occur whenever heavy equipment is in operation, i.e. when a mine truck or loader is in motion or when a drill rig is in the process of drilling. The danger zones differ but the message is the same: if you have to be there, the operator's cabin is the safest place to be. Whenever an accident occurs in the mining and construction industry, human error is almost always a major contributing factor. In fact, the vast majority of accidents in the industry nowadays occur because someone "screwed up". Interestingly, it is also a fact that most incidents do not occur while people are busy operating equipment, but while they are just moving around the worksite or simply getting from one place to another. Many of these incidents could have been so easily avoided. We can see everything from broken ankles caused by jumping from a drill rig in the dark and fingers caught in doors, to serious injuries and even fatalities caused by a disregard for safety procedures.

It's the same story when it comes to personal protection such as the wearing of helmets with chin straps and safety glasses. These are excellent, yet when someone gets hurt, more often than not we find that the victim was not wearing the recommended protective equipment at the time. Every case has its own set of circumstances, but whether they be major or minor incidents, they all have consequences in terms of human suffering, downtime and loss of production for our

customers. Over the years, technological advances have done a great deal to reduce the number of accidents and injuries. The suppliers have consistently contributed with a steady stream of innovations designed to keep operators out of harm's way, as well as providing extensive training programs using equipment simulators, comprehensive operator instructions and safety interlocks.

A long way to zero

Happily, we can see that this work has been very effective. Despite these achievements, however, we still have a long way to go to eliminate the risk of human error. In the mining industry, the obvious way to do this is to try and make all operations as autonomous as possible. In other words, to remove as many people as we can from the mining area and make sure that those who are left are equipped with the very best tools. But even with the best autonomous operation, there will still be a need for people to perform preventive maintenance and service. That implies that we need to intensify our efforts to deal with issues such as incorrect handling, electric shocks, fluid leakage, accidental dropping of heavy items, and so on.

For drillers and drivers, the safest place to be is the cabin of the drill rig, loader or truck. Our equipment has many built-in features that help to increase operator safety. Moreover, today's cabins are all designed with smooth edges and without protruding components that could conceivably injure an operator who omits to wear a helmet. But the fact is, the moment the operator steps outside, he or she is immediately exposed to danger. With a drill rig, it is mainly the area in front of the booms during drilling that poses a threat along with falling rock, but what about the ground below the steps where broken rock or other debris might cause an operator to trip and fall? With loaders or mine trucks, it is when these vehicles are on the move that the danger is greatest.

Small things count

In the quest for total safety, it is often the small things that count. On our Boomer rigs, a light that illuminates the ground below the steps has been installed. On both Boomer and underground trucks, warning signals on the ignition switch alert people who may be nearby when an operator is about to start the engine. All rigs

being used in the automatic mode have light curtains on both sides that will detect anyone walking into the danger zone and will automatically shut the machine down. Key service points on the rigs as well as the underground loaders and trucks are placed on the engines' cool side and these are also accessible from the ground, removing the need for the operator to climb or stand on a ladder.

On our underground trucks, the low, flat hood design increases visibility. We have spring-applied hydraulic release brakes and automatic brake testing, a safety barrier if there is a need to access components on top of the vehicle, and much more.

These are just a few examples and by no means a comprehensive review of all the safety features we offer. Nonetheless, they represent important steps along the road to minimizing and ultimately eliminating equipment downtime.

https://miningandconstruction.com/technicallyspeaking/minimizinghumanerror-983/

Answer the questions to the text.

1. Who creates the most hazardous situations at the working place?
2. How can we avoid industrial accidents?
3. What personal safety equipment should be worn?
4. Where is the safest place for a worker in the industry?
5. What are safety measures for working on the Boomer rig?

4. How do you understand the meaning of the following expressions?

Danger zone	Equipment downtime	Safety procedures	Training program	Screwed up

INCREASE YOUR VOCABULARY

1. Find synonyms in the text to the following words.

trauma	mistake	to do away with	happen	care
to reduce	all-inclusive	to motivate	clarity	extending out

2. Find the English equivalents in the text.

Спільний знаменник	Бурова установка
Конструкторські нововведення	Запустити двигун
Захисне обладнання	Підземні навантажувачі
Простій обладнання	Підпадати під небезпеку
Профілактичне обслуговування	Захисний бар'єр

3. Choose the word or word combination to fill in the gaps.

1. Human error is a common _____ in many accidents and incidents.

a	denominator	b	factor	c	incentive

2. All the accidents and incidents have consequences _____ human suffering, downtime and loss of production for our customers.

a	considering	b	in terms of	c	dealing with

3. But even with the best autonomous operation there will still be a need for people to _____ preventive maintenance and service.

a	perform	b	maintain	c	organize

4. Today’s cabins are all designed with smooth edges and without _____ that could conceivably injure an operator who omits to wear a helmet.

a	spare components	b	luxurious components	c	protruding components

5. On both Boomer and underground trucks, _____ on the ignition switch

alert people who may be nearby when an operator is about to start the engine.

a	warning signals	b	intruder alarm	c	fire alarm

4. Complete the following sentences with the correct form of the words in brackets

1. Don't pour used chemicals into the drains as they will cause _____(contaminate).
2. While they repair the roof, we will close this department as a _____ measure (precaution).
3. These chemicals must be kept in a locked cupboard because they are _____(harm)
4. When working in this area, please wear _____clothing (protect).
_____health is one part of Health and Safety (occupation).
5. Petrol and oil are _____chemicals (flame).
6. Working in a noisy factory without ear protectors is a _____activity (danger).
7. Make sure the container s are _____closed (tight).
8. Make sure you are wearing breathing equipment before starting _____ (fume).
9. Heating this liquid may cause an _____ (explode).

TRANSLATION

1. Translate into English.

1. Головним чинником аварій у гірництві чи на будівництві є людська помилка.
2. Захисні шоломи та захисні окуляри є засобами індивідуального захисту на виробництві.
3. Вирішити проблеми ризику для людей у гірничій промисловості можливо, зробивши усі види робіт автономними.
4. Сучасне обладнання має вбудовані характеристики, які допомагають збільшити безпеку оператора.
5. Підземні вагонетки оснащені пружинними гідравлічними гальмами та автоматичною системою тестування гальм.

6. Проведення з працівниками вступного інструктажу з питань охорони праці – є обов'язком начальника виробництва.

7. Служба охорони праці бере участь у розробці питань безпеки.

8. Гірниче обладнання створюється на основі широкого використання сучасних комп'ютерних технологій в системах автоматизованого проектування.

9. Ефективне планування гірничих робіт – найважливіший і багато в чому визначальний фактор успішної роботи будь-якого гірничого інженера.

10. Традиційно планування гірничих робіт поділяється на довгострокове, середньострокове і короткострокове.

2. Render the meaning of the excerpt into Ukrainian.

A HISTORY OF THE LONDON UNDERGROUND

The Thames Tunnel was the world's very first tunnel that was built underneath a river and it was described as the eighth Wonder of the World. You could say that the Tube was born with the construction of the world's first under-river tunnel - the Thames Tunnel. It was built by an engineer called Sir Marc Brunel and his son Isambard to allow cargo to be transported underneath the busy river Thames. It was opened on 9 January 1843. They ran out of money though, so to begin with it just opened as an attraction for pedestrians.

On the first day, 50,000 people walked through the tunnel. By the end of the first three months, a million people - that was half of the population of London at the time - passed through, making it the most successful visitor attraction in the world. On 10 January 1863, the Metropolitan Railway opened the world's first underground railway. The railway was built between Paddington (which was called Bishop's Road back then) and Farringdon Street. Many more lines would be added to the Underground railway network over the years, but most of it was developed over the next 50 years.

Taken from https://www.bbc.co.uk/newsround/46482813

GRAMMAR REVISION

1. Study the underlined examples in the text. What is the difference between a conjunction and a conjunctive adverb? (See Appendix A. Conjuctive Adverbs).
Fill in the blanks with the appropriate conjunction or adverb. More than one variant is possible.

But, in fact, happily, although, interestingly, moreover, as well as.

1. …..... human error can cause many accidents, …..... these errors can be reduced with thoughtful design innovations.
2. ....., it's a human error that usually contributes an accident in industry.
3. ....., it is a fact that many industrial incidents could have been easily avoided.
4. It can be done a lot to protect workers at their jobs by the equipment suppliers …..... by the workers.
5. ..... extensive training programs can reduce a lot the number of industrial accidents.
6. ..... today's equipment has many built-in features increasing operator's safety.

2. Fill in the blanks with the appropriate conjunction or adverb.

1. You need to put more effort into your work; _____ you won't get a passing grade.

a) moreover	b) otherwise	c) unless	d) instead

2.We wanted to spend the day at the beach; _____, it rained so we stayed home.

a) moreover	b) unless	c) however	d) additionally

3.She is a very smart girl; _____, it's not at all surprising that she gets such good grades.

a) again	b) besides	c) contrarily	d) therefore

4.Jared is a millionaire; _____, his brother Jeremy is always flat broke.

a) in contrast	b) accordingly	c) again	d) likewise

5.He felt he couldn't tell the truth about what happened; _____, he lied.

a) in contrast	b) likewise	c) undoubtedly	d) instead

6. I love to eat toffees; _____, people often give them to me at holidays.

a) nevertheless	b) accordingly	c) however	d) also

7. The tree has developed a large crack over the years; _____, it will have to be cut down for safety's sake.

a) for example	b) eventually	c) likewise	d) however

8. It would be nice to spend our vacation on the beach in Jamaica: _____, it would be fun to hike the Swiss Alps.

a) on the other hand	b) as a result	c) indeed	d) therefore

🗣 SPEAKING

Work in pairs or groups. Discuss the advantages and disadvantages of machines and automation. What threat do they present to mankind? Do you believe machines will ever outsmart people and take over the planet?

Share your ideas with the class.

🔊 LISTENING

THE FUTURE OF MINE AUTOMATION

1. Find the meaning of the following words and expressions.

Oxygen, methane, to capture, rocket propellant, NASA rover, to flip over, to reduce gravity, attraction, to tranche, modification, to reach out into.

2. Watch the video NASA Developing Mining Robot for Moon, Mars *(https://www.youtube.com/watch?v=4ImQih8vlkc)* ***and be ready to answer the following questions.***

1. Why do astronauts need to mine materials along the way?
2. What is the part of rocket propellant in the rocket?
3. What is the Razor?
4. What are the main characteristics of the Razor?
5. What are the new designs and modifications of the Razor?

3. Fill in the gaps with the words and expressions from the video.

Methane, chemicals, propellant, to come up, digging wheels.

1). The Moon is full of oxygen and _____ in the soil.

2). Processing the Moon dirt into the substance such as rocket fuel and breathing air could give _____ astronauts need to travel to asteroids or Mars.

3). The rocket _____ makes up 90% of a rocket mass.

4). Razor is a robotic miner which is meant to move fast, avoid troubles and solve any problems that _____ along the way by itself.

5). Razor has two barrel-shaped _____ that can rotate in opposite directions.

WRITING

Write an essay on the topic (200 – 220 words): What would happen to the world's economy if robots began replacing people in workforce?

SUPPLEMENTARY TEXT

SPACE MINING: ARE WE ON THE CUSP OF AN ASTEROID RUSH?

Vocabulary:

to be underway – на стадії здійснення, реалізації;

artificial intelligence – штучний інтелект;

prospector – старатель, золотошукач;

to split – розділяти, розщеплювати;

sustainably – раціонально, стабільно;

upfront capital costs – стартові капітальні витрати;

odometry – використання бездротової геолокації;

challenge – виклик.

By the end of the 2020s, an outer space gold rush could be well underway. Fleets of space vehicles, some with humans on board and others operated remotely or by artificial intelligence, could be leaving Earth in search of metals, minerals and

more. But, if we compare space exploration today to the Yukon gold rush in the late 1880s, the busiest workers right now are not the space miners, but the engineers, providing fuel, maps and tools to the first robot prospectors.

"The first step won't be looking for titanium, or nickel or other metals in an asteroid; the first step is going to be mining water and ice, splitting the oxygen and hydrogen to make fuel and creating fuel depots on terrestrial satellites for the spacecraft that we will be using to explore," say scientists.

Scientists are developing the software to operate and automate the next generation of commercial and government rovers, landers and satellites. The most important job right now is building up the infrastructure needed to explore and mine on the Moon, Mars or asteroids.

Very important is in situ resource utilization that means mining or prospecting for resources such as oxygen and hydrogen to use as propellant in spacecraft, so you don't need to bring all of the fuel you need from Earth. That will help researchers explore further and longer in space more sustainably.

Mining on the Moon, Mars or an asteroid is similar in many ways to developing a mine in a harsh, remote environment here on Earth. Accessing, exploring, mapping and defining the size and value of the resource are challenging, and if an economic deposit is found, the planning and lead time can take years and millions of dollars in upfront capital costs. These challenges, however, are inspiring innovation and driving research and development (R&D) here on Earth.

The AI algorithms used to help a rover vehicle navigate on the surface of Mars are like those used by a mine mapping robot several kilometres below the surface of the Earth: both need to be able to locate themselves and navigate without access to a global positioning system (GPS). One solution is to use visual odometry, where the robot takes a sequence of pictures or laser scans and analyses them to determine and remember its position. Another major issue is detecting hazards and avoiding becoming stuck.

Many technologies, like the ASAS, developed for space programs have applications here on Earth and vice versa. For example, NASA calls liquid hydrogen

"the fuel of choice for space exploration" and on Earth, BMW has announced it will produce a low-volume hydrogen fuel-cell car by 2021. Lightweight materials for vehicle bodies, batteries for energy storage and robots for exploration are other examples of space innovations ripe for Earth applications. Technologies developed by mining companies and geoscience researchers here on Earth, such as drilling and sampling techniques, can be used to benefit the space industry too.

The possibility of space exploration and mining is inspiring millions of students and researchers, and raising billions of dollars in investment, around the world. The question on everyone's lips: when will we build the first hydrogen fuel station on the Moon, dig the first asteroid mine or bring the material back to Earth? Scientists predict it could be soon.

"Towards the end of the 2030s, which is roughly around the time that many are predicting that there should be people on Mars," said Faragalli, “I think that is when we might realistically see an industry bringing metals back to Earth.”

Adapted from https://www.minescanada.ca/en/content/space-mining-are-we-cusp-asteroid-rush

1. Answer the questions to the text.

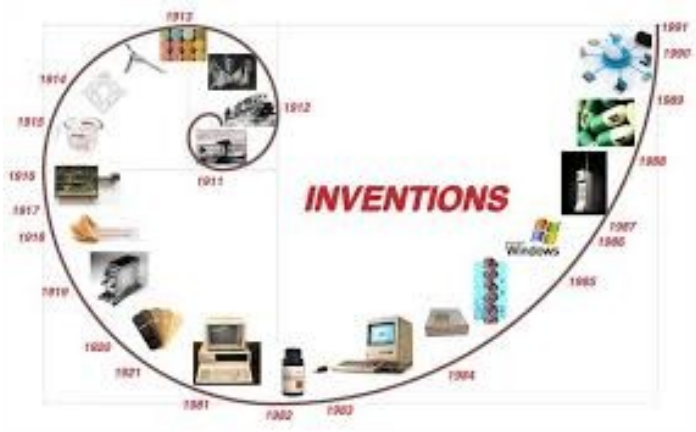
1. What are the author’s predictions for the nearest future?
2. What are the first minerals to be searched on the Moon?
3. What benefits can in situ utilization give to researchers?
4. What is an odometry method?
5. What are the examples of space innovations that could be used on Earth?

2. You are a young researcher and you need to win the grant for the new project. Think about and try to convince the members of the research committee. Cover your ideas in the essay (200 – 220 words)“The most important invention that influenced human society”.

You may choose the domain for your research from the list:

- Radio

- Antibiotics
- Television
- Airplane
- Automobile
- Personal Computer
- Rocketry
- Submarine



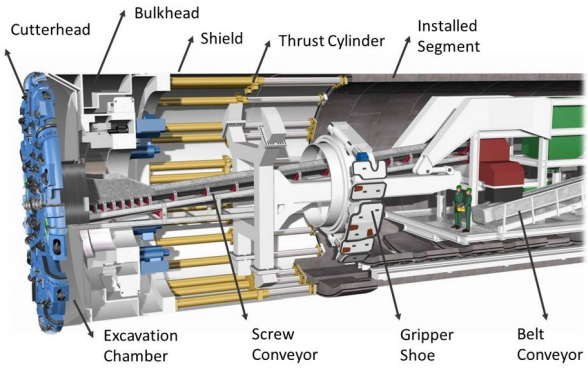
UNIT 4. UNDERGROUND CONSTRUCTION

"Mining is like a search-and-destroy mission.
Stewart Udal

LEAD IN

1. What is a tunnel boring machine? What are the advantages of using modern equipment for urban construction?

2. Below you can see a cross-section of typical tunnel boring machine. Study the parts it consists of and match the names of the parts with their translations.



1)	cutterhead	a)	відсік для екстракції породи
2)	bulkhead	b)	головка бура
3)	shield	c)	захват
4)	thrust cylinder	d)	гвинтовий конвеєр
5)	installed segment	e)	перегородка
6)	excavation chamber	f)	стрічковий конвеєр
7)	screw conveyor	g)	несучий циліндр
8)	gripper shoe	h)	щит
9)	belt conveyor	i)	встановлений сегмент

3. Think about safety rules while working with the tunnel boring machine. Make a risk assessment.

What is Risk Assessment?

It is the process of:

• identifying and analysing safety and health hazards associated with work;

• assessing the risks involved;

• prioritising measures to control the hazards and reduce the risks.

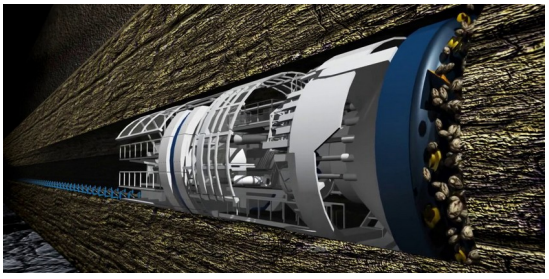
Hazard Identification	Risk Evaluation	Risk Control
• identify hazards • identify potential accidents or incidents	• estimate the risk levels of the workplace hazards identified • prioritise the hazards to be controlled	• formulate the control measures according to the Hierarchy of Controls • analyse and evaluate residual risks

READING and VOCABULARY

1. Read the text and match each paragraph (1- 5) to the titles given below (A - E). You may suggest your titles as well.

A	Open-type TBMs
B	Advantages of TBMs for urban tunnelling
C	TBM — a modern challenge in the mining
D	Safety regulations for workers at TBM
E	Shielded TBMs

TUNNEL BORING MACHINE



(1) A tunnel boring machine (TBM) also known as a "mole", is a machine used to excavate tunnels with a circular cross-section through a variety of soil and rock strata. They can bore through hard rock, sand, and almost anything in between.

Tunnel diameters can range from a metre to almost 16 metres. Tunnels of less than a metre or so in diameter are typically done using trenchless construction methods or horizontal directional drilling rather than TBMs.

Tunnel boring machines are used as an alternative to drilling and blasting methods in rock and conventional 'hand mining' in soil. TBMs have the advantages of limiting the disturbance to the surrounding ground and producing a smooth tunnel wall. This significantly reduces the cost of lining the tunnel and makes them suitable to use in heavily urbanized areas. The major disadvantage is the upfront cost. TBMs are expensive to construct and can be difficult to transport. However, as modern tunnels become longer, the cost of tunnel boring machines versus drill and blast is actually less—this is because tunnelling with TBMs is much more efficient and results in a shorter project.

(2) In hard rock, either shielded or open-type TBMs can be used. All types of hard rock TBMs excavate rock using disc cutters mounted in the cutter head. The disc cutters create compressive stress fractures in the rock, causing it to chip away from the rock in front of the machine, called the tunnel face. The excavated rock, known as muck, is transferred through openings in the cutter head to a belt conveyor, where it runs through the machine to a system of conveyors or muck cars for removal from the tunnel.

Open-type TBMs have no shield, leaving the area behind the cutter head open for rock support. To advance, the machine uses a gripper system that pushes against the side-walls of the tunnel. The machine can be continuously steered while gripper shoes push on the side-walls to react to the machine's forward thrust. At the end of a stroke, the rear legs of the machine are lowered, the grippers and propel cylinders are retracted. The retraction of the propel cylinders repositions the gripper assembly for the next boring cycle. The grippers are extended, the rear legs lifted, and boring begins again. The open-type TBM does not install concrete segments behind it as other machines do. Instead, the rock is held up using ground support methods such as ring beams, rock bolts, shotcrete, steel straps, and wire mesh.

(3) In fractured rock, shielded hard rock TBMs can be used, which erect

concrete segments to support unstable tunnel walls behind the machine. Double Shield TBMs are called so because they have two modes; in the stable ground they can grip against the tunnel walls to advance forward. In the unstable, fractured ground, the thrust is shifted to thrust cylinders that push off against the tunnel segments behind the machine. This keeps the significant thrust forces from impacting fragile tunnel walls. Single Shield TBMs operate in the same way but are used only in the fractured ground, as they can only push off against the concrete segments.

(4) While the use of TBMs relieves the need for large numbers of workers at high pressures, a caisson system is sometimes formed at the cutting head for slurry shield TBMs. Workers entering this space for inspection, maintenance and repair need to be medically cleared as "fit to dive" and trained in the operation of the locks.

(5) Urban tunnelling has the special challenge of requiring that the ground surface be undisturbed. This means that ground subsidence must be avoided. The normal method of doing this in soft ground is to maintain the soil pressures during and after the tunnel construction. There is some difficulty in doing this, particularly in varied strata (e.g., boring through a region where the upper portion of the tunnel face is wet sand and the lower portion is hard rock). When tunnelling in urban environments, other tunnels, existing utility lines and deep foundations need to be addressed in the early planning stages. The project must accommodate measures to mitigate any detrimental effects on other infrastructure.

Adapted from http://www.railsystem.net/tunnel-boring-machine-tbm/

2. Decide if the statements are true or false.

1. Open-type TBMs have the open cutterhead.
2. When making tunnels in urban environments, the soil pressures during and construction should be maintained.
3. All shielded TBMs can be used both in hard rock and fractured ground.
4. Workers entering underground space for inspection, maintenance and repair should take special training.
5. TBM is purposed for boring into the soft ground only.

3. Compare different types of tunnel boring machines.

Open -type TBM	One Shield TBM	Double Shield TBM

INCREASE YOUR VOCABULARY

1. Find synonyms in the text to the following words.

boon	layer	withdrawal	to diminish	catastrophic
to drive	split	division	to perforate	to switch

2. Fill in the gaps with an appropriate derivative.

excavate excavator excavation

1. _____ is best known and most commonly used within the science of archaeology
2. The largest_____ available is the Bucyrus RH400, it weighs above 979,990 kg, has 4500 hp and has a bucket size of about 52.0 m³.
3. For minor ditches or trenches, simply using a shovel and setting about digging is sufficient, but to _____ a deep trench special consideration should be made.

   construct construction constructed
4. _____ wetlands simulate natural wastewater treatment systems, using flow beds to support water-loving plants.
5. They are planning to _____ a new supermarket near our house.
6. In the fields of architecture and civil engineering, _____ is a process that consists of the building or assembling of infrastructure.

   compress compressor compressive
7. _____ strength is the capacity of a material or structure to withstand axially directed pushing forces.
8. _____ your files and folders in a large variety of formats with the simplicity of drag and drop.

9. Centrifugal _____ uses a rotating disk or impeller in a shaped housing to force the gas to the rim of the impeller, increasing the velocity of the gas.

3. Match the words with their definitions.

1.	Hard rock	a	a device used for improving strength in the hands and forearms to take something
2.	Retraction	b	rock with deep fissures or crevices
3.	Tunnel	c	naturally occurring solid aggregate of minerals
4.	Fractured rock	d	a gradual sinking to a lower level
5.	Gripper	e	passageway through or under something, usually underground (especially one for trains or cars)
6.	Subsidence	f	a long anchor bolt
7.	Rock bolt	g	the act of pulling or holding or drawing a part back

TRANSLATION

1. Translate into English.

1. Бурові машини є сучасною заміною бурінню та підриву, а також можуть замінити ручний метод видобування.

2. Дискові бури створюють стискаюче навантаження на гірські породи, змушуючи їх відколюватися від скелі безпосередньо перед буром.

3. При будівництві тунелів у міській зоні необхідно уникати просідання ґрунту.

4. Бурмашини використовуються для буріння твердих та піщаних порід.

5. При бурінні буровими машинами відкритого типу породи утримуються завдяки використанню кільцевих балок, анкерів для скелястих порід, металевої сітки.

6. За 57 років в Києві побудовані три лінії метро довжиною 69,648км, розташовані 52 станцій.

7. Новий бескидський тунель є безпечнішим, адже попередній в аварійному стані, оскільки його збудували близько 130 років тому.

8. Компанія оснащена сучасними і прогресивними, машинами і механізмами,

необхідними для виконання всього комплексу робіт зі спорудження тунелів.

9. Фахівці компанії постійно працюють над вирішенням і подальшим удосконаленням технічних і технологічних розробок, спрямованих на зменшення вартості споруджуваних об'єктів.

10. Компанія виконує проходку тунелів різного призначення в регіонах підвищеної сейсмічності і складних гірничо-геологічних умовах, а також постійне облаштування тунелів.

2. Render the meaning of the excerpt in Ukrainian.

CONSTRUCTION OF A METRO SYSTEM

The construction of underground metro systems often raises concerns about undermining building foundations and the risk of subsidence caused by digging and vibrations. These concerns were not unfounded because many early lines were built using the "cut-and-cover" technique.

These were relatively shallow tunnels for which a trench is excavated and roofed over with an overhead support system. The advantage was that the smoke from the steam engines could easily escape to the nearby surface. The downside to this way of building was the enormous excavation pits at the surface level, for which everything on top had to be demolished, although they usually followed the street plan. Deeper tunnelling, sometimes into the bedrock, became possible with the introduction of pneumatic drills and tunnel boring machines from the 19th century onwards. In this way, some metro tunnels and stations were constructed at a staggering depth. It goes without saying that constructing metro systems was – and is – a strenuous job for workers.

Adapted from https://blog.europeana.eu/2019/09/going-underground-the-rise-of-europes-metro-railways/

GRAMMAR REVISION

1. Fill in the gap with an appropriate modal verb given below (for Grammar references see Appendix A. Modals).

Can, might, must, have to.

1. A TBM ….....have been used in the construction site if the sponsors had invested more money.
2. Modern drilling equipment ….....easily be used for boring through hard rock and sand.
3. A TBM ….....be used as an alternative method to drilling and blasting.
4. Companies using modern construction technologies ….... solve the problems with noise and sustainability.
5. You ….....not neglect personal protective equipment while working at the industrial area.
6. Operators ….....use shielded hard rock TBMs in the fractured rocks.
7. All the employers ….....follow the safety instructions to avoid industrial accidents.

2. Fill in the gaps with suitable modal verbs.

1. Mary has trained as possible pilot and so she *can* fly small planes. (ability)
2. It looks like it ……../……../…… rain. We'd better take our umbrellas. (possibility)
3. When I was little, I ……. Stand on my head. (ability in the past)
4. ……../……../…… I borrow some sugar? (asking permission)
5. You ……. Pay the rent on the first working day of each month. (obligation)
6. You ……../…….. see a doctor about those headaches. (advice)
7. You ……../……../…… eat or drink in this room. (prohibition)
8. She …… be only 15 — she's a university student. (impossibility)
9. We …… have started earlier — we`re running very late. (criticism for past actions)
10. I ……. Give you a lift, if you want. (offer)

🔊 LISTENING

THE DEVASTATING EFFECTS OF GOLD MINING

1. What do you know about gold mining? Take a quiz. You can find the necessary information on the Internet

1. What is a common side effect when rock is unearthed in gold mines?

a. Water that is acidic enough to burn through metal tools;

b. Toxic gases that some miners sniff to get high;

c. Toxic dust that can drift thousands of miles from the mine site.

2. Sometimes dams that hold tailings, the slurry of moist ground ore from which gold has been extracted, fail. Six years ago a tailings dam in Romania ruptured, spilling about 100,000 cubic meters of liquid, which was laced with cyanide and heavy metals, into a local watershed. What was the result?

a. Many fish and other creatures were killed in nearby lakes and ponds;

b. Most fish and other creatures were killed for hundreds of miles of the Danube River system;

c. Any animal that contacted the water, as far away as a thousand miles, died.

3.How much rock must be unearthed to produce an ounce of gold?

a. Hundreds of pounds;

b. Tons and tons;

c. None, it is picked out of river beds.

4. What is most mined gold used for?

a. Bling-bling;

b. Dental fillings;

c. Industrial applications, such as gold-plating electrical contacts.

5. What other pollutants are often associated with gold mining?

a. Frankincense and myrrh;

b. Greenhouse gases such as carbon dioxide, methane, nitrous oxide, and ozone;

c. Heavy metals.

2. Find the meaning of the following words and expressions.

Exploitation, rise to prominence, obsession, recession, chisel, hammer, open-pit mines, pollutants, resource extraction.

3. Watch the video THE DEVASTATING EFFECTS OF GOLD MINING (https://www.youtube.com/watch?v=wq0p5tnFnWs) and be ready to answer the following questions.

1. Why is gold considered to be a shorthand for value and greed?
2. How does a modern gold mining look today?
3. What is the process of laundering gold?
4. What problems are caused by poisonous water after the gold mining process?
5. What chemicals are used to launder gold?
6. What made people of Cajamarca start protests?

4. Fill in the gaps while listening the audio.

Shorthand, marauded, demand, quadruple, gold producing areas, golden nuggets, modern gold mine, specks, flakes, open pit

Gold is maybe the most universal 1 _____there is for value, and for greed. The ancient Egyptians were obsessed with it. European explorers 2 _____through South America in search of it. And American cities like San Francisco and Seattle rose to prominence because of it. It's a big part of our history as humans.

There's still huge 3 _____ for it today - the recession of 2008 helped gold 4 _____ in value. And a full half of all the gold mined in the world has been mined in the past 50 years. But what is different about gold today is how we get it. What happens in 5_____ is not what we imagine where somebodies in a cave, using a

chisel and a hammer to get these big 6_____. That's Diego, a photojournalist who spent some time in Cajamarca, Peru near a 7 _____. Actually, not just any gold mine...the largest in all of Latin America. And modern mining looks very different than it used to most of the gold that we are mining now comes in the forms of little 8 _____of sand, little 9_____ mixed in with dirt. A lot of these companies are using 10 _____ mines to grab as much dirt as possible and then they process it with different chemicals.

WRITING

You are a young mining engineer with a great concern in ecology. Suggest the main points of the governmental programme for mining regions protection. Write a short essay (200 – 220 words).

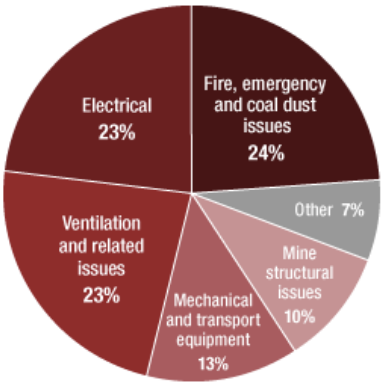
SPEAKING

Work in pairs or small groups and discuss problems and hazards in the mining industry. Use information on the problems and violations from the pie chart below.

How to describe a pie chart

The pie chart is used to illustrate how different parts make up a whole. The best way to present your data in a pie chart is to compare the categories with each other. The following comparison words can be used interchangeably:

- to compare
- compared to
- as opposed to
- versus
- more than
- the majority of
- only a small monitory
- greater than
- less than



SUPPLEMENTARY TEXT

THE CALIFORNIA GOLD RUSH

Vocabulary:

to set up a business – створити бізнес;

boom– прискорювати;

boomtown – місто, що розвивається;

indigenous peoples – корінні народи;

state-sanctioned – санкційоване державою;

gambling – ігри, ігорний бізнес;

enticement – спокуса

rivet – заклепка;

wholesale — оптова торгівля.

To accommodate the flood of ‘49ers (as these new, would-be gold miners were called), gold mining towns sprung up all over. Shops, saloons, brothels and other businesses set up in these towns to serve the '49ers and make money of their own. Chaos and disorder were common, as were gambling, prostitution and violence. San Francisco became the centre of the booming new economy.

But seen from other angles, the gold rush was not a happy event. In particular, for the indigenous peoples who lived there, it was an unmitigated disaster. Thousands of new immigrants pushed the native populations off their land, depriving them of their hunting grounds. Violent confrontations broke out and the newcomers slaughtered as many as 16,000 of California’s first peoples in what amounted to state-sanctioned genocide.

The vast majority of the early gold rush immigrants were men, or at least they appeared to be. In fact, there were numerous instances in which women dressed as men. This phenomenon was so common in gold rush California that when a newspaper photographer advertised for a 'lad' to help him, he was compelled to specify that 'no young women in disguise need apply,'"

Many prospectors did well at first. There was a lot of gold to be found. There are estimates that throughout the gold rush 1,750 pounds (793.7 kilograms) of the

buttery metal were unearthed. But few people were able to hold on to their newfound wealth. Life in a boomtown was notoriously expensive and there were so many ways to lose what you'd found — alcohol, brothels and gambling being the chief enticements.

The Merchant Millionaires

The people who really made money on the California Gold Rush were merchants. Take Levi Strauss. When he heard the news of the California Gold Rush, he headed to San Francisco where he established his wholesale dry goods business in 1853. Then in 1872, Strauss partnered with one of his customers, tailor named Jacob Davis, who was designing heavy cotton work pants hammered with rivets in the pocket corners to make them more durable. The company, "Levi Strauss & Co." couldn't sell enough of their "waist-high overalls" to the miners, lumberjacks and farmers. And, well, you know the rest of the story.

And remember Sam Brannan. Rather than staking a claim on the gold, Brannan bought up all the equipment that prospectors would need; then, when the rush began, re-sold the merchandise at a steep markup. His store made enormous profits, selling as much as $5,000 (about $155,000 in 2020 dollars) in goods *per day* to miners. He became California's first millionaire, perfectly illustrating the old maxim, "during a gold rush, sell shovels."

Adapted from https://history.howstuffworks.com/american-history/gold-rush.htm

1. Answer the questions to the text.

1. What are the main characteristics of the ' 49ers society?
2. What was the effect of the gold rush on the indigenous peoples of America?
3. What were the enticements of such boomtowns?
4. How did Levi Strauss manage to set up his business? What is he famous for?
5. Who became California's first millionaire? What was his business?

2. Read the beginning of the story, a short description of how the first gold miners worked. Find information about one of the mining methods that appeared later and finish the story.

The first tools used to mine gold were extremely simple, knives, small wooden hand tools, such as picks and shovels. Extraction of gold from ore bearing gravel without water was termed “dry washing.” It was a crude and inefficient, but also inexpensive. This was originally an old agricultural procedure of “winnowing” and was first used by miners near the Pueblo of Los Angeles in the San Feliciano Canyon in 1842.

When water was available it was used to work away the lighter dirt and fine gravel concentrating the heavier gold in the bottom of the metal pan or a wooden basket call a “batea.”

3. Compare these mining methods. Fill in the table below.

<u>Hydraulic Mining</u>

<u>Drift Mining/Tunnel Mining/Pocket Mining</u>

Dredging

Mining method	Description	In situ conditions	Hazards
Hydraulic Mining			
Drift Mining/Tunnel Mining/Pocket Mining			
Dredging			

UNIT 5. SUSTAINABLE URBAN CONSTRUCTION

"the costs of action are dwarfed by the cost of inaction".

LEAD IN

How do you understand such expressions? Discuss in groups and present your vision.

1. Development transforms the environment.

2. The costs of action is dwarfed by the cost of inaction.

Study the scheme and explain the relationship between its components

Raw materials	Economy	Products and services
Energy		Wastes (Pollution)

READING and VOCABULARY

1. Before reading the text discuss with your friend the role of green technologies, their application and effects.

2. Study the picture and name green technologies mentioned in it. Think about technologies that can be applied in mining and construction.

3. Study the following words in the box. Make sure you know them.

life-cycle	to put into	control measures
to the extent	maintenance	to be of significant
to define	to coexist	absorption
efficient	prefabricated	viaduct

guideline	semi-enclosed	soundproof shed

4. Read the text and answer the questions after the text.

CONCEPT OF GREEN BUILDING DEVELOPMENT

In the 1960s, Paul Soller, an American Italian architect, merged the words Ecology and Architecture into "Arcology" and proposed the concept of "ecological architecture", known as "green building". The national standard "GB/T50378" defines the "green building" as: during the entire life-cycle of buildings, resources (energy, land, water and materials) should be saved, the environment needs to be protected while pollution ought to be reduced to the maximum extent. It can be conceptually defined as "four savings and one environmental protection". It provides people with healthy, applicable and efficient use of space and buildings which are in harmony with nature. The European green building market is at the highest standard in the world, but the fastest growth of green building is in Asia. In February 2016, the China central government proposed a new eight-character guideline for building evaluation: application, economy, green, and beauty. It directly put "green" into policy. The development of green buildings includes prefabricated construction and standardization, intelligentization and technicalization of operation and maintenance.

Concept of Green Tunnel Development

The tunnel construction requires to minimize the traffic evacuation, groundwater loss, ground deformation, and impact of surrounding buildings. It is essential to exercise green tunnel construction to maintain the safety and comfort of the vehicles and people in tunnels, to minimize the impact on the surrounding environment, and to save energy and protect the environment. "Green tunnel" refers to an underground structure that harmoniously coexists with nature and the city. It provides people with an unobstructed, efficient, convenient, and comfortable travel environment. During the entire life-cycle of green tunnels, it effectively saves resources, protects the environment, and reduces pollution. Its development includes five major aspects: 1) prefabricated construction technology of green tunnel; 2) noise control technology of green tunnel; 3) lighting energy-saving technology of green

tunnel; 4) ventilation technology of green tunnel; and 5) digital intelligent maintenance technology of green tunnel.

Noise-control technology

The tunnel is a semi-enclosed space and the noise is difficult to dissipate. It emitted repeatedly and superimposed by the wall surface which generate a larger noise value. It seriously affects the traffic environment and safety. In addition, the tunnel entrance will have a “horn effect”, which will affect traffic near the tunnel entrance and the lives of residents. From the few cases of existing tunnel noise control, there are limited noise control measures that can be taken after the completion of the tunnel, which greatly affects the passage of the tunnel. Therefore, with the development of urban tunnels, the study of noise control issues in the design phase is of great significance. In road traffic, noise control is mainly conducted through sound insulation, sound absorption, and the use of low-noise road surfaces. Among them, sound insulation is one of the most important methods currently used. Currently, various kinds of sound barriers are used in urban viaducts (some sound barriers also have a sound-absorbing function). Shanghai Xinjian Road Tunnel also adopts a fully enclosed soundproof shed. According to the principle of sound insulation, the effect of a fully-enclosed soundproof shed is far better than that of a normal sound barrier, but its cost including the later maintenance costs are relatively high. Sound-absorbing materials (structures) have always been popular in tunnel noise management. The Nanjing Gulou tunnel uses metal perforated plates within 164.04ft of the tunnel opening, and the perforated aluminium plates are used for the sidewall of the open section, achieving a good noise reduction effect. Some new types of sound-absorbing materials gradually put into utilization in recent years, such as sound-absorbing enamel steel panels and sound-absorbing sandstone panels. The large-pore asphalt concrete was used in the renovation project of Beijing Jinsong Road, which was reduced by an average of 4dB compared with ordinary asphalt pavements by experts. Considering that the road surface environment in the tunnel differs from normal roads, for instance, the change in temperature and humidity is small, which is beneficial to the maintenance of the road surface, the research and

application of low-noise roads in tunnels will have a broader perspective.

Answer the questions to the text.

1. What does the word “Archology” mean?
2. How is “green building” defined? What are the main characteristics of “green building”?
3. Name the advantages of “green tunnels”.
4. In what construction phase should noise issue be taken into account?
5. What are the sound insulation techniques and sound-absorbing materials?

5. Find English equivalents in the text.

Національний стандарт	Втрата підземних вод
Ефективне використання простору	Гармонійне спів існування
Збірна конструкція	Асфальтне покриття
Сервісне обслуговування	Перфоровані алюмінієві пластини
Мінімізувати вплив	Звукопоглинальна панель із піщаника

6. Explain the meaning of the following expressions.

Ecological architecture

Green building

Soundproof shed

Sound-absorbing materials

Urban viaduct

Tunnel noise management

INCREASE YOUR VOCABULARY

1. Find synonyms in the text to the following words.

Means, preservation, direction, employment, dump on, accompany, scatter, preserving, outside.

2. Match the words with their definitions

1	Tunnel	a	a clastic sedimentary rock composed of sand-sized grains of mineral, rock or organic material;
2	Maintenance	b	is made up of stone (aggregate), sand, additives and liquid (petroleum) asphalt;
3	Sandstone	c	the material, resulting in a reduction of the sound pressure;
4	Design phase	d	the movement of fresh air around a closed space, or the system that does this;
5	Sound barrier	e	thought of as a low-end and mass-produced mode of construction;
6	Sound-absorbing materials	f	an underground passageway, dug through the surrounding soil/earth/rock and enclosed except for entrance and exit;
7	Prefabricated construction	g	a material with exceptional properties and has many applications in various aspects of everyday life;
8	Asphalt pavement	h	care or upkeep, as of machinery or property;
9	Enamel steel	i	a large increase in the force opposing a moving object as its speed reaches the speed at which sound travels;
10	Ventilation	j	It seeks to develop detailed specifications that emphasize the physical solution to the user's information technology needs.

3. Choose the correct word in the following sentences.

1. A flat roof is usually covered in roofing **felt/skin** for protection against the weather.

2. Rooms in a building are divided by interior **supports/partitions**.

3. To prevent water form entering the cavity of the wall, moisture barriers are used on the external surface and **vapour/insulating** barriers are used on the internal face.

4. The **assembly/structure** of a building transfers all the loads acting on the building to the group.

5. The **ventilating/acoustical** system provides fresh air.

6. Sound-**deadening/ -barrier** material is used to reduce sound passing from one room to another.

7. The foundations for a skyscraper building must be **deep/shallow**.

8. A spread **footing/ caisson** piers are used when the soil is weak.

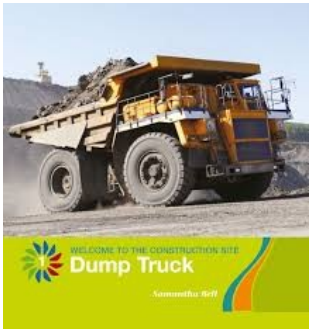
4. Put the following tasks into appropriate phase construction slot.

Consulting engineer communications with clients	*Maintenance*
Extensive site investigation	*Employment of consulting engineer*
Consulting engineer contact with contractors	*Preliminary site investigation*
Feasibility study	*Detailed design*

Phase	**Tasks**
Before construction	
During construction	
After construction	

5. Label the following items of mining equipment with the words from the box.

shovel	headframe	drill
conveyor	mining skip	cage
drift	dragline	dump truck



TRANSLATION

1. Translate into English.

1. Екотехнології - це енерго- і теплозбереження, раціональний підхід до витрачання ресурсів.
2. В основі зеленого будівництва лежить зведення до мінімуму впливу на навколишнє середовище.
3. Зелене будівництво своєю головною метою визначає зниження рівня споживання енергетичних і матеріальних ресурсів.
4. У світі все більше поширюється концепція розумного будинку, яка організована за допомогою автоматизації і сучасних технологій.
5. Витрати на зелені технології окупляться лише через кілька років.
6. Завдяки сучасним механізмам конструювання будівель, облаштування теплоізоляції, вентиляції та опалювальних систем можна скоротити витрати енергії, потрібної для утримання житла.
7. Перехід до зеленої економіки може забезпечити швидке економічне зростання.
8. В Україні очікується збільшення інвестицій в екологічні технології.
9. Розвинуті країни використовують різні інструменти «зеленої економіки» в своїй національній політиці.
10. Розвиток зеленої економіки постає як пріоритетне завдання сьогодення.

2. Render the excerpt in Ukrainian.

The tunnel construction market is one of constant evolution – and sometimes revolution. Dating back to ancient civilizations through today's modern marvels, designers and constructors have kept pace with the needs of society by applying new technology to an ancient craft. The 19th century saw the advent of subaqueous tunnels (Thames Tunnel) and drill-and-blast tunnels (Hoosac Tunnel), that changed the way we travel, while the 20th century ushered in a whole new era of underground construction with the introduction of Tunnel Boring Machines.

Today, we are seeing TBMs that are dealing with a broader range of ground conditions, with larger diameters and under greater pressures. These machines are opening doors for projects that may not have been feasible in the past, improving the quality of our infrastructure and contributing to a sustainable urban environment.

To get a sense of the impact of technology in today's tunnel construction market and where it is headed, we talked with HNTB's Mike Wongkaew and Tony Bauer. Specifically, the topics of large-diameter TBM tunnelling, hyperloop and tunnel lining design were discussed.

GRAMMAR REVISION

1. Change each sentence in reported speech, using a reporting verb from the list.

Inform, apologize, warn, threaten, explain, inform (for grammar references see Appendix A. Reported Speech).

1. "An agent will be boarding a plane for New York at 5 this afternoon," said a manager.
2. "Sorry, I'm late but I got here as soon as I could," said a member of R&D Department.
3. If you don't wear a safety helmet, you won't be allowed to the construction site," said a construction engineer.
4. "If you are not here at 6 sharp, you will be dining alone'," his girlfriend said.
5. "Clean the wood thoroughly, apply a salve and cover it with a bandage," said a nurse.
6. Sorry, I am late, but I got there as fast as I could," the woman said.

2. Punctuation for Quoted Speech. Correct the errors in the following sentences.

1. "Tomorrow's weather will be mostly sunny with a chance of afternoon showers." the weatherman announced.
2. The instructor said: "absolutely no laptop usage during lecture time."
3. "Can we postpone the test until Monday"? the students asked.
4. "All new students must go to the student centre to get their new ID card said the instructor. You must do this before you can get a library card."

5. “There will be no tuition increase this year, ” said the president. In fact, there will be no tuition increase for the next 3 years.”

🗣 SPEAKING

Speaking A. Work with a partner and ask him or her four of the following questions. Then, your partner should ask you four questions.

B. Get together with another pair and report on your conversations.

Example: I *asked Sophie if she would work if she didn’t have to and she said… I asked George how many hours a week he worked and he said..*

1. Would you work if you didn’t have to? Why or why not?
2. What is the best thing about your job?
3. What is the most challenging aspect of your job?
4. What would you like to be doing 10 years from now?
5. If you could schedule your working week any way you wanted, how would you do so?
6. How many hours a week do you work?
7. How many hours a week would you like to work?
8. When do you prefer to work -- morning, afternoon, or evening?

🔊 LISTENING

GOTTHARD – EUROPE’S WILDEST FRONTIER

1. What do you know about tunnels construction? Take a quiz.

1. A _____ is an excavation beneath the surface of the ground, the longer axis of which makes an angle not greater than 20 degrees to the horizontal.

a) tunnel

b) shaft

2. One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has the authorization to take prompt corrective measures to

eliminate them is termed to be a _____.

a) competent person

b) compassionate person

3. The following topics should be part of an underground construction employee training program: Air monitoring and ventilation, Illumination, Communications, Flood control, Personal protective equipment, Emergency procedures, including evacuation plans, Check-in/check-out procedures, Explosives, Fire prevention and protection & Mechanical equipment.

a). true

b)false

4. The employer must maintain a check-in/check-out procedure to ensure that above-ground personnel maintain an accurate accounting of the number of persons underground and to prevent unauthorized persons from gaining access to the site. This is especially important in the event of an emergency but is a common-sense requirement at all times.

a) true

b) false

5. Whenever an underground blasting operation in a shaft is complete, a competent person must check the air quality and make sure that no walls, ladders, timbers, blocking, and wedges have been loosened as a result of the activity.

a) true

b) false

2. Find the meaning of the following words and expressions.

Formidable, frontier, a military stronghold, chisel, to negotiate, an enormous undertaking, excavation, groundbreaking, landmark project.

***3. Watch the video* <u>Gotthard – Europe's wildest frontier</u>**

(https://www.youtube.com/watch?v=aWwWzNlFIPI and be ready to answer the following questions.

1. What is the Gotthard massive known for?

2. Describe the scenery of the old Gotthard.

2. Why is this tunnel called “the greatest engineering achievement”?

3. Why is this tunnel so special for Swiss people?

4. What was the role of ABB in this rail tunnel construction?

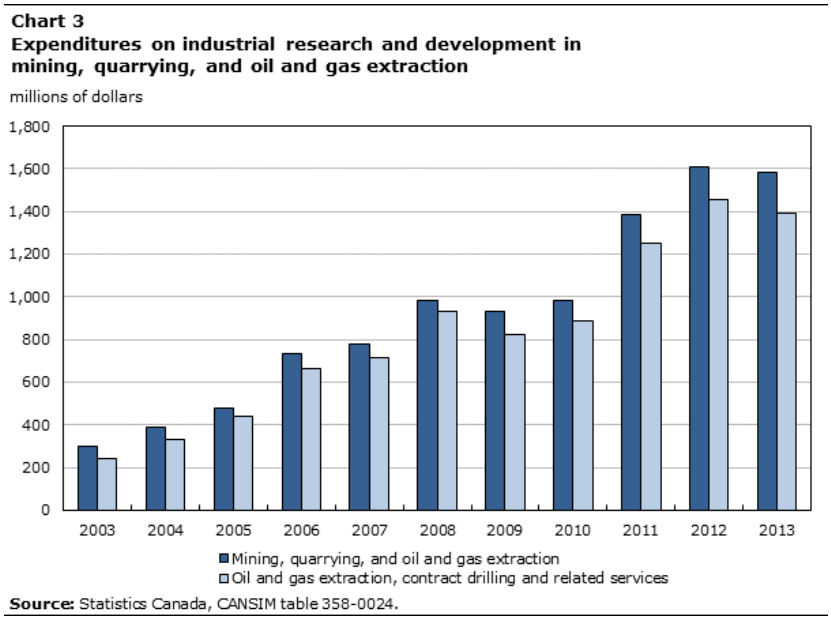
4. Fill in the gaps while listening to the audio.

Formidable, military, negotiating, captured, tunnelling, enormous, expensive, chisels, newly-patented, advancing, completed, achievements.

It’s one of the most laconic sites in Switzerland, the most 1_____ and natural barriers. For centuries it was a trade route between Germany and Italy and an important 2_____stronghold. The only way to cross the Gotthard in the old times was 3_____ the narrow pass. This wild pass 4_____ imagination of Europe’s artists. The idea of tunnelling straight through this rocks was an 5_____ undertaking and an 6_____ one. Excavation on the first rail tunnel began in 1871 with workers using hammers and 7_____ and 8_____ dynamite. The tunnel 9_____ was a meter a day. When it was finally 10_____ 10 years later, it was the world’s longest tunnel and one of the greatest engineering 11_____.

WRITING

As a student you are given the task to write about industrial development of a world-leading country. Study and analyse information in the chart about expenditures on industrial research in Canada. Summarize this information and write an essay (200 – 220 words). Use the expressions given below to describe the chart.



Useful phrases

bar graph shows	*one out of every*	*The ratio of….rose to roughly 55%*
Overall ……enhanced remarkably	*the percentages of …increased sharply*	*improved dramatically within next 5 years*
The given pie charts represent the proportion of	*bar graph compares the number of*	*in combination depicts a picture of the*
The chart compares the percentages of	*it retained the top position in*	*… secured the second position with 16.6%*

SUPPLEMENTARY TEXT
UNSUSTAINABLE DEVELOPMENT

Vocabulary:

Consideration – розгляд, увага;

sustainable development – сталий розвиток;

raw materials – сировина;

to enslave – взяти в рабство;

to annex – анексувати, захопити;

to lease – брати в оренду;

flourishing – процвітаючий;

irreversibly – безповоротно;

settlement – поселення;

deforestation – вирубка лісів;

subsistence – прожитковий мінімум;

outcome – результат;

shrinking resource base – скорочення ресурсної бази;

remnants – залишки;

to regress – регресувати, занепадати.

These considerations hint at an important idea: that development can be 'unsustainable' insofar as it cannot continue indefinitely if economic growth exhausts the available supplies of raw materials, the sources of energy or the pollution sinks. But suppose economic growth does reach the limits of raw material supplies, energy supplies or waste assimilation capacity: what happens then? The following example with Easter Island illustrates what can happen in such a situation.

The Easter Island mystery

Easter Island is one of the remotest inhabited places on Earth. It is a small island (around 400 square kilometres) in the Pacific Ocean, approximately 2000 kilometres from the nearest habitable land (Pitcairn Island). Despite the small size and remote location of the island, at the peak of its society, it had a human population of 7000 people. Yet even that small population was to place demands upon the natural environment that could not be sustained. At the time of the first contact with Europeans in 1722, around 3000 people were found on

the island in desperate conditions. Subsequently, the population continued to decline and their living conditions worsened. In 1877, Peruvians removed and enslaved the remaining population, with the exception of 110 elderly people and children. Eventually, the island was annexed by Chile and was leased to a British company for sheep grazing, with the few remaining inhabitants being confined to a single small village.

The mystery that faced the first European visitors was that, despite the appalling conditions they found on the island, there was also evidence of a once-flourishing and advanced society. Over 600 huge stone statues (averaging over 6 metres in height) were found on the island. The task of carving, transporting and erecting the statues was a complex one and was undeniably beyond the capacity of the poverty-stricken inhabitants of Easter Island in 1722. Indeed, given the limited resources of Easter Island, the society that constructed the statues must have been one of the most advanced in the world for the technology they had available. So what had happened to the statue-makers? Modern archaeological techniques revealed that the advanced society that constructed the statues collapsed because the development that occurred on the island placed immense demands - that could not be sustained - on the natural environment of the island. This makes the history of Easter Island a powerful example of the dependence of human societies on their natural environment - and of the consequences of irreversibly damaging that environment.

The collapse of a society

The colonisation of Easter Island began in the fifth century by Polynesians during a major phase of exploration and settlement across the Pacific Ocean. The first settlers would have found a volcanic landscape with adequate soils but poor drainage and few freshwater supplies. Due to its remote location, the island had few plant and animal species and the surrounding waters contained few fish. Hence the settlers relied on a very limited range of plants and animals for their subsistence: their diet would have consisted mainly of chicken and sweet potatoes. As the population of Easter Island grew, familiar forms of Polynesian social organisation were introduced. Ceremonial activities -including elaborate rituals and monument construction -

became a major part of the social life of the islanders. The growth of the population was accompanied by increased competition between clan groups. In turn, the outcome of that competition was the creation of one of the most complex Polynesian societies, the construction of hundreds of ceremonial centres with large stone platforms, and the carving of the stone statues. It was at this point that the society suddenly collapsed, leaving more than half of the statues partially completed. Why did this collapse occur?

The cause of the collapse of the society was the extensive environmental degradation resulting from the deforestation of the entire island. The Europeans who visited Easter Island in 1722 found the island completely denuded of trees (with the exception of some isolated trees at the bottom of a deep volcanic crater). Yet scientific analysis indicates that, at the time of initial settlement, the island would have been densely vegetated with large areas of woodland. Those trees were cleared by the growing islander population to provide clearings for agriculture, fuel for cooking and warmth, and a source of material for the construction of housing and canoes. Above all, vast quantities of wood were needed to transport the enormous statues to the ceremonial sites around the island; that task was accomplished using an elaborate system of wooden tracks. As a result of the excessive demand for wood, the island was almost entirely deforested by 1600 and the construction of statues halted. By that time, other effects of deforestation would have been apparent. House-building became impossible and people resorted to living in caves, stone shelters or reed huts. Fishing - that previously used nets made from bark - became more difficult. The construction of canoes became impossible and the population was then unable to escape the island. The removal of trees caused soil erosion, the leaching of nutrients and the decline of crop yields. The combined effect of those changes meant that the population could no longer be supported on a shrinking resource base, and a rapid decline in numbers occurred. After 1600, the remnant society regressed to very primitive living conditions and continued to decline until its eventual disappearance.

Adapted from https://www.soas.ac.uk/cedep-demos/000_P501_USD_K3736-Demo/unit1/page_13.htm

1. Answer the questions to the text.

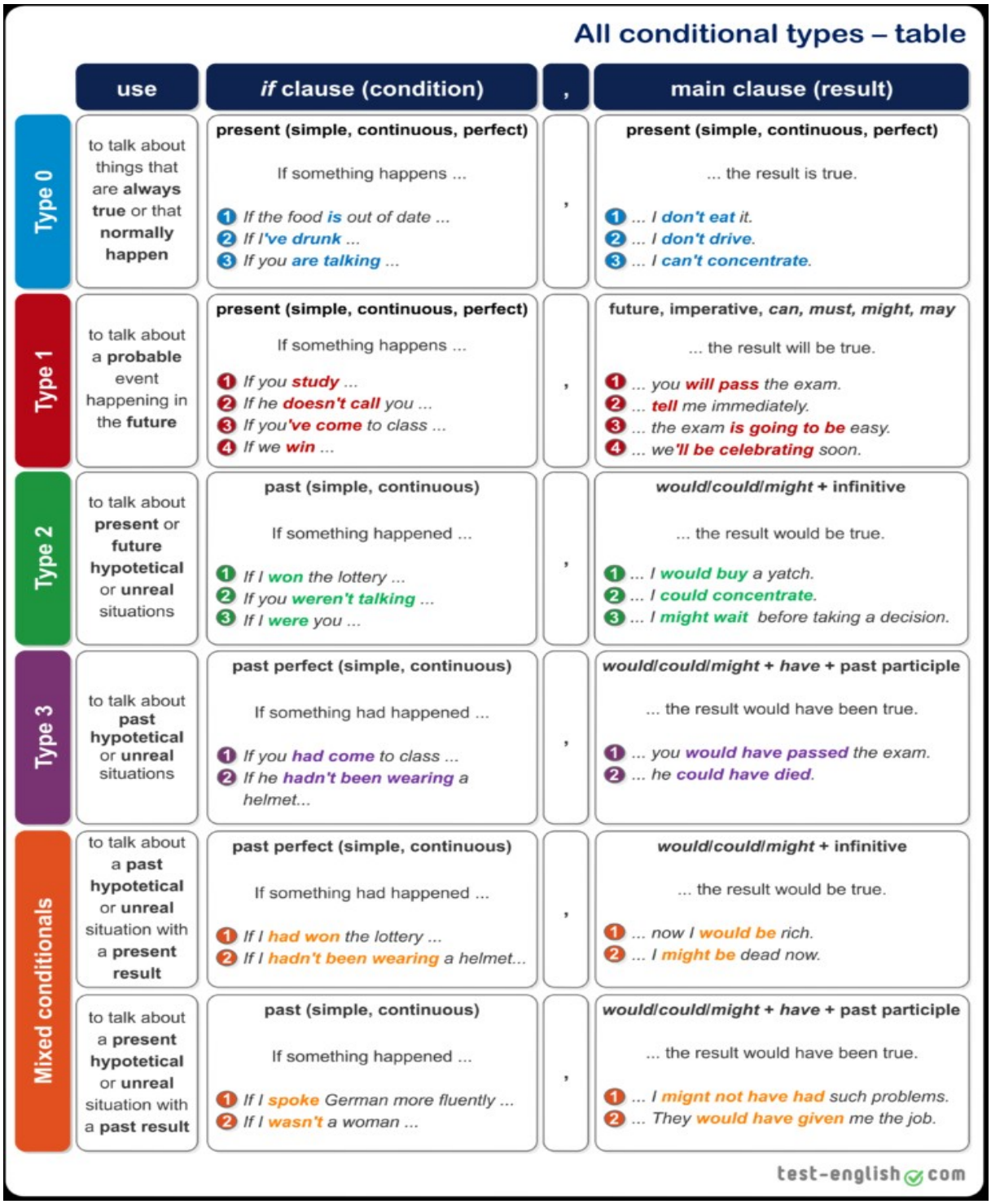
1. What does the example of Easter Island demonstrate?
2. What were the living conditions on the Island when the first European settlers came?
3. What testified about the highly developed society of the Island?
4. What caused the collapse of the Easter Island society?

2. Find interesting information about other outrageous world catastrophes. Write in the essay (200 – 220 words) what could have been done to prevent it.

APPENDIX A

GRAMMAR REVISION

UNIT 1. CONDITIONALS



All conditional types – table

	use	*if* clause (condition)	,	main clause (result)
Type 0	to talk about things that are **always true** or that **normally happen**	**present (simple, continuous, perfect)** If something happens ... 1 *If the food **is** out of date ...* 2 *If **I've drunk** ...* 3 *If you **are talking** ...*	,	**present (simple, continuous, perfect)** ... the result is true. 1 *... I **don't eat** it.* 2 *... I **don't drive**.* 3 *... I **can't concentrate**.*
Type 1	to talk about a **probable** event happening in the **future**	**present (simple, continuous, perfect)** If something happens ... 1 *If you **study** ...* 2 *If he **doesn't call** you ...* 3 *If you**'ve come** to class ...* 4 *If we **win** ...*	,	**future, imperative, *can, must, might, may*** ... the result will be true. 1 *... you **will pass** the exam.* 2 *... **tell** me immediately.* 3 *... the exam **is going to be** easy.* 4 *... we**'ll be celebrating** soon.*
Type 2	to talk about **present** or **future hypotetical** or **unreal** situations	**past (simple, continuous)** If something happened ... 1 *If I **won** the lottery ...* 2 *If you **weren't talking** ...* 3 *If I **were** you ...*	,	***would/could/might* + infinitive** ... the result would be true. 1 *... I **would buy** a yatch.* 2 *... I **could concentrate**.* 3 *... I **might wait** before taking a decision.*
Type 3	to talk about **past hypotetical** or **unreal** situations	**past perfect (simple, continuous)** If something had happened ... 1 *If you **had come** to class ...* 2 *If he **hadn't been wearing** a helmet...*	,	***would/could/might* + *have* + past participle** ... the result would have been true. 1 *... you **would have passed** the exam.* 2 *... he **could have died**.*
Mixed conditionals	to talk about a **past hypotetical** or **unreal** situation with a **present result**	**past perfect (simple, continuous)** If something had happened ... 1 *If I **had won** the lottery ...* 2 *If I **hadn't been wearing** a helmet...*	,	***would/could/might* + infinitive** ... the result would be true. 1 *... now I **would be** rich.* 2 *... I **might be** dead now.*
	to talk about a **present hypotetical** or **unreal** situation with a **past result**	**past (simple, continuous)** If something happened ... 1 *If I **spoke** German more fluently ...* 2 *If I **wasn't** a woman ...*	,	***would/could/might* + *have* + past participle** ... the result would have been true. 1 *... I **mignt not have had** such problems.* 2 *... They **would have given** me the job.*

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UNIT 2. RELATIVE CLAUSES

Relative clauses give us information about the person or thing mentioned.

Relative clauses give us essential information that tells us who or what we are talking about.

The girl who lives next door works in a city bank.

We usually use a relative pronoun or adverb to start a defining relative clause: *who, which, that, when, where or whose.*

who/that

We can use **who** or **that** to talk about people. **That** is more common and a bit more informal.

She's the friend who always helps me.
He's the man that I met at university.

which/that

We can use **which** or **that** to talk about things. **That** is more common and a bit more informal.

There was a one-year guarantee which came with the camera.
The PC that I bought last month has started making a strange noise!

We use relative pronouns to introduce relative clauses. Relative clauses tell us more about people and things:

Subject	**Object**	**Possessive**
who	Who/ whom	whose
which	which	whose
that	that	-

UNIT 3. CONJUNCTIVE ADVERBS

Conjunctive adverbs are words that join independent clauses into one sentence. A conjunctive adverb helps you create a shorter sentence. When you use a conjunctive adverb, put a semicolon (;) before it and a comma (,) after it.

Some examples of conjunctive adverbs are: *accordingly, also, besides, consequently, finally, however, indeed, instead, likewise, meanwhile, moreover, nevertheless, next, otherwise, still, therefore, then, etc.*

Functions of conjunctive adverbs

Addition in addition next also again furthermore	**Comparison** also likewise similarly	**Concession** granted of course still nevertheless	Time before meanwhile lately now since in the meantime
Contrast however instead in spite of rather	**Emphasis** indeed of course certainly further	**Illustrate a point** for example namely that is for instance	**Summarize** all in all that is in summary finally in conclusion

UNIT 4. MODALS

Modals are special verbs which behave irregularly in English. They give additional information about the ***function*** of the main verb that follows it.

- They never change their form. You can't add "s", "ed", "ing".
- They are always followed by an infinitive without "to" (the bare infinitive.)
- They serve to show modality: express certainty, possibility, willingness, obligation, necessity, ability.

Modal Verb	Expressing	Example
must	Strong obligation	You must stop when the traffic lights turn red.
	logical conclusion / Certainty	He must be very tired. He's been working all day long.
must not	prohibition	You must not smoke in the hospital.
can	ability	I can swim.
	permission	Can I use your phone please?
	possibility	Smoking can cause cancer.
could	ability in the past	When I was younger I could run fast.
	polite permission	Excuse me, could I just say something?
	possibility	It could rain tomorrow!
may	permission	May I use your phone please?
	possibility, probability	It may rain tomorrow!
might	polite permission	Might I suggest an idea?
	possibility, probability	I might go on holiday to Australia next year.
need not	lack of necessity/absence of obligation	I need not buy tomatoes. There are plenty of tomatoes in the fridge.
should / ought to	50 % obligation	I should / ought to see a doctor. I have a terrible headache.
	advice	You should / ought to revise your lessons
	logical conclusion	He should / ought to be very tired. He's been working all day long.
had better	advice	You 'd better revise your lessons

UNIT 5. REPORTED SPEECH

Indirect or Reported

Yes / No Questions

“Are you hungry?” Paul asked.	Paul asked us if we were hungry.
“Do you like pizza?” Teresa asked.	Teresa asked whether we liked pizza.
“Would you like dessert?” Bill asked.	Bill wanted to know whether or not we wanted dessert

Note that the verb tenses and pronouns change just as they do in reported statements. For yes / no questions, you have a choice of using if, whether, or whether or not. If is the most common. Also, a reported question does not have a question mark since it is no longer a question.

Reported Information or Wh-Questions

“How many students are in the class?” Amy asked.	Amy asked how many students were in the class.
“What time does class the start?” Susan asked.	Susan asked what time the class started.
“Where is the class?” Bob asked.	Bob asked where the class was

Quoted Speech Punctuation

• “I have two brothers and one sister,” Mary said.

• Pat said, “I’m going to watch a movie tonight.”

• “I visited my aunt on the weekend,” Tom said.

When a speaker changes direct speech to reported speech, he or she will see that many changes take place. These changes are the backshift in the verb tense, modifications of pronouns and time adverbials. Backshifting happens when a verb tense is shifted back to a past form in reported speech. Though backshifting doesn't happen in all reported speech, it does happen often.

The backshift in tenses

Direct Speech	Reported Speech
Simple Present	Simple Past
Present Progressive	Past Progressive
Simple Past	Past Perfect Simple
Present Perfect Simple	
Past Perfect Simple	
Past Progressive	Past Perfect Progressive
Present Perfect Progressive	
Past Perfect Progressive	
Future I (going to)	was / were going to
Future I (will)	Conditional I (would)
Conditional I (would)	

Time adverbials modification

this (evening)	**that (evening)**
today/this day	**that day**
these (days)	**those (days)**
now	**then**
(a week) ago	**(a week) before**
last weekend	**the weekend before / the previous weekend**
here	**there**
next (week)	**the following (week)**
tomorrow	**the next/following day**

APPENDIX B

ESSAY WRITING

THE MAIN TYPES OF ESSAYS

An essay is a focused piece of writing designed to inform or persuade. There are many different types of essay, but they are often defined in four categories: argumentative, expository, narrative, and descriptive essays.

Argumentative and expository essays are focused on conveying information and making clear points, while narrative and descriptive essays are about exercising creativity and writing in an interesting way. At the university level, argumentative essays are the most common type.

Essay type	Description
Expository	Provides a clear, focused explanation of a particular topic, process, or set of ideas. It doesn't set out to prove a point, just to give a balanced view of its subject matter.
Narrative	Tells a story. In most cases, this is a story about a personal experience you had.
Descriptive	Gives a vivid, detailed description of something—generally a place or object, but possibly something more abstract like an emotion. This type of essay, like the narrative essay, is more creative than most academic writing.
Argumentative	Presents an extended, evidence-based argument. It requires a strong thesis statement—a clearly defined stance on your topic. Aim is to convince the reader of your thesis using evidence (such as quotations) and analysis.

ESSAY STRUCTURE

Part	Content
Introduction	• Presents your topic • Provides background • Gives your thesis statement
Body	• Core arguments and analysis • Presents evidence (e.g. quotes) • One main point per paragraph • Each paragraph starts with a topic sentence • All paragraphs relate to your thesis
Conclusion	• Ties together your main points • Shows why your argument matters

APPENDIX C

SUCCESSFUL PRESENTATION

Here are some tips for effective presentation.

1. Love your topic and be an expert in it.

2. Plan the presentation carefully taking into account the background of the audience.

Leave time for questions.

3. Be short, clear and sweet. Use examples.

4. Plan it and rehearse.

PART OF PRESENTATION	**USEFUL VOCABULARY**
Introduction	**Introduce yourself** Good morning/afternoon (everyone) (ladies and gentlemen). It's a pleasure to welcome (the President) here. I'm … Introduce the presentation topic I plan to say a few words about… I'm going to talk about… The subject of my talk is…
Main Body	Now let's move to / turn to the first part of my talk which is about… So, first… To begin with… **Beginning a New Part** Let's move to (the next part which is)… So now we come to the next point, which is… Now I want to describe… Let's turn to the next issue… I'd now like to change direction and talk about… **Ending the Main Body** Okay, that ends (the third part of) my talk. That's all I want to say for now on
Concluding	I think we have seen that we should… In my opinion, we should… I recommend/suggest that we… There are three reasons why I recommend this. First, … / Second, … / Finally,...

Unit 1.

How Safe is the Mining Industry?

is it safe to work in the mining
00:05
industry dirty dusty and dangerous these
00:08
might be the first three words that you
00:10
think of when someone mentions mining
00:12
the mining industry can be one of the
00:14
safest industries to work for in a
00:16
report published by Eurostat in 2015 the
00:19
mining and quarrying industry represents
00:21
one of the lowest fatal and non-fatal
00:22
accident rates for all industries
00:24
surveyed in fact you may be surprised to
00:27
learn that wholesale and retail trade
00:28
had a higher accident rate for that year
00:31
mining is an inherently dangerous
00:33
industry due to the nature of the
00:34
working conditions however a push for a
00:37
strong safe work culture has made the
00:39
industry much safer in the last few
00:40
decades
00:41
take for example Anglo American which is
00:44
one of the world's largest diversified
00:46
mining companies with operations in
00:48
as a whole saw a 25 percent decline in
01:12
fatalities this type of effort toward
01:14
reducing fatalities and injuries is very
01:16
common across mining companies around
01:18
the world the holy grail for safety
01:20
performance the mining industry is
01:22
trying to achieve is to have zero
01:24
injuries safe work culture which entails
01:26
regular safety meetings and in-depth
01:28
training are just a few of the many
01:30
things that the mining industry is doing
01:32
to improve safety advances in mining
01:34
technology and personal protective
01:36
equipment are other integral ways that
01:38
the mining industry is improving safety
01:39
remote controlled drones smart helmets
01:42
that can detect toxic gas and 5g
01:44
telecommunication networks used for
01:47
autonomous equipment are just some of
01:48
the ways that technology is driving the
01:50
industry toward zero arm so the next
01:53
time you think about the mining industry

Australia Chile Colombia Venezuela and
00:51
South Africa when Cynthia Carroll
00:53
stepped into the CEO position of Anglo
00:55
American in 2007 she had made it a
00:57
priority to improve the company's safety
00:59
performance Cynthia did just that and by
01:02
2011 she reduced the fatality rate by 62
01:05
percent and this had a ripple effect on
01:08
the rest of South Africa in which mining
01:10
01:54
you can think of these two phrases
01:56
safety first and technologically
01:58
advanced to learn more about technology
02:00
and safety in the mining industry make
02:03
sure to subscribe to our Channel

Unit 2.

The Future of Mine Automation

the mine sites are normally very remote
00:10
it's difficult to recruit and retain
00:12
competent staff to run mining operations
00:14
in remote places mines are digging
00:17
deeper and deeper to find ore bodies as
00:20
costs go up so must productivity if
00:23
mining companies are to stay profitable
00:26
workforce safety is the most important
00:29
challenge workers safety must be
00:32
improved especially in underground
00:34
production areas and people working
00:37
close to heavy machines are also exposed
00:39
to risks another challenge is rising
00:43
energy costs the key for improving
01:42
value chain and creates a safe reliable
01:44
and predictable production process the
01:47
result is an optimized operation from
01:50
mind support the beauty of system 800 XA
01:55
is that all information is available to
01:58
all users locally centrally as well as
02:02
for mobile operators with iPads or
02:04
smartphones
02:06
with 800 XA everything is integrated 800
02:11
XA can integrate different users like
02:13
video voice and Public Address systems
02:15
web information you name it there's a
02:21
piece of machinery and the operator has

00:46
energy efficiency is a tight integration
00:48
between the process and power areas of
00:51
the plant the last challenge is typical
00:53
in many industries on a site there's a
00:57
large number of independent equipment
00:59
and systems each has its own information
01:01
and interfaces operators and control
01:05
room staff look at different screens and
01:07
have only separate pieces of information
01:09
at hand
01:10
no overview we call this islands of
01:14
automation this mine site has four
01:18
separate areas run by locals specialized
01:20
operators it's costly and less efficient
01:24
we want to bring them together talk the
01:27
same language and be integrated into one
01:29
system where all information is
01:30
available with modern control room
01:34
designs people with different roles can
01:36
work together in the same environment
01:39
extended automation closes gaps in the
02:23
just been alerted by a predictive
02:25
maintenance alarm that it will be
02:27
needing repair soon the operator can
02:29
access the maintenance system and see
02:31
all upcoming work orders in some Minds
02:34
ventilation accounts for almost 50
02:37
percent of energy consumption mine
02:39
vehicles emit diesel exhausts that have
02:42
to be ventilated away the automation
02:44
system knows where each vehicle is
02:47
minimizing energy consumption while
02:49
preserving air quality means great
02:52
savings with the integration of process
02:55
and power automation in system 800 XA
02:58
energy usage can be measured in real
03:00
time in the processing plant impurities
03:03
are eliminated from the off before
03:05
smelting the plant needs to react
03:08
quickly to our property changes with ABB
03:11
technology this becomes possible with
03:15
system 800 XA all information from local
03:18
mines is also available and consolidated
03:21
into corporate headquarters contact us
03:24

Unit 3.

NASA developing Mining Robot for Moon, Mars

if astronauts are to venture deeper into
00:07
space than ever before the trip is going
00:10
to be a lot easier if they can use the
00:12
materials they find along the way the
00:15
moon for example is full of oxygen and
00:17
methane in its soil processing the
00:20
moon's dirt into substances such as
00:21
rocket fuel and breathing air could give
00:24
after knots the vital chemicals that
00:26
need to travel to distant asteroids or
00:28
Mars we've recently found that there's
00:31
water ice at the poles of the moon if we
00:33
can capture that water ice that's h2o
00:35
can take the h2o split out the hydrogen
00:38
oxygen that's rocket propellant rocket
00:40
propellant is very important because
00:41
when a rocket lifts off from Earth 90%
00:44
of its mass is propellant if we can make
00:46
the propellant on the moon or on Mars we
00:49
don't have to bring it from Earth
00:49
basically we have everything we need in
00:51
the rayless collecting the regolith is
00:54
where razor comes in razor is a robotic
00:57
move fast avoid trouble and solve any
01:13
problems that come up along the way by
01:15
itself all while operating 16 hours a
01:18
day for years this is not your typical
01:20
NASA rover with lots of very
01:23
sophisticated instruments on it that are
01:25
quite fragile this is actually a very
01:29
tough little robot it can dig it can
01:31
climb it can flip over if it does flip
01:34
over it can write itself up again what
01:37
are the biggest challenges to overcome
01:38
is the fact that machines working on the
01:41
moon's reduced gravity can't count on
01:43
their own weight to hold them down and
01:45
let them work razors answer to this
01:48
problem is to barrel-shaped digging
01:50
wheels that can rotate in opposite
01:52
directions to give the robot the
01:53
traction and need to mine the dirt in
01:55
the low gravity of the moon each drum
01:58
itself only takes a little bit of a
02:00
scoop at a time it'll allow us to trench
02:03
and dig down deeper under development at
02:06

miner designed for a life spent digging **00:59** into the lunar regolith and carrying it **01:02** to a processing base 40 pounds at a time **01:05** unlike scientific Rovers NASA's operated **01:08** on other worlds before razor is meant to **01:10**	NASA's Kennedy Space Center razor is **02:08** expected to see several modifications as **02:10** engineers and designers refine the **02:12** design **02:13** and put it through more testing each **02:15** time we come with a new design we try to **02:18** further it to get ready for a mission **02:21** and so each one will bring something new **02:24** like trying to get it closer to the **02:26** relative environment if the plans work **02:28** out future explorers could have razor to

Unit 4

The Devastating effects of Gold Mining

Gold is one of the most precious metals in the world, and has run the gamut from its **00:03** use as currency, to jewelry, and even to electronic plating, and infrared shielding. **00:08** But for many people the cost far outweighs its intrinsic value. **00:12** Seeker Stories went to South America to learn about some of the worst exploitation, both **00:16** human and environmental. **00:18** Check it out. **00:20** Gold is maybe the most universal shorthand there is for value, and for greed. **00:26** The ancient Egyptians were obsessed with it. **00:28** **European explorers marauded through South America in search of it.** **00:32** And American cities like San Francisco and	**1:55** you want to keep far away from people. **01:57** But the mining process creates a lot of waste water laced with those pollutants. **02:02** And up in the Andes mountains, the water doesn't stay put. **02:05** when you take a mining operation and you put it on top of a mountain, the water as we all **02:12** know, only follows gravity, it goes down in every direction, **02:21** And therein lies the problem. **02:23** According to Diego, poisoned water has seeped throughout the region, causing stomach cancer **02:28** in people, illnesses in livestock, and decimated fish populations. **02:33** And the people of Cajamarca, who were

Seattle rose to prominence because of it.
00:37
It's a big part of our history as humans.
00:39
Looking at all that, our obsession with gold also seems historical, sort of old timey - but
00:46
that's not at all true.
00:48
There's still huge demand for it today - the recession of 2008 helped gold quadruple in
00:53
value.
00:55
And a full half of all the gold mined in the world has been mined in the past 50 years.
01:01
But what is different about gold today is how we get it.
01:07
What happens in gold producing areas is not what we imagine where somebodies in a cave,
01:13
using a chisel and a hammer to get these big golden nuggets.
01:17
That's Diego, a photojournalist who spent some time in Cajamarca, Peru near a modern
01:23
gold mine.
01:24
Actually, not just any gold mine...the largest in all of Latin America.
01:29
And modern mining looks very different than it used to.
01:33
most of the gold that we are mining now comes in the forms of little specks of sand, little
01:38
flakes mixed in with dirt.
01:41
a lot of these companies are using open pit mines to grab as much dirt as possible and
01:47
then they process it with different chemicals
01:49
Those chemicals are cyanide, arsenic, and mercury...basically a laundry list of things
promised new wealth from the mining economy, haven't
02:38
all seen a benefit.
02:40
they see water that is contaminated and economic opportunities that haven't really changed
02:45
for them.
02:46
[0:30] quality of life has remained the same for many of these people without any of the
02:50
profits you would assume a gold mine would bring to a region
02:55
And so the people have done the one thing they're able to do about the mines: protest.
03:01
They're pushing back against foreign corporate influence, ruined natural resources...and
03:07
a history that somehow never has seemed to change for them.
03:11
they've been exploited for about 500 years now, ever since the spanish arrived and started
03:15
taking the Incan's gold.
03:17
the same story happens wherever you have resource extraction projects.
03:21
it's a dirty industry which makes private profits and public disasters.
03:26
For Diego, it all comes back to the value of gold.
03:30
As expensive as gold is right now, after visiting Cahamarca Diego sees it as undervalued.
03:36
Dangerously so.
03:38
i realized that gold is cheap because we pay to it through the lives of people who live
03:43
in gold producing areas, through the lives of people who live in Cajamarca.

	03:46 This is video's part of a short series we're doing on protest movements around the world. **03:48** To get a peek behind the front lines of a movement called black bloc, click now. **03:50** If you want to see more in depth content like this, check out Seeker Stories. **03:54** They'll take you around the world sharing the stories that surprise, challenge and inspire **03:58** you - like this one about a company that is revolutionizing sustainable energy with an **04:03** unexpected resource. **04:19** Please make sure to like and subscribe to Seeker Stories for more webdocs. **04:23** Thanks for watching!

Unit 5

Gotthard – Europe's wildest frontier

it's one of the most iconic sites in **00:11** Switzerland the Guittard Massif in the **00:14** northwestern Alps is one of the **00:15** continents most formidable natural **00:17** barriers barring the way between **00:19** northern and southern Europe **00:26** for centuries this was a key trade route **00:28** for goods traveling from Germany to **00:30** Italy and an important military **00:32** stronghold **00:35** the 1500 it was the idea that because **00:38** all the river starts near in this region **00:41**	excavations on a first rail tunnel began **01:51** in 1871 with workers using hammers **01:54** chisels and the newly patented dynamite **02:00** it was slow and risky progress with the **02:02** tunnel advancing by just a meter a day **02:05** in the beginning **02:09** when it was finally completed ten years **02:11** later it was the world's longest tunnel **02:14** and one of its greatest engineering **02:16** achievements **02:20** was this line that was first electrified **02:22** by ground Bavarian company the **02:25**

they thought that must be the highest
00:43
mountain of the Alps the difference
00:46
between Leone for our the motor on and
00:48
the cockpit is that the Jungfrau and the
00:50
motor on they do have an image when you
00:53
say when you say matter on just see it
00:55
in the unit when you say God touch there
00:58
are 20 images and somebody said once the
01:03
Gotthard has no image but a lot of
01:05
stories the only way to cross the
01:10
guitard until modern times was by
01:12
negotiating a narrow pass that forded
01:15
turbulent rivers and scales sheer
01:17
granite gorges
01:22
this wild mountainous gotten past
01:24
captured the imagination of Europe's
01:26
artists from William Turner who painted
01:29
the famous Devil's Bridge to Romantic
01:31
poets like Goethe the idea of tunneling
01:37
straight through this rock was an
01:39
enormous undertaking and an expensive
01:41
one the brainchild of Swiss
01:43
industrialist Alfred Asher
01:48
forerunner to ABB in the 1920s
02:31
now abb engineering has helped complete
02:34
a new tunnel and one of the most
02:35
groundbreaking rail projects ever
02:37
attempted
02:39
Switzerland is very small country I
02:42
think to build such a tunnel within a
02:45
county with 8 million inhabitants it's
02:48
very something special you don't have to
02:50
fastest train the longest train the
02:52
highest train but I think our pride is
02:56
to have the longest tunnel which we do
02:58
have now the third time and I hope for a
03:00
long time again
03:06
this newly completed tunnel reaches all
03:08
the way through the very base of the
03:10
Guittard Massif to form the longest and
03:13
the deepest rail tunnel anywhere on the
03:15
globe powered and ventilators by ABB
03:18
Engineering
03:20
it's a worthy successor to the past
03:22
achievements of this imposing region a
03:25
landmark project linking Europe together
03:27
from north to south a suitably iconic
03:30
milestone in a long and legendary

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