ИНОСТРАННЫЙ ЯЗЫК
ВЫСШЕЕ ИНЖЕНЕРНОЕ ОБРАЗОВАНИЕ
ЧАСТЬ 3

Методические указания к самостоятельной работе
для обучающихся по всем образовательным программам
высшего инженерного образования

САНКТ-ПЕТЕРБУРГ
2025

Санкт-Петербургский горный университет императрицы
Екатерины II

Кафедра иностранных языков

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Краткая характеристика:

Методические указания направлены на совершенствование навыков и умений просмотрового и изучающего чтения профессионально-ориентированных текстов с последующим использованием полученной информации в речи, а также на развитие навыков самостоятельной работы с аутентичными текстами.

Методические указания предназначены для обучающихся по всем образовательным программам высшего инженерного образования.

Научный редактор: доц. кафедры иностранных языков И.Г. Герасимова

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ВВЕДЕНИЕ

Методические указания предназначены для учебно-методического сопровождения курса английского языка для студентов специалитета неязыковых вузов, обучающихся по всем специальностям высшего инженерного образования.

Изучение материала преследует цель развития навыков и умений просмотрового и изучающего чтения текстов по изучаемым специальностям. Исходя из программы дисциплины, обучающиеся должны:

Знать:

- наиболее употребительную общетехническую и специальную терминологию в рамках изучаемых тем;
- грамматические структуры, необходимые для понимания и перевода аутентичных текстов общетехнического характера.

Уметь:

- осуществлять просмотровое и изучающее чтение аутентичных текстов;
- выполнять письменный перевод текстов профессиональной направленности на русский язык с использованием словарей и справочной литературы;
- использовать информацию из иноязычных текстов для составления собственных высказываний в рамках профессиональной коммуникации.

Владеть:

- навыками иноязычной коммуникативно-речевой компетенции, достаточной для осуществления профессионального общения.
- техникой перевода аутентичных технических текстов.
- активным словарным запасом, включающим общетехническую и специальную лексику.

При выполнении заданий студентам рекомендуется определить тематику и тип текста, читать по смысловым блокам, анализировать значение слов в контексте или вспомнить ключевые термины на родном языке, использовать специализированные источники (словари), соблюдать последовательность предтекстовых и послетекстовых упражнений, вести личный глоссарий.

PROSPECTING AND EXPLORATION

Text 1 Exploration Geology

Task 1. Read the words and word combinations, translate and memorize them: exploration geology, to exploit, orebody, potential area, satellite imagery, density, to drill holes, core, to log, feasibility, to commence, diligence work, predictive targeting, shear zone, lineament.

Task 2. Put the words into three groups (nouns, adjectives, verbs).

Mineral, identify, geological, approximate, fund, data, available, resource, survey, previous, involve, magnetic, technique, correlate, development, approach, stratigraphic, portray, carboniferous, sedimentary, complimentary.

Task 3. Read and translate the text.

Exploration geology is the single most important and very first phase of mining. It begins by identifying what minerals are to be exploited, their geological setting, approximate size of orebody required and potential areas. Once these factors are considered, funds are required to finance the exploration project. Exploration begins by firstly gathering any possible data available on the resource, area, local geology from the geological survey, from satellite imagery as well as previous scientific work.

The next phase usually involves geotechnical prospecting which makes use of either seismic, electrical, magnetic, radioactive or density techniques. Once a suitable area has been found, holes are drilled and the core retrieved is logged and correlated against other logs to form a model of the orebody. Once sufficient holes have been drilled and the ore tested for qualities, feasibility studies and due diligence work can commence.

The development of exploration technology over a century is briefed along with the emerging challenges for the exploration. Exploration approach design and the myriad activities of exploration cycle are described. The adoption of right combination of techniques is warranted to conduct exploration in a cost-effective manner. The Quality Control/Quality Assurance validated exploration data are integrated to generate 3D models for better interpretation and predictive targeting.

Geological exploration for natural resources is expensive with high risk. However, it opens new challenges and opportunities. Governments and multinational companies are key players. The exploration concept looks for a package of unique stratigraphic age, promising favorable rocks, and type structure to host certain groups of minerals.

Mineral deposits portray a surface signature similar to mineral exposed to a surface, weathering effects, remnants of ancient mining, shear zone, and lineaments that can be identified during a field survey. These features guide exploration and may end with new discoveries.

Task 4. Complete the sentences below using the words from the list. Each word is used only once.

feasibility, correlated, warranted, lineaments, due diligence

1. Before construction began, the company conducted a _______________ study to determine if the project was practical and financially viable.
2. The geologist _______________ the data from the new drill site with existing maps to get a clearer picture of the mineral vein.
3. Investing in such a high-risk venture required extensive _______________ to ensure all the potential problems were understood.
4. The financial cost of the expedition was so high that a significant discovery was _______________ to make it worthwhile.
5. From the aerial photographs, the survey team could identify major____________, which are linear landscape features that indicate underlying geological structures.

Task 5. Answer the following questions:

1. What are three initial considerations that must be identified at the very beginning of an exploration geology project?
2. What is the next phase of exploration after initial data gathering?
3. What is the specific purpose of drilling holes and retrieving core samples during the exploration process?
4. What are the two main characteristics of geological exploration that make it a challenging endeavor?
5. The text mentions that mineral deposits leave "surface signatures." What are three specific examples of these signatures that can be identified in a field survey?

MINING

Text 2 Surface Mining

Task 1. **Read the words and word combinations, translate and memorize them:** physical and chemical properties, to occur, depth, to estimate, surface mining, open-pit mining, strip mining, quarrying, dragline, large shovel, adjacent, waste material, to apply, to require, concrete, soil, disruption, to affect, to influence, groundwater, essential

Task 2. Read and translate the text.

Mining is the process of extracting mineral resources from the earth. The mining method used depends heavily on the physical and chemical properties of the mineral, the physical form in which it occurs, as well as the geometry and depth of the ore body.

It has been estimated that more than two-thirds of the world's yearly mineral production is extracted by surface mining. There are several types of surface mining, but the three most common are open-pit mining, strip mining, and quarrying. These differ from one another in the mine geometries created, the techniques used, and the minerals produced.

Open-pit mining often (but not always) results in a large hole, or pit, being formed in the process of extracting a mineral. It can also result in a portion of a hilltop being removed.

In strip mining, a long, narrow strip of mineral is uncovered by a dragline, large shovel, or similar type of excavator. After the mineral has been removed, an adjacent strip is uncovered and its overlying waste material deposited in the excavation of the first strip. Strip mining is primarily applied to thin, flat deposits of coal.

There are two types of quarrying. There is the extraction of ornamental stone blocks of specific colour, size, shape, and quality—an operation requiring special and expensive production procedures. In addition, the term quarrying has been applied to the recovery of sand, gravel, and crushed stone for the production of road base, cement, concrete, and macadam.

Surface mining causes complete disruption of the surface, which affects the soil, fauna, flora and surface water, thereby influencing all types of land use. If the operation extends to depths below the water table, it will affect the near-surface groundwater. An understanding of the pre-mining environment is therefore essential. It is also important to understand the mining method employed so that surface rehabilitation, an essential component of this type of mining can be meaningfully planned.

Task 3. Complete the following sentences with the information from the text.

1. The three most common types of surface mining are open-pit mining, quarrying, and ______________.
2. Unlike open-pit mining, strip mining is primarily used for thin, flat deposits of _____________.
3. One type of quarrying involves the extraction of ornamental stone, while the other involves the recovery of materials like sand, gravel, and _______________.
4. Surface mining causes a complete disruption of the surface, which affects the soil, surface water, and _____________.
5. To plan surface rehabilitation meaningfully, it is essential to understand both _______________.

Task 4. Write a short summary of the text using the following phrases: *extract mineral resources, ore body, open-pit mining,* *strip mining, quarrying, disruption of the surface, pre-mining environment, mining method, surface rehabilitation.*

MINING MACHINES

Text 3 Underground Equipment

Task 1. Read the following text and use the dictionary to translate the words in bold.

The objective of underground mining is to extract the ore below the surface of the earth safely, economically, and with the removal of as little waste as possible. A modern underground mine is a highly mechanised operation requiring little work with pick and shovel. Rubber-tired vehicles, rail haulage and multiple drill units are commonplace. Here are all the types of mining tools used in underground mining:

Crane lifts. Crane lifts are versatile in underground mining. These mining machines can be used to load explosives and carry other heavy loads and mining equipment.

Continuous miners. Continuous miners are a type of mining tool used in room and pillar mining, and have a large rotating drum with carbide teeth to scrape coal from seams. These mining tools can mine up to five tons of coal a minute and account for approximately 45% of underground coal production. They also have conveyor belts that transport coal, making this an automated process that is controlled remotely.

Drones. Underground mining drones, like Flyability's Elios 3, are used for visual inspections in stopes, ore passes, ventilation shafts, conveyor belts, and other areas of an underground mine. Drone technology has allowed inspections to be conducted in areas that are unsafe for humans to enter, presenting an invaluable tool in such hazardous conditions. However not all drones can be used in mines. For a drone to be functional in an underground mine, it must be able to operate without GPS.

Jumbo drills. Jumbo drills or mining drills are used to drill holes for explosives or to create mine shafts for miners to enter.

Loaders and haulers. Loaders and haulers are an extremely compact and maneuverable type of mining tool used in underground mining, which is designed specifically for underground work. Just like their names suggest, these mining tools load and haul away minerals.

Longwall mining machines. Longwall mining machines are the most common machines used in underground coal mining. These mining tools are used to build underground galleries and tunnels by leveraging the machine's shearing capabilities.

Refuge chambers. Refuge chambers are stand-alone safety chambers for miners that are equipped with oxygen, food, water, and sanitary necessities in case of an emergency. These chambers can safely hold miners for 96 hours to eight days.

It's important to note that underground mining tools that operate in an enclosed environment are no-emission machines. They are specially built to still have the power to move tons of rocks at a time in these harsh conditions.

Task 2: Complete the sentences with the correct mining tool from the list: *Crane lifts / Drones / Jumbo drills / Loaders and haulers / Longwall mining machines / Refuge chambers*

1. ……………………..versatile and can be used to load explosives and carry heavy equipment.
2. For creating access shafts for miners to enter, ... are essential.
3. ………………….are specifically built to be compact and maneuverable for underground work.
4. The………………..are the most common equipment in underground coal mining.
5. In an emergency, miners can seek safety in ....for up to eight days.
6. ……………….like the Elios 3 are used to inspect hazardous areas like ventilation shafts.

Task 3: **Find a word or phrase in the text that has a similar meaning to the following definitions:**

1. the action of cutting or slicing something off

2. extremely useful or necessary
3. the production or release of something, especially gas or radiation
4. able to be moved or directed easily
5. a self-contained unit that can function independently

Task 4: Decide if the following statements are True (T), False (F), or Not Given (NG) based on the text.

1. Continuous miners are responsible for nearly half of all underground coal production.
2. All drones on the market are suitable for use in underground mines.
3. Jumbo drills can be used both for placing explosives and for creating access routes.
4. Loaders and haulers are the largest type of equipment used in underground mining.
5. Longwall mining machines are primarily used for inspections.

Task 5: Write a short paragraph (80-100 words) comparing and contrasting two different underground mining tools from the text. Use the plan:

1. Name the two tools you have chosen.
2. Describe the primary function of each.
3. Explain one key similarity they share (e.g., both are automated, both enhance safety, etc.).
4. Explain one key difference between them (e.g., their specific purpose, how they are operated, etc.).

MINERAL PROCESSING

Text 4 Ore Dressing Methods

Task 1. Look at the following terms from the text: *crushing, grinding, screens, magnetic separators*. **What are the two main *principles* or *methods* which are based on the terms and used throughout the mineral processing process?**

Task 2. Read and translate the text.

Mineral processing, also known as mineral beneficiation, ore sorting, or mineral dressing, is the process of extracting, separating, and concentrating valuable minerals or metals from ore. This is achieved by utilising a range of ore dressing (ore processing) methods.

Comminution is the umbrella term for the crushing and grinding processes that create heterogeneity from a homogenous ore, as well as the devices used for comminution: gyratory crushers, jaw crushers, cone crushers, grinding mills, SAG mills, ball mills, high pressure grinding rolls (HPGR). Anything that takes large particles and makes them into small particles falls under the umbrella of comminution – this aligns with the first principle of mineral processing by creating heterogeneity.

Screens and hydroclones are the two primary types of **sizing** equipment. These are often necessary in the process of creating heterogeneity because there is often a target particle size necessary to create heterogeneity, for example, 100 microns. Screens and size separation devices can remove particles that are too large and return them back to the comminution equipment to maximize the amount of ore processed to the target size. Screening and size separation also use the principle of exploiting heterogeneity: screens separate based on differences in size, and hydroclones separate based on both size and density which means they are frequently used to retain gold particles within a grinding circuit.

Concentration is purely a process of exploiting heterogeneity in mineral ores. Physical concentration devices include gravity separators (centrifuges and spirals), magnetic separators, dense media separators and more. These all use physical properties to separate out particles based on differences in specific gravity, magnetism, optical properties, etc. Flotation specifically separates and concentrates based on surface chemical properties.

Task 3: Complete the paragraph using the words from the list:

heterogeneity, comminution, exploiting, concentration, ore, hydroclones

The entire process begins with (1) ……………_, where large pieces of (2) ………….. are crushed and ground. The goal of this stage is to create (3) …………..by freeing different minerals from each other. Next, (4) ………….are used in sizing to separate particles based on size and density. The final stage is (5) …………which is dedicated entirely to (6)……….the differences between the particles to get a valuable concentrate.

Task 4: Sort the 6 items below into the correct column in the table:

Items: *Hydroclones, Ball Mills, Magnetic Separators, Screens, Jaw Crushers, Flotation*

Comminution	Sizing	Concentration

Task 5: Place the following 6 steps/phases in the correct order to create a logical mineral processing flow sheet.

A. Concentrate valuable minerals using magnetic separators.
B. Remove oversized particles with screens and send them back.
C. Extract raw ore from the ground.
D. Use hydroclones to retain dense gold particles.
E. Crush and grind the ore in a SAG mill.
F. Achieve a target particle size of 100 microns.

Correct Order: 1. ____, 2. ____, 3. ____, 4. ____, 5. ____, 6. ____

OIL AND GAS

Text 5 Oil and Gas Production

Task 1. Read the words and word combinations, translate and memorize them: crucial, prosperity, commodities, drilling rig, well completion, flooding, technological advancement, fracturing, shale formation, production fluids

Task 2. Read and translate the text.

The term “oil and gas production” refers to the operations of extracting petroleum and natural gas from the ground. The oil and gas sectors are crucial to global prosperity because they supply commodities used in a wide variety of businesses.

The initial step is exploration, where geologists and geophysicists use seismic surveys to create detailed images of subsurface rock formations, identifying potential reservoirs. Once a promising site is located, the drilling phase begins. Modern drilling rigs can drill vertically, directionally, and even horizontally to precisely target the reservoir.

Following well completion, the production phase commences. Natural reservoir pressure may force oil and gas to the surface. As this pressure declines, secondary recovery methods like water flooding are employed to maintain flow. A pivotal technological advancement is hydraulic fracturing ("fracking"), which, combined with horizontal drilling, allows access to previously uneconomical shale formations by creating fractures in the rock to release hydrocarbons.

At the surface, production fluids (a mixture of oil, gas, and water) are separated. The oil is then typically stored and transported via pipelines or tankers. The associated natural gas is processed to remove impurities and is then compressed for pipeline transport or, in some cases, liquefied into LNG for shipping.

Throughout this lifecycle, digital technologies are increasingly integral. Supercomputers process seismic data, while sensors and IoT devices on wells and facilities enable real-time monitoring and optimization, ensuring that production is as efficient, safe, and environmentally responsible as possible. This continuous technological evolution is crucial for meeting global energy demands.

Task 3. Decide if each statement is true or false:

1. Exploration involves using seismic surveys to identify potential underground reservoirs.

2. Hydraulic fracturing is used to increase reservoir pressure naturally.

3. Digital technologies, such as sensors and IoT devices, help monitor and optimize oil and gas production.

4. Natural reservoir pressure alone is always sufficient to bring oil and gas to the surface.

5. Oil is typically transported via pipelines or tankers after being separated from production fluids.

Task 4. Give answers to the following questions:

1. What are the main steps involved in oil and gas production?

2. How does horizontal drilling improve access to oil and gas reservoirs?

3. Why are digital technologies increasingly important in the oil and gas industry?

4. What is the purpose of separating production fluids at the surface?

5. How does secondary recovery, like water flooding, help maintain oil flow?

CONSTRUCTION

Text 6. The Mine Construction Phase: From Permits to Production

Task 1. Read the words and word combinations, translate and memorize them: permits in hand, site preparation, worker camps, environmental management, land restoration, adhere to guidelines, clearing old structures, building infrastructure , relocating wildlife, erosion, setbacks, public protest, objections, delays, halt to work

Task 2. Read and translate the text.

Once a mining company has all its permits in hand, the construction phase begins. This stage usually takes a few years, depending on the site's location, the scale of the project, and the local regulatory landscape. Investors will receive updates through press releases and reports, and it's crucial to pay attention to these. Even though the risky exploration stage is over, investors need to be sure the company is avoiding major setbacks and sticking to the rules.

Site preparation. Before major construction can start, the site must be prepared. This involves clearing old structures, building necessary infrastructure like roads and bridges, and setting up initial worker camps. This is also when environmental management begins in earnest. The company must follow the guidelines set out in its permits, which can include relocating wildlife, planting for future land restoration, and putting in measures to control erosion and water.

Building the Mine. Constructing a mine is a massive undertaking, especially in remote areas. These sites can become like small towns, requiring not just processing plants but also housing, schools, and medical facilities for workers. If the mine is near an existing community, this might not be necessary, and the company can focus on building only what is needed for the mining and milling processes. This often includes maintenance shops and facilities for processing the ore.

There are two main types of gold mines: open-pit and underground. Open-pit mining is more common and is used for the majority of mineral production. It involves removing the overlying rock (overburden) to expose the ore body. Building an underground mine, on the other hand, involves digging a network of tunnels for access, ventilation, and safety. The specifics of how these are built lead into the next stage: mine operation.

Ongoing Oversight and Risks. While getting to the construction phase is a major hurdle, the job is far from done. This period requires significant investment, and any delays in starting production are costly. The company must continue to work closely with regulators, providing site plans, construction details, and access to prove it is adhering to all permit conditions. This is also vital for keeping financiers confident and funding in place.

A potential wildcard at this stage is public protest. Objections to the mine can continue even after official approval is granted, sometimes leading to delays or even a halt to work. While a company can reduce this risk by following best practices and engaging with local communities, some of the richest mineral deposits are in politically or environmentally sensitive areas, making this a persistent challenge.

Task 3. Decide if each statement is true or false:

1. According to the text, the environmental management plan is only implemented after the main mine structures are built.

2. The text states that building a mine in a remote area typically requires more infrastructure, such as housing and schools, than one built near an existing community.

3. The removal of "overlying rock" or "overburden" is a process described as part of constructing an underground mine.

4. Investor reports during the construction phase are important to monitor for setbacks and regulatory compliance, even though the exploration phase is over.

5. The text suggests that public protest is a risk that can be completely avoided if a company follows all the official government rules.

Task 4. Choose the most appropriate word or phrase to complete the sentence: *setbacks, overlying rock, infrastructure, environmental management, milling processes, public protest, permits, underground mine, remote, investor reports*

1. Before any heavy machinery arrives, the company must focus on _______________, which includes tasks like relocating wildlife and controlling erosion.

2. Building an open-pit mine requires the removal of the _______________ to expose the valuable ore body beneath.

3. A significant risk to a project's timeline is _______________, where local communities may object to the development despite official approval.

4. During construction, it is crucial for a company to monitor and minimize any _______________ that could cause costly delays.

5. The company secured all necessary _______________, allowing them to finally move from the planning stage to the construction phase.

6. A mine located in a _______________ area often needs to build its own housing and schools for workers, like a small town.

7. Regular _______________ provide crucial updates for shareholders to ensure the project remains on schedule and within regulations.

8. In an _______________, engineers must dig a network of tunnels for access, ventilation, and safety, instead of digging a large pit.

9. The construction of access roads and power lines is part of developing the necessary _______________ for the mine to operate.

10. After the ore is extracted, it is often treated on-site through various ___________ to separate the valuable minerals from the waste rock.

Task 5. Review the use of the bolded word in each sentence. If it is incorrect, **explain the error**.

1. The company's financial **oversight** meant they carefully tracked every dollar spent.
2. The first step at the **mill** is to crush the ore into small pieces to extract the gold.
3. Building a mine in the desert is a small and simple **undertaking**.
4. After the permits were approved, the environmental work began **in earnest**.
5. The truck was **adhering to** the muddy road, making it difficult to drive.

ELECTRICAL ENGINEERING

Text 7. Powering the Mine: The Role of Electrical Engineers

Task 1. Read the words and word combinations, translate and memorize them: mine power systems, heavy machinery, underground networks, hoisting, electrical motors, circuit, transformers, generate, distribute, mills, smelters, standards and regulations

Task 2. Read and translate the text.

From the nineteenth century, electricity became a primary focus for scientists. Today, electrical engineers are vital to every industry worldwide, and the mining industry is no exception. Their role is critical, encompassing the design, development, and supervision of the electrical equipment and systems that are essential for mining operations.

The scope of their work is extensive. Mine power systems range from relatively simple installations for small surface mines to complex underground networks that must provide a reliable service without compromising miner safety. Both opencast and underground mines require substantial power to operate heavy machinery, including underground drilling equipment such as jackhammers and jumbo drills, and open-pit machinery like excavators, crushers, and high-angle conveyors. Electrical engineers are responsible for planning and designing the power stations and generating equipment that supply these demanding operations.

A vital and specialized duty of mine electrical engineers involves the hoisting of material from underground. Skips, which are used to transport material to the surface, are powered by electrical motors whose maintenance and handling are managed by competent electrical engineers. These professionals also determine the necessary circuits, transformers, and other equipment required for these critical systems. Their responsibilities extend beyond the mine itself to the mills and smelters where the mined material is sent for further processing; there, they oversee the installation, operation, and maintenance of complex electrical systems.

In their daily work, these engineers develop and update engineering plans, calculate project costs, and design systems to generate, distribute, and manage electricity for the entire mining complex. They must expertly interpret technical drawings, standards, and regulations, and are responsible for writing reports and instruction manuals for new installations. Ultimately, they oversee all electrical system tests and are tasked with correcting any faults, ensuring that the lifeblood of the mine—power—flows safely and without interruption.

Task 3. Give answers to the following questions:

1. According to the text, what are the two main categories of mining operations that require electrical engineering, and what is a key safety challenge specific to one of them?
2. The text mentions that electrical engineers are involved from "the mine itself" to "mills and smelters." Explain how the role and responsibilities of an engineer might differ between these two locations.
3. Besides operating equipment, what are three key design and planning tasks that fall under an electrical engineer's duty to "generate, distribute, and manage" power for a mine?

4. Why is the hoisting system considered a "vital and specialized duty," and what specific electrical component is crucial to its operation?

5. How do standards and regulations influence an electrical engineer's work throughout the different stages of a mining project, from initial design to daily maintenance?

6. The text calls power the "lifeblood" of the mine. Using details from the text, justify this metaphor by explaining what would happen if this "lifeblood" were interrupted.

7. What specific skills, beyond pure electrical knowledge, must a competent mine electrical engineer possess based on the tasks described in the text?

8. Compare the power needs of an open-pit mine's "high-angle conveyors" and an underground mine's "jackhammers." How do these examples illustrate the "substantial power" required and the engineer's role in meeting this demand?

Task 4. Complete the sentences using the words: *distribute, hoisting, smelters, circuit, heavy machinery, standards and regulations*

1. The massive excavator and bulldozers are examples of the ________________ needed to move tons of earth.

2. After the ore is crushed at the mill, it is sent to the ________________ where it is melted to extract pure metal.

3. The engineer checked the entire electrical ________________ to find the break in the power line.

4. A primary safety concern was the ________________ of miners and materials from the deep shaft to the surface.

5. All electrical work must comply with strict ________________ to ensure everyone's safety.

6. The main power station's job is to ________________ electricity to every building in the industrial complex.

Task 5. Match each term on the left with its correct definition on the right.:

Term	**Definition**
1. Heavy Machinery	a) The overarching electrical infrastructure that

Term	Definition
	supplies electricity to the entire mining complex.
2. Mine Power Systems	b) Professionals responsible for designing and supervising all electrical systems in a mining operation.
3. Hoisting	c) The three core functions describing control over the entire electrical lifecycle
4. Mills and Smelters	d) Large, power-intensive equipment essential for the core tasks of mining.
5. Electrical Motors	e) Facilities where mined material is sent for further treatment.
6. Standards and Regulations	f) Components that convert electrical power into mechanical motion for equipment.
7. Electrical Engineers	g) The process of lifting mined material from underground to the surface.
8. Generate, Distribute, and Manage	h) The rules and guidelines that ensure all electrical systems are safe and compliant.

ELECTRONICS AND IT

Text 8. Model Mines

Task 1. Read the words and word combinations, translate and memorize them: digitalization, digital twins, virtual models, scenarios, equipment configurations, predictive maintenance, unplanned downtime, real-time data, fault-finding, training tool

Task 2. Read and translate the text.

Digitalization is a term most often associated with smart factories, and conjures up images of clean, sterile manufacturing spaces populated only by robots. But digitalization can also be a catalyst for change in heavy industries like mining.

A huge benefit of digitalization is its ability to let us explore different scenarios virtually before we build them in reality. These virtual models are referred to as digital twins. They offer the ability to try out new concepts, such as different equipment configurations, before committing to investment. This saves money by preventing poor development, makes engineering decisions easier, and gives confidence that the project can be delivered effectively without any unforeseen impacts.

A further key benefit of the digital twin is as a training tool. It can be used to train operatives in a controlled environment without disruption to normal operations and in total safety.

Digital twins also play a key role during operation and maintenance. They hold all the data about every piece of plant and equipment, and can be used to analyze the existing design and suggest improvements.

Digital twins are also adept at fault-finding, because they can continuously analyze real-time data to spot performance patterns that may indicate a part is beginning to fail. This in turn makes predictive maintenance much easier and prevents unplanned downtime – particularly if the equipment supplier offers a hotline or remote support backup that can be triggered by an alert from the digital twin

Task 3. Give answers to the following questions:

1. Beyond cost-saving, what are two other benefits mentioned for using digital twins in the planning and design phase of a mining project?
2. How do digital twins specifically contribute to a safer working environment for mine operatives?
3. In what two key ways do digital twins support the operational phase of mining equipment, according to the text?
4. Explain the process of how a digital twin facilitates predictive maintenance and prevents unplanned downtime.
5. The text states that digitalization is a "catalyst for change" in mining. Based on the benefits described, what specific aspects of traditional mining does it change?

Task 4. Decide if each statement is true or false:

1. The primary function of a digital twin is to control robots autonomously in a sterile factory environment.

2. Digital twins can be used to test the viability of different equipment setups before any physical investment is made.

3. Training with a digital twin requires the temporary shutdown of normal mining operations.

4. A key operational benefit of a digital twin is its ability to store data and suggest design improvements for equipment.

5. For predictive maintenance to be effective, the digital twin must be able to analyze real-time data to spot early signs of component failure.

Task 5: **Complete the paragraph using the most appropriate words**: *predictive maintenance, unplanned downtime, digital twins, real-time data, scenarios, fault-finding, equipment configurations, digitalisation*

The adoption of ________________ is transforming the mining industry. A core component of this shift is the use of ________________, which are virtual models of physical systems. These models allow engineers to test different operational ________________ and ________________ before implementing them in the real world, saving significant costs. Once operational, these virtual models are fed with ________________ from the physical equipment. This enables advanced ________________ to identify potential problems, a process known as ________________. By addressing issues early, mines can schedule repairs proactively and avoid costly ________________, ensuring a more efficient and safer operation.

ECONOMICS

Text 9. Mine Planning and Evaluation Process

Task 1. Read the words and word combinations, translate and memorize them: mine planning, technical component, economic analysis, production schedules, unit costs, viability, strategic assessment, risk, sensitivity, shareholder value

Task 2. Read and translate the text.

A complete mine planning and operating task involves a technical component, a focused economic analysis, and a broader financial and business assessment.

The technical component concerns mine layout, equipment productivities, alternative production schedules, and mine operating requirements. It defines all of the important elements related to the implementation of the proposal, focusing solely on technical criteria, regardless of the project's ultimate economics.

The focused economic analysis applies operating and capital costs to the technical schedules. It considers alternative schedules and alternative equipment in economic terms—e.g., the price per ton. It also builds up and examines unit costs, such as the fuel cost per liter, annual fuel cost for the whole mine, and labor cost per person per year. The objective of this phase is to provide comparison of options in economic terms.

The broader financial and strategic assessment aims to understand the degree of viability of a plan and how the plan fits within a wider corporate context. Whole-project viability is a function of what other projects the company may have available, as well as what other companies (suppliers, customers, and competitors) are doing. This phase of evaluation also examines the relative risk associated with investment decisions and the sensitivity of the plan to factors outside management control.

Mining is an expensive activity, the cost-effectiveness of which demands these economic analyses. Mine evaluation is also an expensive activity and demands its own economic analysis. The task of the mine planner is to develop a plan that will maximize shareholder value, and one of the components in this process is the cost, and the resulting savings of the mine-planning process itself.

Task 3. Decide if each statement is true or false:

1. The technical component of mine planning is contingent on the project first being deemed economically viable.

2. A core objective of the focused economic analysis is to facilitate the comparison of different project options using a financial framework.

3. The broader financial assessment is solely concerned with the internal costs of the mining operation and does not consider the actions of competitors.

4. According to the text, it is possible to conduct a valid, narrowly-focused economic analysis on a specific part of a project even if the overall mine is uneconomical.

5. The technical component of mine planning includes evaluating the strategic fit of the project within the company's wider portfolio.

6. The text states that the stability of the corporate structure can be linked to management's ability to deliver on the promises of the mine plan.

7. The mine planner's responsibility includes optimizing the resources allocated to the planning process itself to maximize shareholder value.

8. The sensitivity of a mine plan is analyzed during the focused economic analysis phase, which examines factors like fuel cost per liter.

Task 4. Complete the following sentences using the most appropriate term from the list: *viability, unit costs, sensitivity, technical component, economic analysis, strategic assessment, production schedules, risk, mine planning, shareholder value.*

1. The primary goal of any mining project is to maximize _______________.

2. Before considering costs, engineers must first complete the _______________, which defines the mine layout and equipment requirements.

3. A _______________ study helps a company understand how a change in metal prices could affect the project's profitability.

4. Calculating the fuel cost per liter and labor cost per person are examples of building up _______________.

5. Determining whether the project aligns with the company's long-term portfolio is part of the broader _______________.

6. The process of creating a _______________ involves determining the sequence and volume of ore extraction over the mine's life.

7. A complete _______________ process integrates technical, economic, and financial considerations.

8. The _______________ of a project is a function of its potential profit and how it fits within the company's other opportunities.

9. Applying capital and operating expenses to different technical scenarios is the core of the _______________.

10. Every investment carries some level of _______________, which must be evaluated before making a final decision.

Task 5. Match the term on the left with its correct definition on the right.

1. Strategic Assessment	A. The application of costs to technical plans to compare options financially.
2. Sensitivity	B. The uncertainty associated with an investment decision.
3. Economic Analysis	C. An evaluation of how a project fits within the wider corporate and market context.
4. Risk	D. A measure of how a plan is affected by changes in external factors.
5. Viability	E. The overall feasibility and potential for success of a project.

HEALTH, SAFETY, AND ENVIRONMENT

Text 10. Mining Safety Measures to Consider

Task 1. Read the words and word combinations, translate and memorize them: safety measures, comprehensive training programs, potential risks, safety protocols, emergency response procedures, hazard recognition, advanced technology implementation, automation, remote-controlled machinery, hazardous environments, real-time data, personal protective equipment (PPE), respiratory protection, emergency response plans, health monitoring programs, hazardous substances, occupational diseases, community engagement, sustainable mining operation

Task 2. Read and translate the text.

To ensure a safer working environment, mining companies must implement a range of safety measures that cover every aspect of their operations.

Comprehensive Training Programs. Adequate training is vital to enable miners to comprehend the potential risks that may be associated with their tasks and the safety protocols that are put in place to mitigate them. Regular training sessions should cover emergency response procedures, equipment operation, and hazard recognition, equipping personnel with the knowledge and skills to identify potential hazards and respond appropriately in case of emergency.

Advanced Technology Implementation. The mining industry has increasingly embraced technology to enhance safety in the workplace. Automation and remote-controlled machinery minimize workers' exposure to hazardous environments. Furthermore, drones and sensors provide real-time data on mine conditions, offering a promising way forward for safer working conditions.

Personal Protective Equipment (PPE). Using appropriate PPE is essential to minimize the risk of injuries. Equipment such as helmets, gloves, respiratory protection, and reflective clothing, should be inspected and replaced regularly to ensure that workers are adequately safeguarded.

Emergency Response Planning. Mining companies must maintain robust emergency response plans for hazards such as fires, explosions, and cave-ins. Regular drills and simulations prepare workers to react quickly and efficiently, reducing the impact of any incident.

Health Monitoring Programs. Continuous surveillance of employees' physical well-being, particularly their exposure to hazardous substances, is vital for the early detection of potential health issues. Regular health check-ups, lung function tests, and screenings for occupational diseases are essential to allow for timely intervention.

Community Engagement. Mining companies should actively communicate with local communities to address concerns related to safety and environmental impact. This open dialogue fosters trust and cooperation, leading to a shared responsibility for maintaining a safe and sustainable operation.

By breaking new ground in safety measures, the mining industry can contribute to a future where responsible mining is the norm, ensuring the prosperity of both the industry, its workers and the communities it serves.

Task 3. Complete the sentences below using the most appropriate term from the list: *automation, community engagement, emergency response plans, hazard recognition, hazardous substances, health monitoring programs, personal protective equipment (PPE), potential risks, real-time data, sustainable mining operation*

1. Regular medical check-ups and lung function tests are core components of effective _______________ designed for the early detection of occupational illnesses.

2. A fundamental goal of safety training is to ensure all workers can accurately identify _______________ in their work environment before an incident occurs.

3. Wearing hard hats, steel-toed boots, and respirators are all examples of using _______________ to create a barrier between the worker and workplace dangers.

4. The implementation of _______________ in machinery allows tasks to be performed with minimal human presence in unstable or toxic areas.

5. Drones equipped with gas sensors can provide _______________ on air quality in underground shafts, allowing for immediate evacuation if necessary.

6. Through open dialogue and _______________, mining companies can build trust with local residents and work towards a shared vision for a _______________.

7. Every site must have well-developed _______________ that are regularly practiced through drills to ensure a swift and organized reaction to events like a fire or cave-in.

8. Continuous exposure to _______________ like silica dust requires strict controls and ongoing health surveillance for affected employees.

Task 4. Match the term on the left with its correct definition on the right.

Term	Definition
1. Safety Protocols	A. Formal strategies that outline procedures for reacting to critical incidents like fires or collapses.
2. Emergency Response Procedures	B. The systematic process of identifying sources of potential harm or danger in the workplace.
3. Hazard Recognition	C. The use of technology to operate machinery from a safe distance, reducing worker exposure.
4. Remote-Controlled Machinery	D. A long-term mining model that balances economic, environmental, and social responsibilities.
5. Sustainable Mining Operation	E. The official rules and methods established to prevent accidents and ensure worker well-being.

Task 5. Deeper text understanding.

a) Match the safety measure on the left with its correct description on the right.

Safety Measure	Description
1. Comprehensive Training	a) Using tools like drones and automated machines to keep workers out of danger.
2. Advanced Technology	b) Regular health check-ups to catch illnesses early from exposure to dangerous materials.
3. Emergency Planning	c) Teaching workers about risks, protocols, and how to handle emergencies.
4. Health Monitoring	d) Conducting regular drills for incidents like fires or cave-ins.
5. Community Engagement	e) Talking with local residents to build trust and address their safety concerns.

b) The role of technology

The text states that technology offers a "promising way forward for safer working conditions."

- Give two specific examples of technology mentioned.
- Explain *how* each example directly improves miner safety.

c) Proactive vs. reactive measures

Safety measures can be *proactive* (aimed at preventing an incident) or *reactive* (aimed at minimizing harm after an incident starts). Categorize the following as either *proactive* or *reactive*:

- Regular health screenings for occupational diseases.
- Practicing emergency response drills for a cave-in.
- Using remote-controlled machinery in hazardous areas.
- Providing respiratory protection to miners.

d) Beyond the mine site

The text includes "Community Engagement" as a key safety measure.

Why is talking to the local community considered an important part of a mining company's safety plan? What is the ultimate goal of this dialogue?

e) The "Swiss Cheese" model of safety

Imagine safety as a stack of Swiss cheese slices. Each slice (a safety measure) has holes (weaknesses), but when layered together, they block a hazard from causing an incident.

Describe how **three** different safety measures from the text (e.g., Training, PPE, and Technology) would work together as "layers" to protect a miner from a specific hazard, like a toxic gas leak.

f) Prioritizing investment

A mining company has a limited safety budget and can only fully fund one new initiative this year.

- **Option A:** State-of-the-art **automation** for the most dangerous part of the mine.
- **Option B:** A year-long, in-depth **comprehensive training program** for all employees.

- Which option would you recommend and **why**? Justify your answer using reasoning from the text.

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