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Кафедра иностранных языков

ИНОСТРАННЫЙ ЯЗЫК. ВЫСШЕЕ
ИНЖЕНЕРНОЕ ОБРАЗОВАНИЕ. Ч.3.

Методические указания для практических занятий студентов
института базового инженерного образования всех направлений
подготовки

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ИНОСТРАННЫЙ ЯЗЫК. ВЫСШЕЕ ИНЖЕНЕРНОЕ ОБРАЗОВАНИЕ.

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Методические указания предназначены для студентов института базового инженерного образования. На материале аутентичных текстов, в которых освещаются основные аспекты геологоразведки, горнодобывающей и нефтегазовой промышленности, переработки минерального сырья, строительной отрасли, экономики, экологии, информационных технологий в горном деле, электроэнергетики и конструирования горных машин и оборудования, обучающиеся смогут овладеть необходимыми навыками для решения коммуникативных задач в профессиональной деятельности, а также подготовиться к экзамену по дисциплине «Иностранный язык».

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ПРЕДИСЛОВИЕ

Данные методические указания предназначены для проведения практических занятий по английскому языку со студентами института базового инженерного образования всех специальностей. Методические указания составлены в соответствии с учебной программой по дисциплине «Иностранный язык» для формирования иноязычной профессиональной компетенции будущих инженеров. В методические указания включены аутентичные тексты, в которых освещаются основные аспекты геологоразведки, горнодобывающей и нефтегазовой промышленности, переработки минерального сырья, строительной отрасли, экономики, экологии, информационных технологий в горном деле, электроэнергетики и конструирования горных машин и оборудования.

Использование предложенного комплекса упражнений способствует формированию у будущих специалистов навыков перевода с английского языка на русский специализированных технических текстов, совершенствованию навыков просмотрового, ознакомительного, изучающего и поискового чтения, а также развитию умений реферировать аутентичные тексты на английском языке. Особое внимание уделяется формированию активного словарного запаса, который включает наиболее употребительные термины и выражения.

UNIT 1. PROSPECTING AND EXPLORATION

Text 1. Prospecting and Exploration Methods

Prospecting and exploration are precursors to mining and often occur simultaneously.

Prospecting is the process of searching the region for mineral deposits. Historically, prospectors would explore a region on foot with a pick and shovel. Modern prospecting uses a variety of geological methods. Geology experts use a direct method to discover surface mineral deposits by examining the area visually. Geophysics experts use an indirect method to identify underground mineral deposits by detecting rock alterations under the surface. Geochemistry can also be used to analyze samples of soil, rock, and water. These methods are supplemented by aerial or satellite photography, and combined with historical maps and literature to develop detailed maps of surface and underground rock formations. Drilling is used to search for mineral occurrences or the clues in the rocks that may lead to them. Information gathered in this stage may or may not lead to a discovery of valuable minerals.

In mining exploration, experts use additional techniques to determine the possible size and value of the mineral deposit discovered during prospecting. Samples that are collected by drilling undergo various analyses by geologists and metallurgists to determine the richness and extent of the mineral, both vertically and horizontally. Such analyses of geological confidence and technical and economic evaluation allow experts to label the deposit as a “mineral resource” and/or an “ore reserve,” to better establish the economic value of the deposit and to estimate mining costs.

Exercise 1. Put these steps in correct order (1-6).

Process Sequencing

- ___ Conduct geochemical analysis
- ___ Perform aerial surveys
- ___ Visual surface examination
- ___ Drill core samples
- ___ Evaluate economic viability

Exercise 2. Collocations: Complete the phrases from the text using the words in italics.

mining costs, evaluation, to establish, contractual, to determine, analyses, to exploit, rock formations, resource, samples, confidence

1. _____ arrangements
2. Geological _____
3. Technical and economic _____
4. Mineral _____
5. Surface and underground _____
6. _____ an area
7. To collect _____
8. To undergo various _____
9. _____ the economic value
10. To evaluate _____
11. _____ the size and value of the mineral deposit

Exercise 3. Decide whether the statements below are True, false or Not Given.

1. Prospecting always leads to mine development.
2. Modern prospecting uses only indirect methods.
3. Satellite imagery supplements field data.
4. Metallurgists determine mining safety protocols.
5. "Ore reserve" indicates economic viability.

Exercise 4. Complete the table comparing prospecting techniques.

| method | direct/indirect | tools used | detects... |
|-------------|-----------------|-------------------|------------------------|
| Visual exam | Direct | Eyes, basic tools | Surface deposits |
| Geophysics | _____ | _____ | Subsurface alterations |
| _____ | Indirect | Lab equipment | Chemical composition |
| _____ | Both | Drilling rigs | Core samples |

Text 2. Mineral Resources

A mineral resource is a concentration of potentially **valuable material** that **naturally occurs** in the earth that can potentially be mined for **economic profit**. Whether it is worth extracting now or later may depend on the amount, form, location, and quality of the material, a concept called **geological confidence**. Experts use **geological sampling** and **testing methods** to classify a mineral resource into three different categories according to geological confidence. When the amount and quality of the mineral can be estimated with only a low level of confidence based on **limited sampling**, it is called an **“inferred” mineral resource**. Such a resource will likely not be mined at this time, but may be mined one day in the future, either because all other reserves have been **exploited** or because improvements in technology make it easier to extract less **concentrated ores**. Additional sampling may allow the amount, quality, **density**, shape, and physical characteristics of the mineral to be estimated with a reasonable level of confidence, and it is classified as an **“indicated” mineral resource**. If further sampling and reliable and detailed exploration allow the amount, quality, density, shape, and physical characteristics of the mineral to be **accurately estimated** with a high level of confidence, it is classified as a **“measured” mineral resource**.

Exercise 5. Read the text and match the words in bold with their Russian equivalents below:

геологическое опробование, рудный концентрат, степень геологической достоверности, предварительно оцененные запасы, оцененные (измеренные) запасы, предполагаемые запасы полезных ископаемых, плотность, осваивать/разрабатывать полезные ископаемые, ограниченная выборка, методы опробования (тестирования), экономическая прибыль, встречаться в природе (естественным образом), ценные полезные ископаемые.

Exercise 6. Answer the questions to the text.

1. What four factors determine whether a mineral resource is worth extracting?

2. How does geological confidence relate to mineral resource classification?
3. What is the key characteristic of an ‘inferred’ mineral resource?
4. Why might an inferred resource become economically viable in the future?
5. What additional information becomes available when a resource is upgraded to ‘indicated’ status?
6. What level of sampling and analysis is required to classify a resource as ‘measured’?
7. How does the classification system help mining companies make decisions?

Exercise 7. Translate the text into Russian.

The seismic method in mineral exploration is similar to ultrasound imaging in medicine, providing detailed images of what lies beneath the surface. In a reflection seismic survey, controlled energy — generated by small explosive charges or special trucks — travels through the earth’s crust. When these sound waves hit different rock layers and boundaries, they bounce back as echoes. Microphones on the surface capture these echoes, which are processed through advanced data analysis to create visual representations of underground structures. This technique is especially useful in areas where the shape, orientation, and characteristics of rock formations play a key role in locating valuable mineral deposits. By mapping these structures, geologists can better predict where minerals like gold, copper, or petroleum might be found.

UNIT 2. MINING

Task 1. Read and translate the follow words and word combinations. Then read the text below.

to extract, valuable minerals, to employ a method, underground (subsurface) mining, surface mining, placer, in-situ (solution) mining, ore, tunnel, shaft, pollution, open-pit mining, strip mining, excavate, seam, terrain, open-pit mines, quarry, overburden, landfill, waste disposal site

Mining is an important activity for many industries and societies, as it provides the necessary resources to power progress. Mining is used to extract valuable mineral resources from the Earth like metals, minerals, fossil fuels, and even water that cannot otherwise be grown or fabricated through artificial means. Out of the many mining methods available, four main methods are typically employed by the biggest mining companies in the world: underground, surface, placer and in-situ.

Surface Mining

Surface mining is a type of mining activity that involves the extraction of minerals located near the surface of the Earth. This is a process where ore is extracted from the ground by digging it out with heavy machinery. In particular, surface mining is used to retrieve sand, gravel, stones, coal, iron and other metals. The main advantage of surface mining is that it is easy to set up as there are no tunnels or shafts required. However, the disadvantage is that the land has been disturbed which may cause environmental problems such as erosion and pollution.

Surface mining can include open-pit mining or strip mining procedures, depending on the amount of material present in an area and the intended final outcome.

Strip mining gets its name from the fact that the process involves stripping the surface away from the mineral that's being excavated (usually coal). Soil, rock, and vegetation over the mineral seam is removed with huge machines, including bucket-wheel excavators. This type of mining makes sense when the mineral is near the surface. If the ore is too far under the surface, the process of strip mining becomes impractical and needlessly damaging to the terrain.

Open-pit mining is similar to strip mining, except the ore is removed from an open pit which is not then filled in. Open-pit mining has been around for centuries, with ancient cultures like the Greeks, Romans, and Persians mining for granite, marble and even salt. Open-pit mines are commonly called quarries when they produce materials used in building: limestone, granite, and marble, for example. These pit mines continue to be enlarged until there is no more ore to mine or the overburden becomes too heavy. When it's no longer economical to operate an open-pit mine, it's commonly converted to a landfill or waste disposal site.

Exercise 2. Read the text and answer the questions.

1. Why is mining considered important for industries and societies?
2. What are the four main mining methods mentioned in the text?
3. What are the two main types of surface mining discussed?
4. What are three advantages of surface mining mentioned in the text?
5. What environmental problems can surface mining cause?
6. How does strip mining get its name?
7. What determines whether strip mining is practical or not?
8. What's the difference between open-pit mining and strip mining?
9. What were some materials mined by ancient cultures through open-pit mining?
10. What typically happens to an open-pit mine when it's no longer economical to operate?

Exercise 3. Match these mining terms with their definitions.

| | | |
|----|------------|---|
| 1. | overburden | a) a natural concentration of valuable minerals |
| 2. | ore | b) a layer of mineral deposits |
| 3. | excavator | c) waste rock covering a mineral deposit |
| 4. | quarry | d) a machine used for digging |
| 5. | seam | e) an open-pit mine for building materials |
| 6. | landfill | f) a site for waste disposal |

Exercise 4. Fill in the blanks with the words in italics and translate the sentences.

erosion, shafts, excavated, landfill, employed, impractical, procedures, converted

1. Underground mining requires digging _____ to reach deep minerals.
2. Surface mining can cause soil _____ if not managed properly.
3. Old open-pit mines are often converted to _____ sites.
4. Mining companies have _____ various methods to extract minerals efficiently.
5. When ore is too deep, strip mining becomes _____.
6. Different mining _____ are used depending on the deposit location.

7. After closure, the pit might be _____ into a recreational area.
8. The coal was _____ using massive bucket-wheel excavators.

Exercise 5. Make sure you know the Russian equivalents and meaning of the following terms and word combinations. Then read the text below.

Underground Mining

to access a deposit, equipment, skilled personnel, to yield, deposit, hard-rock underground mines, soft-rock underground mines, sedimentary rocks, metamorphic igneous hard rocks, room and pillar mining, block caving, longwall mining, open stopping, mine site

Underground mining, also known as subsurface mining, is a method used to extract valuable minerals by digging deep beneath the earth's surface. This type of mining is most suitable for extracting minerals that are located deep underground and cannot be accessed by other methods. Gold, lead, copper and silver are just a few of the many types of minerals typically targeted with underground mining. Underground mining involves creating tunnels deep into the Earth that can access a deposit and extract it with ease.

While this type of operation is time consuming and expensive due to the need for specialized equipment and skilled personnel, it often yields higher quality results than alternative mining methods due to its ability to access hidden deposits deep within a rock face or mountain range. There are some hard-rock underground mines and soft-rock underground mines. For instance, coal deposits are usually found in soft sedimentary rocks, while gold deposits live in metamorphic igneous hard rocks, and so does copper, diamond, silver, zinc and nickel. Some of the common underground mining methods include, room and pillar mining, block caving, longwall mining, and open stopping.

The core advantage of underground mining methods is that it has a reduced environmental impact on the surrounding land as the methods cause minimal disruption to the soil around the mine site. Another benefit of this method is its lessened exposure to weather conditions.

Exercise 6. Read the text and decide whether the following statements are True, False or Not Given.

1. Underground mining is only used for extracting gold and silver.
2. This method is preferred when minerals are located deep underground.
3. Underground mining requires less specialized equipment than surface mining.
4. Underground mines always produce higher quality minerals than surface mines.
5. All underground mines extract minerals from hard rock formations.
6. Underground mining completely eliminates environmental damage.
7. Weather conditions significantly affect underground mining operations.
8. Copper can be found in both hard and soft rock formations.
9. Block caving is suitable for extracting coal deposits.

Exercise 7. Translate the text into Russian.

There are three major types of mining, surface mining, underground mining, and solution mining; their use depends on the type of ore and where it is located, as well as issues of safety, technology, economics, and environmental impacts. Surface mining, which includes strip mining, open-pit mining, and mountaintop removal, removes soil and rock from on top of the mineral deposit. It may begin as soon as the pre-development steps are complete. Underground mining uses shafts and tunnels to access deeply-buried mineral deposits, while the overlying rock is left in place. This type of mining is usually more expensive and complex, and requires a lot of additional planning for convenience and safety. Solution mining, sometimes referred to as in situ leaching, is performed by pumping a leaching solution such as an acid into the ground, where the solution then dissolves the solid minerals into a liquid. This liquid containing the minerals is then pumped out of the ground and the mineral can then be recovered by various techniques.

UNIT 3. MINING MACHINES

Mining Equipment

Carrying out mining operations requires the use of a large number of machines and vehicles to complete the task, although some of them are not strictly necessary for the core mining process.

Before starting the work phase, you need to involve various mining equipment such as excavators, dozers, graders and wheel loaders to build road infrastructure and access to the mining site. After that, service trucks become essential to ensure the smooth operation of all heavy equipment.

There is also the presence of an articulated garbage truck whose job is to transport leftover materials. Next, water trucks are used to maintain machines and reduce the amount of dust in certain areas.

Below are the types of heavy mining equipment that are often used:

Wheel Loaders

The first type of heavy equipment is the wheel loader, sometimes referred to as a front loader, wheel loaders play an important role in most mining activities and large construction projects.

In simple terms, this tool is a strong machine that is used to lift and carry materials such as rubble, soil, gravel, stones, and anything that needs to be cleaned from the mine site. When it comes to earthmoving, wheel loaders are among the most frequently used equipment in mining facilities.

Wheel loaders are equipped with a tool in the form of a front bucket that can be raised and lowered to lift heavy loads. There are various types of buckets, but basically they all have the same function, namely lifting and carrying materials from one place to another. Unlike some types of mining machines that run on rails, wheel loaders have four large wheels and a cab over them for the operator, allowing the driver a clear view of the front bucket.

Dozer Tracks

Tracked dozers are similar to wheel loaders in many aspects, but also have significant differences. First of all, they move using rails instead of wheels, thus providing better maneuverability in areas with uneven or rocky surfaces.

Second, the main function is slightly different. Instead of digging and lifting material to a certain height, dozers are used to push large amounts of material. While the front equipment isn't as deep as a wheel loader's bucket and doesn't have the same large carrying capacity, you can use it to scrape material lower to the ground.

The tracks on this dozer help distribute the weight more evenly, providing superior thrust capabilities. This is why tracked dozers are often used on mining sites. Tracked dozers are useful for ripping and pushing coal, building roads, and moving heavy materials. In addition, they can clear paths effectively thanks to the blade on the front.

Articulated Dump Trucks

When the need to move large amounts of material simultaneously arises, articulated spill trucks become an indispensable solution. This is a type of mining machine commonly used to transport a variety of materials, from sand and gravel to crushed stone.

Articulated Dump Trucks, also known as spill trucks, consist of a front section or cab, as well as an articulating rear section, allowing for easier transportation of materials. Most articulated spill trucks have the capacity to transport materials weighing up to 30 tons.

Different from other mining equipment such as diggers, Articulated Dump Trucks are designed to be more similar to conventional trucks. This allows the truck to have excellent turning ability and be able to turn within a small radius. This feature provides operators with more flexibility, especially when operating in confined areas.

Excavator

There are various types of excavators used in both the mining and construction industries, ranging from mini excavators for small jobs to much larger machines. This machine has become very commonly used because it has a variety of functions, including digging trenches, moving large materials, demolishing building structures, and other earthmoving applications.

Excavators generally operate on rails, which allows them to access areas and maneuver freely in places that are difficult for wheeled machines to reach.

Several types of excavators used in mining activities include backhoes, bucket wheel excavators, electric shovels, and dragline excavators. In the context of mining activities that are closely related to excavation, these machines become very important. They are capable of flowing hundreds of cubic meters of material every hour.

Whether you need a small excavator to move nimbly in tight spaces or a variant with a wider reach for hard-to-reach areas, excavators always feature precision, flexibility and speed in their operations.

Exercise 1. Read the text above and answer the following questions in full sentences.

1. What machines are used to build roads before mining?
2. How much weight can articulated dump trucks carry?
3. What is the difference between wheel loaders and tracked dozers?
4. How are articulated dump trucks different from conventional trucks?
5. What are the advantages of articulated dump trucks?
6. What types of excavators are mentioned?
7. What tasks can excavators perform?
8. Why are excavators useful in mining?
9. Why are different types of mining equipment needed?
10. How do environmental conditions affect mining equipment choice?

Exercise 2. Scan the text and match the words with their definitions.

words

- 1 excavator
- 2 wheel loader
- 3 dozer
- 4 bucket
- 5 tracks
- 6 operator
- 7 blade

- 8 cab
- 9 articulated dump truck
- 10 grader

definitions

- a) the person who drives the machine
- b) the part used to scoop or carry material
- c) a machine for digging and moving earth
- d) equipment for leveling surfaces
- e) the enclosed space for the driver
- f) a machine for pushing large amounts of material
- g) a vehicle for transporting materials with a jointed frame
- h) the flat part at the front of a dozer
- i) a machine for lifting and carrying materials
- j) continuous bands that help machines move over rough ground

Exercise 3. Fill in the blanks with the words from the text.

1. The ... is used to dig trenches.
2. ... are essential for lifting and carrying rubble.
3. The ... helps the dozer clear paths.
4. ... dump trucks can transport up to 30 tons.
5. The ... sits in the cab and controls the machine.
6. ... are used for building road infrastructure.
7. The ... allows the operator to see and control the machine.
8. ... help distribute the weight of the dozer.

9. ... are used to maintain machines and reduce dust.
10. ... are used for leveling surfaces.

Exercise 4. Translate the text into Russian.

Draglines are highly productive and massive pieces of equipment that offer the lowest material cost per ton and have an operating life span of 40 years. They are the most productive and versatile machines in the mining industry. Utilized in a similar fashion as cranes, draglines are used primarily for open-pit operations to dismantle and transport materials. In strip mining operations, draglines with their long boom and large bucket are used to remove overburden from mines. Unlike smaller excavators, the dragline's design allows for precise digging below its base level, which is particularly useful in creating the necessary slopes for road embankments. Its ability to swing and dump materials over a considerable distance reduces multiple handling, speeding up the construction process. The machine operates from a stable platform above the excavation site, reducing the risk of cave-ins and improving worker safety.

UNIT 4. OIL AND GAS

Text 1. The Oil and Gas Industry

The oil and gas industry is usually divided into two major sectors: **upstream** and **downstream**.

The upstream oil sector is also commonly known as the **exploration** and **production** (E&P) sector. Upstream activities include exploratory work, such as the search for underground (or underwater) oil and gas **reservoirs**, and the initial **drilling**, followed by the production phase, which is the actual **extraction** of oil from the ground.

The downstream sector is the part of the oil industry involved with purifying **crude oil** and **refining** it into different products. It also involves the **transportation** and **marketing** of crude oil and its products.

In addition to these two sectors, many experts now recognize a **midstream** sector. This sector encompasses operations such as building

and maintaining **pipelines, storage facilities, and processing plants** that transport and prepare **hydrocarbons** for refining or **distribution**.

Exercise 1. Read the text and decide whether the following statements are true or false.

1. The upstream sector is responsible for refining crude oil into different products.
2. Exploration is part of the upstream sector.
3. Drilling goes after the production phase.
4. The production phase involves producing petrochemicals.
5. Downstream activities include searching for underground reservoirs of oil and gas.
6. Marketing involves transporting crude oil from production sites to refineries.
7. The midstream sector primarily involves activities related to the transportation and marketing of petroleum products.

Exercise 2. Match the words with their definitions.

| | |
|-------------------|---|
| 1) upstream | a) the process of purifying and converting raw materials into usable products |
| 2) downstream | b) natural, unrefined petroleum taken directly from the ground |
| 3) exploration | c) the movement of oil and its products from one place to another, such as by pipelines or ships |
| 4) reservoir | d) the part of the industry involved with finding and producing oil |
| 5) drilling | e) the activity of promoting and selling products to consumers |
| 6) refining | f) the act of creating holes in the ground to access oil reserves |
| 7) crude oil | g) the part of the industry that involves processing raw oil into different products and selling them |
| 8) extraction | h) the activity of searching for underground or underwater oil and gas deposits |
| 9) transportation | i) a large natural underground structure where oil or gas is found |
| 10) marketing | j) the phase where oil is removed from underground sources |

Exercise 3. Fill in the blanks with the most appropriate words from the list below.

storage facilities, processing plants, distribution, hydrocarbons, production, pipelines, midstream

The oil and gas industry revolves around the extraction, transportation, and refinement of hydrocarbons, with each sector playing a critical role. Upstream focuses on 1) ..., extracting crude oil and natural gas from reservoirs. The 2) ... sector ensures efficient transport through 3) ... and other infrastructure, while 4) ... help balance supply and demand. 5) ... in the midstream and downstream sectors refine raw 6) ... into usable products, which are then delivered to consumers through extensive 7) ... networks. Together, these components form an integrated system that powers global energy needs.

Text 2. An Introduction to the Upstream Sector

Exploration

The upstream sector begins with exploration, where geologists and geophysicists study the Earth's surface and underground layers to identify promising areas that may contain oil. They use techniques like seismic surveys, which send sound waves into the ground and analyze how they bounce back, creating images of what lies beneath. Satellite images and other advanced tools also help gather valuable information about potential sites.

Once a promising location is identified, further testing and analysis are conducted to assess the size and quality of the reserves. This initial phase is crucial for determining whether commercial extraction is feasible.

Drilling

Once a promising location is identified, companies proceed to drill a well to determine if oil is present. Drilling involves using a long pipe called a drill string that rotates to bore into the earth. During this process, circulating drilling mud helps cool the drill bit and carries away rock debris. When the workers reach the target depth, they insert a casing—a pipe that lines the well—and seal it with cement for safety and stability.

There are two main types of drilling: onshore and offshore. Onshore drilling takes place on land and is generally simpler and less expensive

because access is easier, allowing equipment to be moved more readily. Offshore drilling occurs in the ocean, where companies build specialized platforms – either floating or supported by tall legs resting on the seabed – to reach underwater reservoirs. Offshore rigs are more complex and costly due to harsh environmental conditions like waves, wind, and cold temperatures, especially in deep water or remote locations.

Initial Production

After confirming that oil exists at a site through exploration and drilling, companies move into production the process of extracting oil from underground reservoirs. During production, oil naturally flows from underground through the well into surface facilities if enough pressure exists within the reservoir. This natural pressure can sometimes push sufficient amounts of oil to the surface; however, over time, as oil is extracted, this pressure diminishes. To assist in extracting the remaining oil, pumps are often used to help lift the oil from the well to the surface.

To maintain or increase flow when natural pressure declines, techniques known as enhanced oil recovery are employed. These involve injecting substances such as steam or chemicals into the reservoir to boost pressure or alter how fluids move within the rocks. This helps push more oil toward the wellbore for extraction.

Exercise 4. Read the text above and answer the questions in full sentences.

1. What are the main techniques used during exploration to identify promising oil sites?
2. What does the drilling process consist of?
3. How do the two types of drilling (onshore and offshore) compare in terms of location, complexity, and cost?
4. What happens during initial production when enough pressure exists within the reservoir?
5. How does enhanced oil recovery work, and why is it important in oil extraction?

Exercise 5. Translate one part of Text 2 into Russian in written form.

Exercise 6. Read Text 3. Decide whether the following statements are true or false.

1. Crude oil arrives at refineries already free of impurities.
2. Refineries only use distillation to process crude oil into usable fuels.
3. Gasoline and naphtha are collected from the top of the fractionating column during distillation.
4. Pipelines are mainly used for short-distance transportation.
5. Specialized ships transport crude oil internationally.
6. Oil companies buy waxes and asphalt from manufacturers.

Text 3. An Introduction to the Downstream Sector

Refining

At the heart of downstream operations are refineries, where crude oil undergoes a series of complex transformations. When crude oil arrives at a refinery, it contains hundreds of different hydrocarbon compounds mixed with impurities like sulfur. The refining process begins with distillation, where crude oil is heated in tall fractionating columns. As vapors rise through the column, they condense at different levels based on their boiling points. Light products like gasoline and naphtha are drawn from the top, while heavier products like lubricating oil and fuel oil are collected from lower sections.

However, distillation alone cannot meet modern fuel demands. Additional processes like catalytic cracking, reforming, and hydrotreating are employed to convert heavy fractions into more valuable light products and remove contaminants.

Transportation and Marketing

After crude oil is refined into usable products, a transportation network delivers them to consumers. Pipelines serve as the primary method for moving large volumes over long distances, while tanker trucks and railcars handle shorter routes and remote areas. For international trade, specialized ships transport petroleum products across oceans. Before reaching end users, fuels are stored in large terminals near demand centers to ensure a steady supply. The marketing phase then distributes these products to gas stations, airports, industries, and homes. Additionally, oil companies sell products like waxes and asphalt to manufacturers and construction firms.

Exercise 7. Answer the questions in full sentences.

1. What happens to crude oil at refineries?
2. How does distillation separate crude oil?
3. Which products come from the bottom of the fractionating column?
4. What additional refining processes are used after distillation?
5. How are refined products transported?

UNIT 5. MINERAL PROCESSING

Ore Processing

Mineral processing (ore dressing or ore beneficiation) is an art of treating crude ores and mineral products in order to separate the valuable minerals from the waste rock, or gangue. It is the first process that most ores undergo after mining in order to provide a more concentrated material for the procedures of extractive metallurgy. The primary operations are comminution and concentration, but there are other important operations in a modern mineral processing plant, including sampling and analysis and dewatering.

Exercise 1. Read the introduction above and match the English terms with their Russian equivalents.

| | |
|------------------------------|------------------------|
| to treat ores | подвергаться обработке |
| gangue | измельчение |
| to undergo a process | обогащение руды |
| extractive metallurgy | обезвоживание |
| comminution | обогажительная фабрика |
| concentration | перерабатывать руды |
| sampling | пустая порода |
| dewatering | добывающая металлургия |
| processing plant | концентрация |
| ore dressing / beneficiation | опробование |

Sampling and analysis

Routine sampling and analysis of the raw material being processed are undertaken in order to acquire information necessary for the economic appraisal of ores and concentrates. In addition, modern plants

have fully automatic control systems that conduct in-stream analysis of the material as it is being processed and make adjustments at any stage in order to produce the richest possible concentrate at the lowest possible operating cost.

Sampling is the removal from a given lot of material a portion that is representative of the whole yet of convenient size for analysis. It is done either by hand or by machine. Hand sampling is usually expensive, slow, and inaccurate, so that it is generally applied only where the material is not suitable for machine sampling (slimy ore, for example) or where machinery is either not available or too expensive to install.

After one or more samples are taken from an amount of ore passing through a material stream such as a conveyor belt, the samples are reduced to quantities suitable for further analysis. Analytical methods include chemical, mineralogical, and particle size.

Comminution

In order to separate the valuable components of an ore from the waste rock, the minerals must be liberated from their interlocked state physically by comminution. As a rule, comminution begins by **crushing** the ore to below a certain size and finishes by **grinding** it into powder, the ultimate fineness of which depends on the fineness of dissemination of the desired mineral.

In primitive times, crushers were small, hand-operated pestles and mortars, and grinding was done by millstones turned by men, horses, or waterpower. Today, these processes are carried out in mechanized crushers and mills.

Some ores occur in nature as mixtures of discrete mineral particles, such as gold in gravel beds and streams and diamonds in mines. These mixtures require little or no crushing, since the valuables are recoverable using other techniques. Most ores, however, are made up of hard, tough rock masses that must be crushed before the valuable minerals can be released.

Concentration

Concentration involves the separation of valuable minerals from the other raw materials received from the grinding mill. In large-scale operations this is accomplished by taking advantage of the different

properties of the minerals to be separated. These properties can be colour (optical sorting), density (gravity separation), magnetic or electric (magnetic and electrostatic separation), and physicochemical (flotation separation).

Dewatering

Concentrates and tailings produced by the methods outlined above must be dewatered in order to convert the pulps to a transportable state. In addition, the water can be recycled into the existing water circuits of the processing plant, greatly reducing the demand for expensive fresh water.

Exercise 2. Answer the questions to the text.

1. What are the two main purposes of sampling and analysis in mineral processing?
2. How do modern plants automate the sampling and adjustment process?
3. What are the three main disadvantages of hand sampling?
4. Under what circumstances would hand sampling still be used?
5. What three types of analysis are performed on reduced samples?
6. Why is comminution necessary for most ores?
7. Describe the two-stage process of comminution.
8. What determines how finely the ore needs to be ground?
9. Compare traditional and modern comminution methods.
10. Which types of ores require little or no crushing? Why?
11. What is the goal of the concentration process?
12. Name four mineral properties used in separation and the corresponding techniques.
13. Why might different separation methods be used in combination?
14. What two purposes does dewatering serve?
15. How does water recycling benefit the processing plant?

Exercise 3. Match the terms with their definitions.

| | |
|----------------|---|
| 1. comminution | a) waste material from processing |
| 2. concentrate | b) real-time monitoring during processing |

| | |
|---------------------------|---------------------------------------|
| 3. tailings | c) valuable mineral product |
| 4. gravity separation | d) water removal from pulps |
| 5. flotation separation | e) size reduction of ore |
| 6. dewatering | f) separation by density differences |
| 7. in-stream analysis | g) measuring grain dimensions |
| 8. particle size analysis | h) separation using surface chemistry |

Exercise 4. Fill in the blanks using the information from the text.

1. ... sampling is used for slimy ores that clog machines.
2. The fineness of grinding depends on the ... of the mineral.
3. ... separation works well for magnetic minerals like magnetite.
4. Ancient comminution used ... and ... powered by animals.
5. Water recycling reduces the need for expensive

Exercise 5. Speaking: Complete the table and compare traditional and modern methods of ore beneficiation. Provide the necessary details.

| aspect | traditional methods | modern methods |
|-------------|---------------------|----------------|
| comminution | hand tools | mechanized |
| sampling | manual | _____ |
| analysis | visual | _____ |
| efficiency | low | _____ |

Exercise 6. Translate the text.

Dressing, or the concentration process, normally begins with crushing and grinding. In certain cases, pre-dressing is done, which means that coarse waste particles are separated from the ore flow at an early stage of the process. Pre-dressing is not always possible, for example, if a commercially valuable mineral has small-sized grains. Generally, pre-dressing also leads to some loss of valuable elements. The goal of crushing and grinding is to reduce the ore to a particle size where a mineral can be separated from the waste in subsequent separation

processes. The most common separation processes are based on differences in the density, magnetic or surface properties of different minerals. But there are also methods based on differences in electrical conductivity or optical properties.

UNIT 6. CONSTRUCTION

Exercise 1. Discuss the following questions with a partner.

1. What do you know about construction?
2. What kinds of things do people build?
3. What are some of the world's most famous buildings and structures?
4. What materials are commonly used in construction?
5. What tools and machinery do construction workers use?

Exercise 2. Write Russian equivalents of the following words and phrases. If there are any words you don't know, add them to your vocabulary list.

building construction, industrial construction, residential, non-residential, public works, water supply, water treatment plant, utility network, underground excavation, tunnel boring machine, chemical plant, mill, heavy machinery

Exercise 3. Read the text carefully, paying attention to the use of the words listed in Exercise 2.

Construction Industry Sectors

The construction industry is a large and diverse field that plays a crucial role in shaping our environment. It can be divided into three main sectors: building construction, infrastructure, and industrial construction.

The first sector, building construction, focuses on creating structures where people live, work, or do business. Building construction is often split into two parts: residential and nonresidential. Residential buildings include houses, apartment complexes, and other structures designed for people to live in. Non-residential buildings include offices, schools, hospitals, shopping centers, and other commercial spaces. These

projects require careful planning to ensure safety, comfort, and functionality. Architects and engineers work closely with construction teams to design buildings that meet the needs of their users.

The second sector, infrastructure, is also known as “heavy civil” or “heavy engineering.” This sector involves large-scale public works that support transportation, water supply, energy, and communication systems. Examples include roads, bridges, tunnels, dams, railways, airports, water treatment plants, and utility networks for electricity and water distribution. Infrastructure projects are often complex because they cover vast areas and require specialized equipment and techniques. For example, tunnel construction is a key part of infrastructure work. Building tunnels involves underground excavation using tunnel boring machines (TBMs) or other methods to create passages beneath cities or mountains. This type of construction is challenging because it requires careful planning to avoid damaging existing structures and to ensure safety for workers.

The third sector, industrial construction, includes building facilities for manufacturing, energy production, mining, and processing industries. Examples are refineries for oil and gas, chemical plants, mills for processing raw materials, offshore platforms for energy extraction at sea, and factories for producing goods. Industrial projects often involve heavy machinery and specialized skills because they deal with complex systems like pipelines or high-pressure equipment.

Exercise 4. Translate the first two paragraphs of the text into Russian.

Exercise 5. Answer the questions in full sentences.

1. What are the three main sectors of the construction industry?
2. What does building construction focus on?
3. What are the examples of non-residential buildings mentioned in the text?
4. How do architects and engineers contribute to building construction projects?
5. What are the examples of infrastructure projects mentioned in the text?
6. Why is tunnel construction considered challenging?

7. What does industrial construction include?

Exercise 6. Write Russian equivalents of the following words and phrases. If there are any words you don't know, add them to your vocabulary list.

strength, longevity, environmental footprint, concrete, composite material, aggregate, gravel, admixture, high-performance concrete, durability, reinforced concrete, rebar, tensile strength, foundation, beam, shotcrete, steel, wood, cross-laminated timber, brick, clay, thermal insulation, load-bearing wall, facade, transparency, interior partition, double-glazed glass, low-emissivity glass

Exercise 7. Read the text carefully, paying attention to the use of the words listed in Exercise 6.

Building Materials

Building materials are the fundamental elements of the construction industry. The choice of materials significantly impacts the strength, longevity, safety, and environmental footprint of any construction project. Understanding the properties and applications of different building materials is essential for designing effective and sustainable structures.

Concrete is one of the most widely used building materials worldwide due to its versatility and strength. It is a composite material made from cement, water, aggregates (such as sand and gravel), and sometimes admixtures to enhance specific properties. Concrete can be produced in many varieties to suit different needs. For example, standard concrete is suitable for general construction purposes, while high-performance concrete offers increased durability and strength for demanding applications. Reinforced concrete combines concrete with steel reinforcement bars (rebar), which provide tensile strength that concrete alone lacks. This combination makes reinforced concrete ideal for foundations, beams, columns, bridges, and large-scale infrastructure projects. Another specialized form is shotcrete, which is sprayed onto surfaces at high velocity using a hose. Shotcrete is especially useful in tunnel construction, repair work, or complex architectural shapes because

it can be applied quickly to irregular surfaces and provides immediate support.

Steel is another crucial building material known for its high tensile strength. It is often used in the construction of skyscrapers, bridges, and industrial buildings where structural integrity under tension is vital. Steel can be fabricated into various shapes and sizes, making it adaptable to many design requirements.

Wood remains a popular material in residential construction due to its lightweight nature, ease of use, and aesthetic appeal. It also has excellent insulating properties. However, wood requires treatment to improve its resistance to moisture, pests, and fire hazards. Despite these challenges, modern engineered wood products like cross-laminated timber (CLT) are gaining popularity because they combine natural beauty with enhanced strength.

Bricks are traditional building materials that have been used for centuries. Made from clay or other earthen materials that are fired at high temperatures, bricks offer good thermal insulation and aesthetic qualities. They are often used in load-bearing walls or facades for their durability and classic appearance. Modern innovations have led to the development of lightweight bricks and blocks that improve insulation while reducing overall weight.

Glass has become an essential material in contemporary architecture due to its transparency and ability to bring natural light into buildings. It is used extensively in windows, facades, skylights, and interior partitions. Advances in glass technology have produced energy-efficient options such as double-glazed or low-emissivity glass. They help reduce heating and cooling costs while maintaining aesthetic appeal.

Exercise 8. Answer the questions in full sentences.

1. Why is the choice of building materials important in construction projects?
2. What are the main components of concrete?
3. How does high-performance concrete differ from standard concrete?
4. What is reinforced concrete?
5. What is shotcrete?
6. What are the key properties of steel?

7. What are the advantages and disadvantages of using wood in residential construction?
8. What are the key properties of bricks?
9. In what parts of buildings are bricks often used?
10. In what parts of buildings is glass usually used?

Exercise 9. Match the words with their definitions.

| | |
|-----------------------|--|
| 1) aggregate | a) a material consisting of blocks of dried or baked clay |
| 2) composite material | b) the ability of a material or structure to withstand force or pressure without breaking or deforming |
| 3) foundation | c) a building material made from a mixture of cement, water, aggregates, and sometimes admixtures |
| 4) steel | d) the maximum stress a material can withstand while being stretched |
| 5) transparency | e) a horizontal structural element that supports loads from above |
| 6) strength | f) particles like sand, gravel, or crushed stone used in making concrete |
| 7) brick | g) a material made from two or more different substances |
| 8) beam | h) a material primarily made of iron and carbon |
| 9) concrete | i) the quality of allowing light to pass through |
| 10) tensile strength | j) the lowest part of a building that transfers its load to the ground |

Exercise 10. Translate the text into Russian.

Immersed tube tunnels are a type of underwater tunnel built by placing prefabricated sections, called tubes, beneath a body of water such as a river or sea. The construction process begins with designing and manufacturing the tunnel sections in a dry dock or factory. These large segments are then floated to the construction site using tugboats. Once in position, a trench is excavated along the planned route on the seabed or riverbed. The tunnel sections are carefully lowered into this trench and connected to form a continuous tunnel. After placement, the joints between the sections are sealed to prevent water leakage. The interior of each segment is reinforced with concrete and steel supports to ensure stability and safety. Once the tunnel is securely assembled, the trench

around it is filled back with soil or gravel, and the surface is restored to its original condition.

UNIT 7. ELECTRICAL ENGINEERING

Exercise 1. Discuss these questions with a partner.

- What do you know about electricity?
- Can you name any devices that use electricity?
- What jobs do you think electrical engineers do?
- Why do you think electricity is important in our lives?
- Have you ever seen an engineer at work? What were they doing?

Exercise 2. Read the text below and say if the following sentences are True or False. Correct false information.

1. Electrical engineering is only about building computers.
2. Electrical engineers work with electricity and electronics.
3. Electrical engineers design and test electrical equipment.
4. They only work in power plants.
5. Electrical engineers help create devices like smartphones.
6. They need to know how to use electricity safely.
7. Electrical engineering is not important for daily life.
8. Electrical engineers help solve problems.
9. They work in many different industries.
10. Electrical engineers do not work with communication systems.

What is Electrical Engineering?

Electrical engineering is a field of engineering that studies electricity, electronics, and electromagnetism. Electrical engineers design, develop, and test electrical equipment, such as motors, generators, communication systems, and power systems. They work in many industries, including energy, transportation, telecommunications, and manufacturing.

Electrical engineers help create devices we use every day, like smartphones, computers, and home appliances. They also work on large systems, such as power plants and electrical grids, which supply electricity to homes and businesses. To do this job, electrical engineers

need to understand how electricity works and how to use it safely and efficiently.

Electrical engineering is important because it helps make our lives easier and more comfortable. It also helps solve problems, such as how to produce clean energy or how to improve communication between people.

Exercise 3. Complete the sentences with the correct word:

electricity, engineer, equipment, design, develop, devices, power, industry, communication, solve

1. An electrical ... works with electricity and electronics.
2. They ... and test electrical
3. Electrical engineers help ... problems.
4. Many ... use electricity, such as computers and phones.
5. The energy that powers our homes is called
6. Electrical engineers ... new systems for companies.
7. They work in many different
8. Good ... is important for engineers working in teams.
9. Electrical engineers ... equipment to make life easier.
10. A ... plant supplies energy to many homes.

Exercise 4. Match the words with their correct meanings.

| | |
|-----------------|--------------------------------------|
| 1) governed | a) dangerous, risky |
| 2) jeopardize | b) strict, very severe |
| 3) ventilation | c) controlled or influenced by rules |
| 4) depreciation | d) workers, employees |
| 5) stringent | e) loss of value over time |
| 6) hazardous | f) essential, necessary |
| 7) flammable | g) actions taken to prevent danger |
| 8) integral | h) able to catch fire easily |
| 9) personnel | i) putting something at risk |
| 10) precautions | j) air circulation system |

Exercise 5. Read the text and answer the questions below.

Mine Power Supply

Power supply for mining operations is governed by numerous specific requirements which give such systems a special character compared with electrical systems. In addition to striking differences in the basic design, mine power supply systems also involve a number of special features relating to the installation of the system and necessitated by particular operating conditions deriving from environmental factors, difficult maintenance and repair operations, and special safety considerations. Similarly, the impact of any power failures is considerably greater as compared to aboveground installations: a power failure underground may jeopardize the entire mine (pit) and, more importantly, endanger human life (pit ventilation breakdowns and other accidents). The design of mine power supply systems also poses specific requirements regarding the service life and depreciation of the installation. Thus, the economic aspect has a particular bearing on the basic design parameters, especially where the cable network is concerned. Whereas the useful life of an aboveground cable may even exceed thirty years, in pit conditions it may be reduced to as low as one or two years, which has a great deal of relevance to the design of the network and for the requirements to be met by other equipment.

Finally, special attention should be paid to safety considerations, particularly to the potentially hazardous atmosphere containing explosive mine gas. This potential danger necessitates that most stringent precautions be taken, lest the use of electric power should bring further possible hazards, such as fires or explosions of flammable gases or dust. Electrical installations are an integral part of mine equipment, particularly in the working zone, and are handled directly by operating personnel. Considering the limited space and difficult environmental conditions, this implies an increased potential hazard of electric contact due to possible faults in the electrical system. Therefore, protection against electric-shock hazards must be designed in such a way that no danger to mine personnel can come from such faults in the system.

1. Why are mine power supply systems different from aboveground systems?
2. What are the dangers of a power failure in a mine?

3. How long can an aboveground cable last compared to an underground one?
4. Why are strict safety measures necessary in mines?
5. What are some hazards caused by electricity in mines?
6. Who works directly with electrical installations in mines?
7. Why is protection against electric shock important in mines?

Exercise 6. Match the terms to their Russian equivalents.

| | |
|--------------------------|---|
| 1) flammable gas | a) срок службы |
| 2) cable network | b) воспламеняющийся газ, горючий газ |
| 3) operating personnel | c) особые/специальные требования |
| 4) special features | d) ограниченное пространство |
| 5) power failures | e) технический персонал |
| 6) service life | f) кабелепроводка, кабельная сеть |
| 7) specific requirements | g) добыча открытым способом, карьерная добыча |
| 8) limited space | h) перебой в подаче электроэнергии |
| 9) open-pit operations | i) главная проблема |
| 10) key challenge | j) специальные функции, особенности |

Exercise 7. Say if the following sentences are True or False. Correct the false ones.

1. The mine power supply system's architecture places certain constraints on cutting carbon emissions.
2. Particularly in the case of the cable network, the practical element has a specific impact on the fundamental design parameters.
3. Mine equipment is not effective without electrical installations, especially in the working zone.
4. Safety precautions need to be taken very seriously, especially in light of the potentially dangerous environment that contains explosive mine gas.
5. Even under pit conditions, an aboveground cable's usable life can last longer than thirty years.

Exercise 8. Translate the text into Russian.

Power plants make electricity by transforming natural energies from the world. Power plants generate electricity and send it to our homes and businesses. This energy travels through a network called the grid. It's like a huge invisible highway made of wires. Electric companies work hard to make sure this power highway is stable and reliable. Electricity moves at super-fast speeds over long distances. The grid uses substations to help control and distribute the power. Transformers within the substations adjust the electricity to the right level for safe home use. Keeping the grid stable is a big job. If too much electricity is made, it could be wasteful. If too little is made, there might not be enough to go around. Electric companies balance this to make sure electricity is always there when you flip the switch.

UNIT 8. ELECTRONICS AND IT

Exercise 1. Discuss the following questions with your partner.

1. What electronic devices do you use every day? Which one could you NOT live without? Why?
2. Have you ever fixed a broken electronic device? What was wrong with it?
3. How has technology changed the way we communicate compared to 10 years ago?
4. What household tasks do you think robots or AI will do for us in the future?
5. What skills do you think are most important for an IT professional? Why?
6. Would you prefer to work in software development (apps/websites) or hardware (computers/robots)? Why?
7. Is it safe to share personal data online? Give examples of risks and benefits.
8. Should children learn to code at school? Why/why not?
9. What invention do you hope will exist in 50 years? How would it help people?
10. Will books/paper disappear because of e-books and tablets? Why do you think so?

Exercise 2. Read the text and match the terms to their definitions below.

What is Electronics and IT?

Electronics and Information Technology (IT) are two closely related fields that power our modern world. Electronics deals with electrical circuits and devices, such as smartphones, computers, and medical equipment. IT (Information Technology) focuses on storing, processing, and transmitting data using computers and networks. Together, they shape how we communicate, work, and live.

Key Areas of Electronics and IT:

1. Hardware – Physical components like processors, keyboards, and circuit boards;
2. Software – Programs and apps that run on devices (e.g., Windows, TikTok);
3. Networks – Systems that connect devices (Wi-Fi, 5G, cloud computing);
4. Cybersecurity – Protecting data from hackers and viruses;
5. AI (Artificial Intelligence) – Smart systems like chatbots and self-driving cars.

Electronics and IT engineers design, build, and maintain these technologies. They need skills in coding, problem-solving, and teamwork to innovate and fix issues.

| | |
|------------------|---|
| 1) hardware | a) programs that run on computers or phones |
| 2) software | b) machines that can perform tasks like humans |
| 3) network | c) physical parts of a computer or device |
| 4) cybersecurity | d) protection against online threats |
| 5) AI | e) a system that connects devices to share data |
| 6) coding | f) writing instructions for computers |
| 7) cloud | g) online storage for files and programs |
| 8) data | h) digital information collected and processed |
| 9) circuit | j) professional who designs technical systems |
| 10) engineer | i) path for electricity in electronic devices |

Exercise 3. Complete the sentences with the following terms:

coding, circuits, data, engineers, cloud, hardware, software, network, cybersecurity, AI

1. Modern smartphones contain both ... and ... components.
2. Computer ... write programs using programming languages.
3. Electrical ... allow devices to process information.
4. Large companies store their ... on secure servers.
5. The ... allows you to access files from any device.
6. ... specialists protect systems from hackers.
7. Many apps use ... to provide personalized recommendations.
8. A strong Wi-Fi ... is essential for video calls.
9. Learning ... helps you create websites and apps.
10. Tech ... solve problems and develop new inventions.

Exercise 4. Are the following sentences True or False?

1. Hardware includes physical components like keyboards.
2. Software refers only to computer games.
3. Networks can be wireless or wired.
4. Cybersecurity isn't important for personal devices.
5. AI is used in voice assistants like Siri.
6. Coding is only useful for IT professionals.
7. The cloud stores information on your personal hard drive.
8. Data can include text, numbers, and images.
9. Circuits are only found in large computers.
10. Engineers work in many different technical fields.

Exercise 5. Read the text below and complete the sentences with the correct word:

efficiency, sensors, downtime, predictive, remotely, safety, data, maintenance, alerts, productivity.

1. IoT helps mining companies increase ... and reduce costs.
2. ... are devices that collect information from mining equipment.
3. Reducing ... means less time when machines are not working.
4. ... maintenance predicts when equipment needs repair before it breaks.
5. Engineers can fix some problems ... without going to the mine site.
6. Worker ... is very important in mining because of the risks involved.
7. Mining companies collect a lot of ... to improve their operations.
8. IoT systems can send ... to warn about problems or dangers.

- 9. Increasing ... means producing more with the same resources.
- 10. Sensors help monitor equipment to avoid unexpected

The Internet of Things (IoT) in Mining

While technologies such as artificial intelligence, machine learning, drones, etc., are already being used in the mining industry, IoT solves the challenges of the industry at the core, helping mining organisations gain efficiency and save operational costs. Let's check out how.

Cost Optimisation

The driving purpose for mining organisations' utilisation of IoT in their operations is to increase productivity and cost optimisation. By implementing sensors on mining hardware and systems that monitor equipment, diggers can utilise huge sets of data, also known as big data, to find more cost-effective methods of conducting their operations and further developing efficiency along these lines. The deployment of sensors likewise can diminish operational downtime by and large, as organisations can utilise the data accumulated to train their machinery and prevent breakage.

For example, Glencore's Matagami Zinc mine in Canada has been utilising digital sensors organisation Newtrax since 2016. Using Newtrax's Mobile Equipment Telemetry (MET), which furnishes mine tasks with fundamental data from interconnected resources and equipment, Glencore can effectively see how their equipment functions to improve efficiency. Over time, the organisation has revealed that the average tonnage of ore pulled in each outing has ascended from 55 tons to 60 tons.

Predictive Maintenance

Having a completely integrated network, checking each part of an operation becomes far simpler and results in more prominent functionality and security. It consists of identifying wear and tear for crucial pieces of equipment and projecting when repairs or maintenance are required.

More Control

Administrators can gain significant insights in real-time by monitoring, gathering, and analysing the data from individual mining equipment. IoT assists administrators with comprehension in case there is

a breakage or deterioration in performance, offering them the chance to respond quickly and suitably. In the mining business, each rock squashed is cash in the bank. Administrators can't stand to have systems down for a few hours while they trust that an engineer will head out to the site as it can bring about a considerable loss in production. While IoT can assist with reducing the cases of downtime, issues will happen, and when they do, each moment counts in the race to fix. Nonetheless, IoT can help here, as well. Engineers don't generally have to have an actual presence on location to repair with approval from administrators. They can sign in remotely and help mine workforce to address the issues, saving the site important time and money.

Better Plant Design

One of the initial applications of IoT in the mining industry is plant design. Each plant is interesting with a unique hardware set and flow sheet that details the production stream. Data gathering devices like sensors are often not set in predetermined locations in the flowsheet in light of the theory during the underlying design. When deployed, these wired gadgets become static, and it's undeniably challenging to make additions or adjustments because of the capital escalated and tedious process. Presently, with IoT communications technologies, you can be substantially more flexible. You can move the sensor around and choose which area is ideal for data collection during production.

Improved Safety

There are noticeable risks in the mining business, even though innovation has figured out how to kill some of them. IoT can assist with forestalling the breakdown of unsound shafts because the sensors will get real-time information and predict any faulty machine or where issues might occur, which considers modifications to be made before anything turns out wrong. Mining organisations can likewise avoid accidents. Moreover, an IoT powered central system can provide better evacuation procedures and rescue operations in case of an accident. To improve safety, IBM has partnered with wearable technology developer Garmin to provide mining organisations with real-time sensor information and alerts on their workforce. Using IBM's Maximo Worker Insights solutions, an IoT platform that gathers data from wearables and natural sensors, mining organisations can get real-time alerts and

warnings on high pulses, man-down situations and other biometric signs to further safeguard worker safety.

Exercise 6. Rewrite these sentences about IoT using the word in brackets:

1. IoT helps predict equipment failures. (PREDICTIVE)
→ IoT enables ... maintenance.
2. Sensors collect data about machine performance. (TELEMETRY)
→ ... systems monitor equipment.
3. The system shows information immediately. (REAL-TIME)
→ The ... display helps operators.
4. Workers wear health-tracking devices. (WEARABLES)
→ ... monitor biometric data.
5. The diagram explains production steps. (FLOW)
→ The ... sheet shows the process.
6. The mine reduced unplanned stops. (DOWNTIME)
→ They minimized production
7. Engineers can fix problems from afar. (REMOTELY)
→ Repairs can be done
8. Data helps find cost savings. (BIG)
→ ... analysis improves efficiency.
9. The layout uses movable detectors. (SENSORS)
→ Flexible IoT ... help adaptation.
10. Alarms warn about shaft stability. (SAFETY)
→ ... systems prevent accidents.

Exercise 7. Find and correct one mistake in each sentence:

1. IoT helps mining companies to loose less money.
2. Predictive maintenance prevent unexpected breakdowns.
3. The telemetry system sended data every minute.
4. Workers uses wearables to track health.
5. Real-time dates helps quick decisions.
6. Flow sheets shows production steps.
7. Biometric signs include heart rate.
8. Downtimes are expensive for mines.
9. Sensor can be moved easily now.
10. Big datas analysis finds efficiencies.

Exercise 8. Match each mining problem with its IoT solution:

| | |
|--------------------------------------|----------------------------------|
| 1) unexpected equipment breakdowns | a) predictive maintenance alerts |
| 2) dangerous working conditions | b) wearable biometric monitors |
| 3) inefficient production flow | c) mobile IoT sensors |
| 4) high operational costs | d) remote repair access |
| 5) slow emergency response | e) real-time monitoring systems |
| 6) difficulty tracking worker health | f) optimized flow sheet analysis |
| 7) wasted time waiting for repairs | g) automated evacuation systems |
| 8) static sensor locations | h) big data cost analysis |
| 9) lack of real-time data | i) equipment telemetry systems |
| 10) poor maintenance planning | j) centralized safety alerts |

Exercise 9. Translate the following passage into Russian.

Digital twins are digital copies of real assets, structures, or operations used in mining. These digital equivalents give mining businesses access to real-time data and observations, allowing them to proactively evaluate and improve their activities. Businesses can replicate different situations, anticipate possible problems, and make data-driven decisions by incorporating digital twins into mining processes. This method dramatically lowers operating expenses and downtime while simultaneously increasing efficiency. Digital twins, for instance, can examine drilling trends and recommend more effective strategies. They can also evaluate how various mining processes affect the extraction of resources, assisting you in selecting the most efficient ones. With this data-driven strategy, you can be confident that your procedures are set up to produce the most with the least amount of waste.

UNIT 9. ECONOMICS**Exercise 1. Discuss the following questions with your partner.**

1. If mines can't choose where minerals are located, how does this make mining different from other businesses?
2. Why might a gold mine and copper mine in the same country have completely different profits?

3. What invisible costs might a mining company have that a smartphone factory wouldn't?
4. How could changing electricity prices dramatically affect a mine's profits?
5. If a mine takes 5 years to become profitable, what risks does this create?
6. Why would a rich mineral deposit sometimes lose money while a poorer one succeeds?
7. What happens to mining towns when metal prices suddenly drop?
8. Should governments charge mines more for operating permits if mineral prices rise?
9. How might a mining company 'prepare for the future' when prices are high?
10. Would you invest in a mine knowing profits might take 10+ years? Why/why not?

Exercise 2. Match each term (1-18) with its definition (A-R).

| | |
|--------------------------------|--|
| 1) geographic constraints | a) cleaning and restoring land after mining ends |
| 2) natural resource | b) percentage of valuable metal in mined rock |
| 3) commodity price | c) physical barriers like mountains or rivers affecting operations |
| 4) ore grade | d) building roads, power lines, and other support systems |
| 5) environmental remediation | e) money set aside for emergencies or future needs |
| 6) infrastructure development | f) processes that use large amounts of electricity/fuel |
| 7) energy-intensive operations | g) when a country limits foreign access to its minerals |
| 8) cost structures | h) rapid, unpredictable price changes in global markets |
| 9) short/long-term investments | i) materials like metals or oil found in nature |
| 10) market volatility | j) evaluating potential dangers before |

| | |
|---------------------------|---|
| | starting projects |
| 11) management efficiency | k) how well a company uses its workers and equipment |
| 12) economic dependence | l) government fees on business profits or production |
| 13) boom-bust cycles | m) planning for future goals and challenges |
| 14) taxation | n) when communities rely too heavily on one industry |
| 15) resource nationalism | o) the market value of metals/minerals |
| 16) strategic planning | p) patterns of economic growth followed by collapse |
| 17) reserve funds | q) money spent expecting returns over months or decades |
| 18) risk assessment | r) fixed vs. variable expenses in running a mine |

Exercise 3. Fill each gap with one term from Exercise 2.

1. ... occurs when countries limit foreign access to their minerals.
2. A high ... means each ton of rock contains more valuable metal.
3. After closing a mine, ... is required to clean up polluted land.
4. Aluminum smelting is one of the most ... due to its high electricity needs.
5. Before opening a mine, engineers conduct a ... to evaluate potential problems.
6. Building roads and power lines for remote mines involves significant ...
7. Copper is a valuable ... found in many electronic devices.
8. Digging a new mine requires ... that may take decades to repay.
9. Governments use ... policies to fund public services from mining profits.
10. Improving ... helps mines reduce waste and increase profits.
11. Labor and equipment expenses are key parts of a mine's
12. Mines should maintain ... to cover unexpected expenses.
13. Mining companies must consider ... like mountains or deserts that make transportation difficult.

14. Rapid changes in supply and demand cause ... for minerals like lithium.
15. Some countries develop ... on mining towns when no other industries exist.
16. The mining industry often experiences ... with periods of high profits followed by layoffs.
17. When the ... of gold rises, mines often increase production.
18. Wise ... helps companies prepare for future challenges like price drops.

Exercise 4. Translate into Russian.

The Mining Industry: Challenges and Strategies

The mining industry faces unique challenges due to geographic constraints and reliance on finite natural resources. Commodity prices and ore grade directly impact profitability, while energy-intensive operations drive up costs. Companies must balance short-term investments with long-term investments amid market volatility. Effective strategic planning and management efficiency help navigate boom-bust cycles, especially in regions with economic dependence on mining. Governments influence the sector through taxation and resource nationalism, requiring firms to maintain reserve funds for stability. Infrastructure development in remote areas adds complexity, while environmental remediation ensures sustainable practices. Before launching projects, thorough risk assessment is crucial to address operational and financial uncertainties. By optimizing these factors, mining companies can improve resilience and profitability in a competitive global market.

Exercise 5. Skim the text below and say what it is about.

The economics of the resources industry are unique. All mining is subject to uncertainties not applicable to other industries. Every mine is different. Industry economics are difficult to quantify and categorize. Information is very costly. In major mining countries, there is now a real dichotomy. The products of the minerals industry are essential primary ingredients in almost everything used in an advanced society, yet their availability is often taken for granted. In the developed world, the value of mining is increasingly being called into question. The difficulty in

making profits is compounded by political uncertainties and environmental restrictions on top of the uncertainties created by nature. Against this backdrop, however, actual production in many developed countries has increased. Despite declining prices, as well as profitability that frequently falls short of expectations, more capital continues to be injected into the industry. Many of the factors that lead to profits or losses escape recognition if conventional tools of analysis are used. Low profitability may be the order of the day for many participants in the industry, but this is not universal. In some cases, the finding of a rich orebody, either by skillful exploration or by chance, has been the key to success. Yet there are many examples of rich orebodies not producing profitable mines and of mediocre orebodies turning into successful long-term enterprises. In some cases, the ability of a company to anticipate the market has resulted in profits above expectations. More commonly, an unexpected market downturn has resulted in losses despite efficiency elsewhere in the mining operation.

Even in this environment, superficially similar mines have turned in vastly different profit performances. Management decision making and factors other than market pricing and orebody characteristics probably have a much greater influence on industry profitability than has been acknowledged up until now.

Exercise 6. Read the summaries below. Which one (A-D) best captures the main ideas of the text? Explain why the others are wrong.

A) Mining is a simple, predictable industry where all mines operate similarly. Companies easily make profits by following standard rules. Rich mineral deposits always lead to success, while poor ones always fail. Governments never interfere with mining operations.

B) The mining industry faces unique economic challenges due to natural and political uncertainties. Despite declining profits, production continues to grow. Success depends on factors beyond ore quality, like management decisions, but many influences are hard to measure with traditional methods.

C) Mining is becoming less important in modern societies because minerals are no longer useful. New technology eliminates all risks in the

industry. Every mine produces identical profits if they follow environmental rules strictly.

D) Only mines in developed countries face economic difficulties. Profitability is guaranteed when companies use conventional analysis tools. Market prices never change unexpectedly, and all mines require the same investment timeframe.

Exercise 7. Find these details in the text:

1. two reasons why some mines succeed unexpectedly;
2. the term meaning "rich mineral deposit";
3. what conventional tools fail to recognize;
4. two types of uncertainties affecting profits;
5. the phrase describing when profits are below expectations;
6. what continues to enter the industry despite challenges;
7. two ways rich orebodies are discovered;
8. what sometimes happens to efficient mines during market changes;
9. the phrase comparing profit performances of similar mines;
10. what has greater influence than previously thought.

UNIT 10. HEALTH, SAFETY, AND ENVIRONMENT

Exercise 1. Write the Russian equivalents of the following words and phrases. If there are any words you don't know, add them to your vocabulary list.

occupational safety and health, injury, safety issues, exposure, hazards, harmful chemicals, silica dust, safety rules, personal protective equipment, gloves, goggles, occupational diseases, accidents, hearing loss

Exercise 2. Read the text carefully, paying attention to the use of the words listed in Exercise 1.

Occupational Safety and Health in the Mining Industry

Mining is a vital industry that provides many of the materials we use every day, such as metals, minerals, and energy resources. However, working in mines can be very dangerous. Miners face many risks that can

cause injuries or serious health problems. Because of these dangers, safety and health are very important in the mining industry. One of the main safety issues in mining is exposure to airborne hazards, including harmful chemicals, asbestos fibers, and silica dust. These substances can cause health problems if workers breathe them in or come into contact with them. To stay safe, miners must follow safety rules and protect themselves by wearing personal protective equipment (PPE), such as masks, gloves, and goggles. Proper ventilation and safe disposal of chemicals are also important to prevent health issues and occupational diseases.

Mining also involves working with heavy machinery and vehicles. Accidents involving trucks, drills, or other equipment can cause severe injuries or even death if safety procedures are not followed. Managing traffic inside mines and making sure all machinery is well-maintained are essential steps to keep workers safe.

Explosives are another important part of mining operations. They are used to break rocks and create tunnels. Handling explosives safely is crucial because accidents can be very dangerous. Only trained workers should handle explosives, following strict safety rules for storage and detonation. Hearing loss is also a common problem for miners because of loud noises from drilling, explosions, and machinery. Without proper ear protection, workers risk permanent hearing damage.

Finally, miners at surface mining operations face weather-related dangers like heat and sun exposure during the summer months. Too much sun can cause sunburns, dehydration, headaches, or more serious health issues.

Exercise 3. Translate the first two paragraphs of the text into Russian.

Exercise 4. Answer the questions in full sentences.

1. Why are safety and health considered very important in the mining industry?
2. What are some airborne hazards miners are exposed to?
3. Why is proper ventilation important in mining operations?
4. What types of accidents involving machinery are common in mines, and what can be done to prevent them?

5. Who should handle explosives in mining?
6. How can loud noises from mining activities affect miners' health, and what can be done to protect them?
7. What weather-related dangers do surface miners face during the summer months?

Exercise 5. Match the words with their definitions.

| | |
|-----------------------------------|---|
| 1) occupational safety and health | a) a set of guidelines designed to prevent accidents and protect workers' health and safety |
| 2) occupational disease | b) an unexpected event that causes harm or damage, often leading to injuries |
| 3) hazard | c) an illness that workers can develop due to their work environment or conditions over time |
| 4) injury | d) the state of being in contact with something harmful or dangerous over a period of time |
| 5) safety rules | e) anything that has the potential to cause harm, injury, or damage |
| 6) exposure | f) physical harm or damage to the body |
| 7) accident | g) the field focused on protecting workers from risks at their job and ensuring safe working conditions |

Exercise 6. Fill in the blanks using the words from the list.

mine rescue, bravery, teamwork, collapse, gas leak, physical endurance, victim, emergency, rescue technique, obstacle course

1. Effective ... is crucial for completing complex rescue missions efficiently.
2. Rescue teams often train on an ... to improve their skills and coordination.
3. A ... can trigger an explosion in a mine if ventilation systems fail to operate effectively.

4. In case of an ... , workers are trained to respond swiftly and follow safety protocols.
5. Rescuers need ... to carry out long and physically demanding operations inside the mine.
6. A ... in a mine can trap miners underground for a long period.
7. The injured worker was identified as a ... who needed urgent medical attention.

Exercise 7. Write the Russian equivalents of the following words and phrases. If there are any words you don't know, add them to your vocabulary list.

extractive industry, pollution, sulfur dioxide, nitrogen oxide, acid rain, carbon dioxide, climate change, mercury, oil spill, coastline, marine life, soil degradation, topsoil, fertile, erosion, sinkhole, waste, waste rock, tailings, contaminate, earthquake, habitat destruction, biodiversity loss, extinction, sustainable development

Exercise 8. Read the text carefully, paying attention to the use of the words listed in Exercise 7.

Environmental Issues in the Resources Sector

Extractive industries are very important for providing the resources we use every day, such as metals, fuel, and energy. However, these industries also cause many serious environmental problems that can harm our planet. One major problem is air pollution. During mining and oil extraction, dust and harmful gases are released into the air. For example, gases like sulfur dioxide (SO₂) and nitrogen oxides (NO_x) can cause smog and acid rain, which damage plants, animals, and human health.

Additionally, gas flaring—burning off excess natural gas during oil production—releases large amounts of carbon dioxide (CO₂), a greenhouse gas that contributes to climate change. Another serious issue is water pollution. Mining often involves chemicals like cyanide or mercury to extract minerals. If these chemicals leak into rivers or lakes, they can poison water supplies for people and wildlife. Oil spills are also a significant problem, as they can cover large areas of the ocean or coastlines, killing marine life.

Soil degradation is another concern. Mining activities remove topsoil and disturb land, making it less fertile. This can lead to erosion, where soil is washed away by rain or wind. Additionally, mining can cause the formation of sinkholes if underground mine workings collapse. Waste is another problem. Mining produces large amounts of waste rock and tailings that need to be stored safely. If not managed properly, waste can contaminate soil and water sources. Mining and drilling can also trigger small earthquakes or tremors due to underground explosions. These seismic events can sometimes damage nearby buildings or ecosystems. Noise pollution from drilling rigs, trucks, and machinery also affects nearby communities and wildlife.

Finally, both industries often lead to habitat destruction and biodiversity loss. Forests are cleared to make way for mines or oil fields, destroying homes for many animals and plants. This loss of habitat threatens many species with extinction. It is crucial for companies and governments to adopt cleaner technologies and stricter regulations to reduce pollution and protect ecosystems. This will ensure sustainable development for future generations.

Exercise 9. Answer the questions in full sentences.

1. What are the two main types of pollution caused by mining and oil extraction?
2. What air pollutants are mentioned in the text?
3. How does gas flaring contribute to environmental problems?
4. What chemicals are often used in mining, and what risks do they pose to people and wildlife?
5. How does mining lead to soil degradation?
6. What are the two main types of waste produced by mining?
7. In what ways can seismic activity be triggered by mining or drilling?
8. How do extractive industries cause habitat destruction?
9. What should companies and governments do to reduce environmental damage from extractive industries?

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