МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ УКРАЇНИ
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ»

Англійська мова для науковців 1

Методичні вказівки
до практичних занять для студентів V курсу Інституту енергозбереження та енергоменеджменту

(напрям підготовки 6.050702 «Електромеханіка»,
спец. 7.05070205” Електромеханічні системи геотехнічних виробництв”)

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Англійська мова для науковців 1: Метод. вказівки до практичних занять для студентів V курсу Інституту енергозбереження та енергоменеджменту (напрям підготовки 6.050702 «Електромеханіка», спец. 7.05070205 "Електромеханічні системи геотехнічних виробництв") електронне видання / Укладачі: Семида О.В., Шиліна Л.І. – К.: НТУУ «КПІ». – 73 с.

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Навчальне видання

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ЗМІСТ

ПЕРЕДМОВА

Методичні вказівки розроблені відповідно до робочої навчальної програми «Англійська мова для науковців-1» факультету ІЕЕ для студентів 5 курсу і спрямовані на поглиблення практичних навичок володіння англійською мовою для професійного спілкування та наукової діяльності майбутніх інженерів спеціальностей «Електромеханіка», «Електромеханічні системи геотехнічних виробництв». Методичні вказівки призначені для роботи на практичних заняттях протягом 9 та 10 семестрів (20 годин аудиторних занять), можуть бути використані і для самостійної роботи студентів.

Видання складається з 10 розділів, які містять оригінальні тексти за фахом, вправи на розвиток лексичної, граматичної та мовленнєвої компетенцій. Кожний розділ включає передтекстові вправи, спрямовані на підготовку до сприйняття тексту, вправи на перевірку розуміння тексту та на засвоєння лексичних одиниць і граматичних структур, які містяться в тексті, а також творчі завдання. Автентичні англомовні тексти, взяті з науково-технічних електронних джерел, їх лексичне наповнення дає змогу підготувати студентів до спілкування за фахом англійською мовою, розроблені вправи спрямовані на активізацію засвоєних слів та виразів, удосконалення навичок аудіювання, говоріння та письма.

Виконання студентами методичних вказівок сприяє інтенсифікації процесу навчання англійської мови і створює умови для правильного і найбільш доцільного тренування, яке забезпечує тривалі навички розуміння структури науково-технічного тексту.

UNIT 1

A. UNDERSTANDING A PRINTED TEXT.

This text will give you information about automation role in industry and our society.

I. **Before reading the text discuss with your friend the role automation technologies play in our society. What problems can intensive application of automation technologies cause?**

II. **Speak about automation technologies used in energy industry.**

AUTOMATION

Automation, robotization or industrial automation or numerical control is the use of control systems such as computers to control industrial machinery and processes, replacing human operators. In the scope of industrialization, it is a step beyond mechanization. Whereas *mechanization* provided human operators with machinery to assist them with the *physical* requirements of work, *automation* greatly reduces the need for human *sensory* and *mental* requirements as well. Automation plays an increasingly important role in the global economy and in daily experience. Engineers strive to combine automated devices with mathematical and organizational tools to create complex systems for a rapidly expanding range of applications and human activities.

There are still many jobs which are in no immediate danger of automation. No device has been invented which can match the human eye for accuracy and precision in many tasks; nor the human ear. Even the admittedly handicapped human is able to identify and distinguish among far more scents than any automated device. Human pattern recognition, language recognition, and language production ability is well beyond anything currently envisioned by automation engineers. Specialized hardened computers, referred to as programmable logic controllers (PLCs), are frequently used

to synchronize the flow of inputs from physical sensors and events with the flow of outputs to actuators and events. This leads to precisely controlled actions that permit a tight control of almost any industrial process.

Social issues of automation

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

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

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

Millions of human telephone operators and answerers, throughout the world, have been replaced wholly (or almost wholly) by automated telephone switchboards

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

B. CHECK YOUR UNDERSTANDING

I. Answer the questions to the text.

1. What is the role and meaning of automation in industry?
2. Can automated devices replace a human being completely?
3. What social issues does the use of automation rise?
4. What are the advantages of automation use in industry?
5. What occupations are mostly subjected to the automation process?
6. What is the side-effect of the automation implementation?

II. Find English equivalents in the text.

Фізичні вимоги

Щоденний досвід

Автоматизовані прилади

Розширюючи діапазон застосування

Програмований логічний контролер

Соціальні питання

Вплив автоматизації на безробіття

Передова технологія

Кваліфікований труд

Затьмарити довготривалий вплив

III. Explain the meaning of the following expressions.

Human pattern recognition

Human sensory and mental requirements

Computerized systems

Skilled job

Outsourcing

C. INCREASE YOUR VOCABULARY

I. Find synonyms in the text to the following words

Entire, to try, to recognize, endanger, to initiate, to profit, unclear, to diminish, sharply, advanced.

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

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

a) reduces b) produces c) benefits

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

a) is inventing b) has been invented c) has been inventing

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

a) flow of inputs b) flow of charts c) synchronized data

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

a) usage of computers b) economic progress c) advance of technology

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

a) is benefiting b) is encroaching c) is assailing

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

a) outsourcing b) mechanization c) luddites

III. Translate into English

1. Все ще залишається чимало робіт яким не загрожує автоматизація.
2. В тестовій автоматиці автоматизоване тестове обладнання контролюється комп'ютером.
3. Автоматизація може призвести до зростання рівня безробіття у всьому світі.
4. Автоматизація знецінює людський труд, замінюючи його менш дорогими машинами.
5. Дивним побічним ефектом автоматизації є поява поява можливості для робітників виконувати більш інтелектуальну та кваліфіковану роботу.

D. GRAMMAR REVISION

Study the underlined examples in the text. What types of subordinate clauses are they?

I. Combine the sentences using a relative clause.

1. There are many jobs. These jobs are in no immediate danger of automation process.
2. We really need good physicians. Even they can be partly replaced by the robots.
3. Industrial automation replaced human operators. These operators work in different branches of industry.
4. Automation played a great role in the worldwide changes. These changes are not studied well.
5. Automation makes people enter more skilled jobs. These jobs are usually paid more highly.

SUPPLEMENTARY TEXT

HOME AUTOMATION TECHNOLOGY (Part 1)

Useful words and expressions:

to tighten one's belt – затягнути пасок

to make ends meet – зводити кінці з кінцями

out of reach - недосяжний

a frivolous luxury – легковажна розкіш

appliances - електроприлади

implementation - застосування

When it comes to the question of whether or not you should invest in a solution for home automation, price is no doubt an important factor. And that is especially true, given the current state of the economy. After all, with unemployment being as high as it is, and people tightening their belts and struggling to make ends meet, you might think that the last thing on peoples' minds is home automation. Price points may justifiably make it out of reach for many people, as the use of this type of technology is considered by many to be a frivolous luxury.

Their argument is that who in their right mind would want to control a toaster oven, a vacuum cleaner, or a coffee maker from their computer anyway? They posit the question that have we become so lazy and have we geeked out so much that we can't simply just control our appliances the old-fashioned way. But what these people don't realize is that while it is true that for some people, it is just a luxury that they can do without out, there are many others who can actually benefit from and may actually even need home automation. Price is not an issue, when you look at the issue through the lens of someone who actually needs and is dependent on this technology in order to function, or from the perspective of someone whose life could be improved or could operate more smoothly with the implementation of this technology.

E. WRITING

Suggest some practical applications of the use of home automation technology and how it can benefit our lives. Write a short essay.

UNIT 2

A. UNDERSTANDING A PRINTED TEXT

This text will give you information about general safety regulations and precautions in working with industrial equipment. It reveals some reasons of industrial accidents.

1. Tell your partner about the safety regulations while working with industrial equipment. Why is it so important to follow these regulations?
2. Who /what is the main factor of the accidents at the industry?
3. How do you understand the title and subtitles of the text

   Minimizing human error

   A long way to zero?

   Small things count.
4. Can you predict the main idea of the text basing on them?

Now read the text and check your predictions.

MINIMIZING HUMAN ERROR

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

It's the same story when it comes to personal protection such as the wearing of helmets with chin straps and safety glasses. These are excellent, yet when someone gets hurt, more often than not we find that the victim was not wearing the recommended protective equipment at the time. Every case has its own set of circumstances, but whether they be major or minor incidents, they all have consequences in terms of human suffering, downtime and loss of production for our customers. Over the years, technological advances have done a great deal to reduce the number of accidents and injuries. The suppliers have consistently contributed with a steady stream of innovations designed to keep operators out of harm's way, as well as providing extensive training programs using equipment simulators, comprehensive operator instructions and safety interlocks.

A long way to zero

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

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

that the danger is greatest.

Small things count

In the quest for total safety, it is often the small things that count. On our Boomer rigs a light that illuminates the ground below the steps have been installed. On both Boomer and underground trucks, warning signals on the ignition switch alert people who may be nearby when an operator is about to start the engine. All rigs being used in the automatic mode have light curtains on both sides that will detect anyone walking into the danger zone and will automatically shut the machine down. Key service points on the rigs as well as the underground loaders and trucks are placed on the engines' cool side and these are also accessible from the ground, removing the need for the operator to climb or stand on a ladder.

On our underground trucks, the low, flat hood design increases visibility. We have spring-applied hydraulic release brakes and automatic brake testing, a safety barrier if there is a need to access components on top of the vehicle, and much more. These are just a few examples and by no means a comprehensive review of all the safety features we offer. Nonetheless, they represent important steps along the road to minimizing and ultimately eliminating equipment downtime.

B. CHECK YOUR UNDERSTANDING

I. Answer the questions to the text.

1. When are the most hazardous situations created ?
2. How can industrial accidents be avoided?
3. What personal safety equipment should be worn?
4. What is the safest place for a worker at the industry?
5. What safety measures are taken on the Boomer rig?

II. Explain the meaning of the following expressions.

Danger zone

Screwed up

Safety procedures

Equipment downtime

Training program

III. Do you know the difference between the *incident* and *accident*?

C. INCREASE YOUR VOCABULARY

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

Mistakes, to happen, to cut down, trauma, to encourage, all-inclusive, to do away with, care, extending out, clarity

II. Find the English equivalents in the text.

Спільний знаменник

Змістовні конструкторські нововведення

Захисне обладнання

Простій обладнання

Профілактичне обслуговування

Бурова установка

Запустити двигун

Підземні навантажувачі

Підпадати під небезпеку

Захисний бар'єр

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

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

a) denominator b) factor c) incentive

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

a) considering b) in terms of c) dealing with

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

a) perform b) maintain c) organize

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

a) spare components b) luxurious components c) protruding components

5. On both Boomer and underground trucks, _____ on the ignition switch alert people who may be nearby when an operator is about to start the engine.

a) warning signals b) intruder alarm c) fire alarm

IV. Translate into English.

1. Коли б не трапилася аварія у гірництві чи на будівництві, головним чинником майже завжди є людська помилка.
2. Захисні шоломи та захисні окуляри відносяться до засобів індивідуального захисту на виробництві.
3. Найбільш очевидним шляхом уникнення ризику для людей у гірничій промисловості — це зробити усі види робіт якомога автономнішими.
4. Сучасне обладнання має вбудовані характеристики, які допомагають збільшити безпеку оператора.
5. Підземні вагонетки оснащені пружинними гідравлічними гальмами та автоматичною системою тестування гальм.

D. **GRAMMAR REVISION**

Study the underlined examples in the text. What is the difference between conjunction and conjunctive adverb?

I. Fill in the blanks with the appropriate conjunction or adverb. More than one variant is possible.

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

1. ……... human error can cause many accidents, ……... these errors can be reduced with thoughtful design innovations.

2. ……., it's a human error that usually contributes an accident in industry.

3. ....., it is a fact that many industrial incidents could have been easily avoided.

4. It can be done a lot to protect workers at their jobs by the equipment suppliers ……... by the workers.

5. ……... extensive training programs can reduce a lot the number of industrial accidents.

6. ……... today's equipment has many built-in features increasing operator’s

safety.

SUPPLEMENTARY TEXT

Read the text and be ready to discuss.

HOME AUTOMATION TECHNOLOGY (part 2)

Useful words and expressions:

to benefit from - скористатися

to take for granted – сприймати як

impediment – перешкода, затримка

child-proofing – забезпечення безпеки дитини

electrical appliances – електричні прилади

cost-conscious - економний

to manage risks – керувати ризиками

to conserve energy - зберігати енергію

Physically challenged people are perfect candidates for home automation technology, and could stand to greatly benefit from it. Whether you are handicapped or you are elderly, you can leverage the use of home automation technology to make the job of managing your household easy to do with a few mouse clicks. Simple tasks that many of us take for granted can be automated so that people with physical impediments don't ever have to worry about them. A home automation system can provide an all-inclusive, complete security solution that includes the management of windows and doors, locks, gates, garage doors, motion sensors, motion-triggered lawn lighting, surveillance cameras, alarm systems, and 911 emergency notifications. Home automation systems can be retrofitted for both home as well as commercial properties.

Child-proofing is a common problem that millions of parents have to deal with as their toddlers learn to walk and interact with their environment. Child proofing is yet another practical application of home automation. Price should never be a constraint when it comes to keeping your children and your household safe. If you find that your toddler is constantly getting into things or fiddling with appliances that he or she should not be, then you can manage your home's child-proofing needs

centrally from your computer. Managing electrical appliances and the locking and operation of windows, gates, door locks, and blinds is easy to do with a home automation system. Keeping your children out of harm's way is every parent's primary responsibility. Keeping your home secure and safe is the first step in managing risks.

Many cost-conscious homeowners would be happy to know that there is yet another very practical application of home automation: Price control over out-of-control, skyrocketing utility bills such as electric, gas, water, and sewage. Home automation systems can be leveraged to help you conserve energy. The automation of windows and blinds to allow sunlight in, or to keep cold or heat drafts from coming through is one example of how it works. Other examples include thermostat control, as well as the heating and cooling of water and the shutting off of unnecessary appliances during the day when nobody is home.

E. DISCUSSION

Think about some examples of home automation practical application.

F. WRITING

Write an essay on the topic : **Home automation can bring you peace of mind.**

UNIT 3

A. UNDERSTANDING A PRINTED TEXT

This text will give you information about equipment widely used in the mining industry. It will explain briefly the main working principles of a tunnel boring machine.

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

II. Discuss with your friend safety rules while working with the tunnel boring machine.

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

A. Open-type TBMs

B. Advantages of TBMs for urban tunnelling

C. TBM — a modern challenge in the mining

D. Safety regulations for workers at TBM

E. Shielded TBMs

TUNNEL BORING MACHINE

(1) A tunnel boring machine (TBM) also known as a "mole", is a machine used to excavate tunnels with a circular cross section through a variety of soil and rock strata. They can bore through hard rock, sand, and almost anything in between. Tunnel diameters can range from a metre to almost 16 metres. Tunnels of less than a metre or so in diameter are typically done using trenchless construction methods or horizontal directional drilling rather than TBMs.

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

actually less—this is because tunnelling with TBMs is much more efficient and results in a shorter project.

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

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

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

(4) While the use of TBMs relieves the need for large numbers of workers at high pressures, a caisson system is sometimes formed at the cutting head for slurry shield TBMs. Workers entering this space for inspection, maintenance and repair

need to be medically cleared as "fit to dive" and trained in the operation of the locks.

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

B. CHECK YOUR UNDERSTANDING

I. Define whether the statements are true or false.

1. TBM is purposed to bore in soft ground only.
2. Open-type TBMs have the open cutter head.
3. When tunnelling in urban environments, the soil pressures during and after the tunnel construction are to be maintained.
4. All shielded TBMs can be used both in hard rock and fractured ground.
5. Workers entering underground space for inspection, maintenance and repair need to be specially trained.

II. Complete these definitions using the information given in the text.

1. TBM is nicknamed «mole» because …..
2. The advantages of TBMs are …..
3. Double Shield TBMs have the following modes: ….
4. Open -type TBM is …..

III. Make a list of the differences between different types of tunnel boring machines.

Open -type TBM	One Shield TBM	Double Shield TBM

C. INCREASE YOUR VOCABULARY

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

Layer, to perforate, boon, split, to drive, withdrawal, division, to switch, catastrophic, to diminish.

II. Fill in the gaps with an appropriate derivative.

excavate excavator excavation

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

construct construction constructed

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

compress compressor compressive

7. _____ strength is the capacity of a material or structure to withstand axially directed pushing forces.
8. _____ your files and folders in a large variety of formats with the simplicity of drag and drop.
9. Centrifugal _____ uses a rotating disk or impeller in a shaped housing to force the gas to the rim of the impeller, increasing the velocity of the gas.

III. Match the words with their definitions.

1	Hard rock	A	a device used for improving strength in the hands and forearms to take smth

2	Retraction	B	rock with deep fissures or crevices
3	Tunnel	C	naturally occurring solid aggregate of minerals
4	Fractured rock	D	a gradual sinking to a lower level
5	Gripper	E	passageway through or under something, usually underground (especially one for trains or cars)
6	Subsidence	F	a long anchor bolt
7	Rock bolt	G	the act of pulling or holding or drawing a part back

IV. Translate into English.

1. Бурові машини використовуються для буріння твердих та піщаних порід.
2. Бурові машини є сучасною альтернативою до методів буріння та підриву, а також до звичного ручного видобування.
3. Дискові бури створюють стискаюче навантаження на гірські породи, змушуючи їх відколюватися від скелі безпосередньо перед буром.
4. При будівництві тунелів у міській зоні необхідно уникати просідання ґрунту.
5. При бурінні буровими машинами відкритого типу породи утримуються завдяки використанню кільцевих балок, шоткрету, анкерів для скелястих порід, металевої сітки.

D. GRAMMAR REVISION

I. Fill in the gap with an appropriate modal verb given below.

Can, might, must, have to.

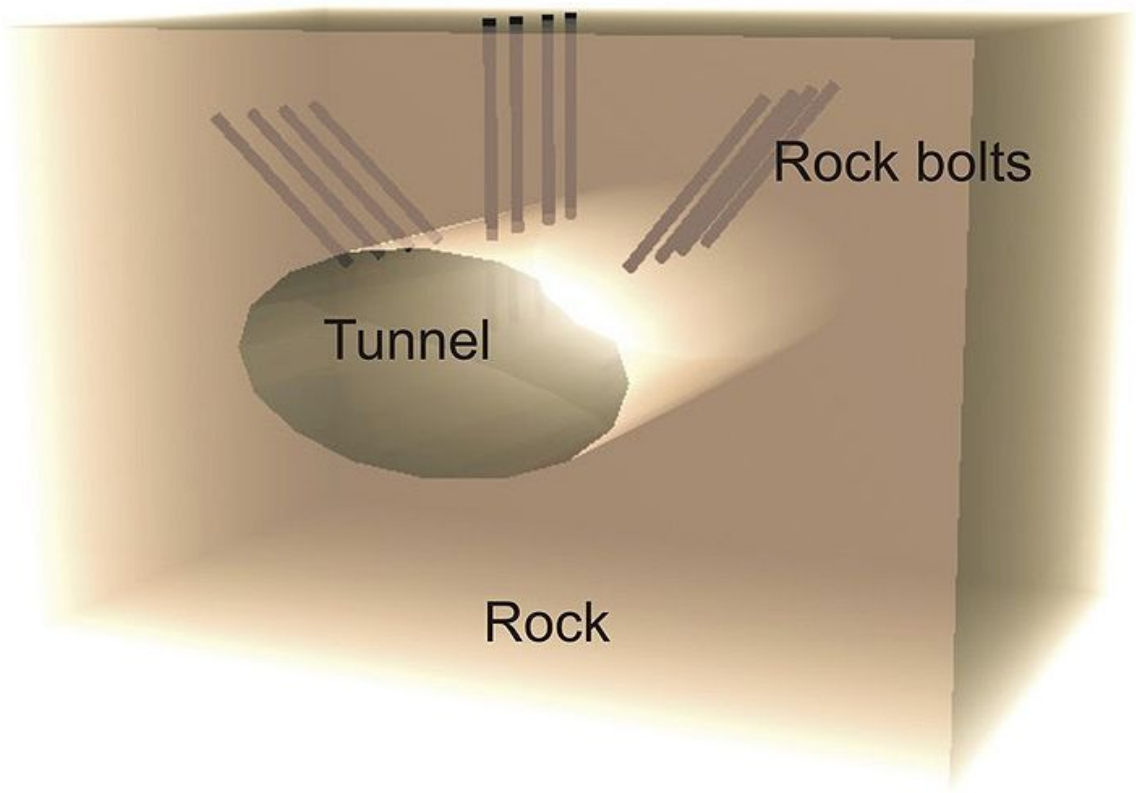
1. A TBM ……..have been used in the construction site if the company had invested more money.
2. Modern drilling equipment ……..easily bore through hard rock and sand.
3. A TBM ……..be used as an alternative to drilling and blasting methods.
4. Developers of the modern construction technologies ……. solve the problems with noise and disturbance.
5. You ……..not neglect personal protective equipment while working at the construction site.

6. Workers ….....use shielded hard rock TBMs in the fractured rocks.
7. Workers ….....follow the safety instructions to avoid industrial accidents.

SUPPLEMENTARY TEXT

ROCK BOLTS

A rock bolt is a long anchor bolt, for stabilizing rock excavations, which may be tunnels or rock cuts. It can transfer load from the unstable exterior, to the confined (and much stronger) interior of the rock mass. Rock bolts were first used in mining starting in the 1890s, with systematic use documented at the St Joseph Lead Mine in the US in the 1920s. Rock bolts were applied to civil tunnelling support in the US and in Australia, starting in the late 40s.



Rock bolts should be installed in a pattern, the design of which depends on the rock quality designation and the type of excavation. As with anchor bolts, there are many types of proprietary rock bolt designs, with either a mechanical or epoxy means of establishing the set. Rock bolts work by 'knitting' the rock mass together sufficiently before it can move enough to loosen and fail by unravelling (piece by piece). Rock bolts may be used to support wire mesh, but this is usually a small part of their function. Unlike common anchor bolts, rock bolts can become 'seized' throughout their length by small shears in the rock mass, so they are not fully dependent on their pull-out strength.

E. DISCUSSION

On this figure you can see a typical rock bolting pattern for a tunnel. Basing on the text above, explain how this method is applied and think about its advantages.

Render the text into Ukrainian.

UNIT 4

A. UNDERSTANDING A PRINTED TEXT

This text will give you information about underground construction in the urban area and about some technologies used to spare off the damage of the adjacent buildings.

I. Discuss with your partner.

1. Why do we need an underground construction?
2. What objects can be located underground?
3. What special knowledge is required for safe underground construction?

II. Look through the text. Match the titles (A-D) with paragraphs (1-4).

A. Damage from adjacent construction

B. Safety requirements in underground construction

C. Soil, rock and water

D. Focus of underground research

BELOW GROUND IN THE URBAN ENVIRONMENT

There is a great increase in underground construction at present. Our rocks will to an increasing extent be used for transport, storage spaces and garages. At the same time, our knowledge of what happens during construction below ground is inadequate. Urbanization has long been a fact. We observe cities be spreading out over good agricultural land, areas of unstable ground, the bottoms of old lakes, and over green spaces during urban densification. Cities are becoming vulnerable systems. They can be easily exposed to landslides and flooding. At the same time, traffic is increasing. The environmental problems are comprehensive and concern health, waste disposal, pure air and clean water. Structured planning of natural and energy resources is necessary. Scientists suppose issues regarding land use to be of key importance for the development of infrastructure, construction and industrial activity. In densely developed areas there are evident trends today to expand upwards. Since there is only limited space for expansion, underground construction will greatly increase.

(1) Urban underground construction imposes very great demands on technical know-how and experience in planning and implementation. Attention must be paid to the complex geological, hydrogeological and rock mechanics conditions, and to the disruptions and points of conflict that arise in conjunction with existing installations below ground and with the intact street and living environment. We notice urban construction impose great demands on knowledge of conditions below ground. Geotechnical and other investigations are needed for increased knowledge of geology, geotechnics, rock mechanics, hydrogeology and material properties both in the ground and in adjoining areas. Multidimensional modelling is an important and necessary tool for the assessment of risks. Several problem areas can be identified: water, reinforcement, drainage, maintenance, training and life cycle costs.

(2) Research programs should have a focus on sustainable development and climatic adaptation, consideration and reduction of greenhouse gases. Important issues are:

- Water and its interaction with rock and soil
- Safety and forecasts, comprising a risk analysis, working environment, preliminary investigation methods etc
- Operation and maintenance
- Effectiveness – here in a very broad sense that includes many subgroups
- Logistics and material supply

(3) In modern urban environments, heavy construction often must be conducted immediately adjacent to neighboring properties and structures. Often the neighboring buildings are occupied and must remain open to business or residency during the full course of construction. This can be problematic if the new construction involves high levels of noise or vibration (i.e., pile-driving or heavy traffic loads), deep excavation, or dewatering.

We expect vibration damage to occur when construction activity, such as pile driving or soil compaction, produces waves in the ground that travel outward from the source to adjacent properties. Construction typically produces traveling ground deformations known as Raleigh waves. While these waves attenuate with distance

from the source, depending on soil type or the fragility of the adjacent property, the waves may still be sufficiently strong to cause discomfort, if not damage.

(4) There are two fundamental mechanisms for vibration damage—1) distortion from inertial loads, and 2) settlement of the soils supporting the foundation. If the soil settlement is not uniform, distortion and damage can occur. Researchers expect such differential settlement to be due to deep excavations adjacent to existing foundations, or to changes in groundwater levels due to dewatering to keep the construction site dry. To reduce the risk of vibration damage, contractors are often required to maintain vibration levels below damage thresholds established by building departments or technical standards. Underpinning of adjacent foundations is often done to prevent damage from excavations or dewatering. Because few structures begin free of distress, it is often difficult to differentiate between preexisting damage and new damage caused by adjacent construction. To help differentiate, preconstruction surveys of adjacent properties are often done to map the cracking and foundation elevations prior to the beginning of construction. It is often possible to resolve construction damage from other sources by comparing post-construction and preconstruction photographs and elevation surveys.

B. CHECK YOUR UNDERSTANDING

I. Define whether the statements are true or false.

A) Underground space can be used for transport, storage spaces and garages.

B) Geotechnical knowledge we possess and investigations we conduct are enough for the underground construction.

C) In modern urban environments, it is not allowed to conduct heavy construction adjacent to neighboring properties and structures.

D) Vibration damage occurs when construction activity produces traveling ground deformations known as Raleigh waves

E) Allowed vibration levels during construction are established by building departments or technical standards.

II. Explain the meaning of the following words and word combinations.

Urbanization process, infrastructure, geotechnics, rock mechanics, raleigh waves

C. INCREASE YOUR VOCABULARY

I. Find the synonyms to the following words.

Sensitive, to distribute, contact, to weaken, bordering, dehydration, to distinguish, study, corruption, to happen.

II. Match the terms with their definitions.

1	Underground construction	A	the area of geology that deals with the distribution and movement of groundwater in the soil and rocks of the Earth's crust
2	Landslide	B	any harm or injury
3	Know-how	C	the act of constructing something below the ground
4	Hydrogeology	D	the act of digging
5	Vibration	E	the (technical) knowledge and skill required to do something
6	Excavation	F	a shaky motion
7	Damage	G	slide of a large mass of dirt and rock down a mountain or cliff

III. Find the English equivalents in the text.

Міські ущільнення

Вразливі системи

Планування та реалізація

Механіка гірських порід

Багатомірне планування

Робота та обслуговування

Пошкодження, спричинені вібрацією

Поріг рівня вібрації

Дегідрація місця будівництва

Глибокі викопні роботи

IV. Translate into English.

1. Міста є дуже вразливими системами, які можуть постраждати від зсувів землі та паводків.
2. Підземне будівництво у містах ставить вимоги до технічних новинок, наявності досвіду у його плануванні та втіленні.
3. Багатовимірне моделювання є важливим і необхідним інструментом для оцінки ризиків.
4. Будівництво призводить до рухомої деформації ґрунтів, відомої як коливання Рейлі.
5. Якщо осідання ґрунту нерівномірне, може трапитися пошкодження будівель.

D. GRAMMAR REVISION

I. Study the underlined examples in the text. What grammar phenomenon is it?

Paraphrase the following sentences using complex objects.

1. Our knowledge of what happens during construction below ground is inadequate (consider)
2. Multidimensional modelling is an important and necessary tool for the assessment of risks (believe).
3. Cities are becoming vulnerable systems (make).
4. Contractors are often required to maintain vibration levels below damage thresholds (expect).
5. Governmental programmes have a focus on climatic adaptation, consideration and reduction of greenhouse gases (know).
6. Construction produced traveling ground deformations known as Raleigh waves (not expect).

E. WRITING

Suggest the main points of the governmental programme focusing on the underground construction in your city.

TEXT 5

A. UNDERSTANDING A PRINTED TEXT

This text will give you information about the problems and prospects of the tunnel construction and about some technologies used in this sphere.

I. Discuss with your partner:

- the level of the tunnel construction development in your country;
- discuss possible difficulties in this sphere;
- discuss the necessity of the tunnels construction and their pros and cons.

II. Look through the text. Match the titles (A-D) with paragraphs (1-4).

A) Stages in the serial system

B) Safe tunnels

C) Cost estimates

D) Drill and blast

TUNNELS DEMAND SPECIAL KNOWLEDGE

Owing to geological uncertainties, underground projects are considered to be as innovation projects since the knowledge underlying the geological forecast is constantly updated. It costs time and money to investigate the material in a tunnel project. But without knowledge of the construction material it may be expensive and time consuming in the end. Underground projects for roads and railways are known to be different from other road and rail projects. The great differences are: most of the construction material is already on site; the working space is confined; this is a relatively new science with a limited number of projects.

The fact that most of the construction material is already on site means that the desired properties cannot be selected as in a bridge project. Paradoxically, knowledge of the properties of the construction material in underground projects is often limited. The reason for this is that it is both costly and time consuming to carry out preliminary investigations. But the uncertainties concerning the construction material, the geological uncertainties, may have an impact on both time and cost in the long run.

The confined space happen to impose special demands on the design of the cross section, services, the safety of persons, ventilation and aerodynamics. It also means that underground construction is a serial system with few points of access, where a disturbance in one activity is easily propagated to several subsequent activities.

The fact that fewer tunnels are built than bridges means that the collected experience is limited. And each individual has the opportunity to participate in only a few tunnel projects during his professional life. Underground construction is also based on sciences that are more recent than for many other civil engineering projects. All in all, this means that all the regulations which govern road and rail tunnels are under development and that they are based less on experience than is the case for bridge structures.

(1) The majority of road and rail tunnels in rock have been, or are being, carried out with the drill and blast method, often with comprehensive grouting prior to blasting. A tunnel boring machine, TBM, is used. A lining of grout is installed that is used for stabilisation and as a seal, but it is also essential for the progress of the TBM.

(2) There is a need for better and more comprehensive preliminary investigation methods, together with probabilistic calculation methods. This concerns both reinforcement and water disposal. The great problem is the ability to evaluate how large the uncertainties are and what consequences they may give rise to. Because tunnelling is a serial system, it is essential to make an assessment not only of the consequences of each individual operation, but also to understand how changes impact on all other operations. The confined space has given rise to a lot of questions and revealed a lack of knowledge concerning air quality and aerodynamic effects. In the case of the City Tunnel special measures had to be taken to reduce air velocities on the platforms and to reduce pressure changes. For example, in Stockholm glass walls will be built between platforms to alleviate these problems.

(3) Another constantly recurring discussion is how tunnels and stations are to be designed with respect to the safety of persons. This issue is very complex and

ranges from technical design to psychological aspects concerning the way people react to accidents in tunnels. The aspiration is that it should be just as safe to travel by train in a tunnel as above the tunnel. In an underground space it is difficult to take countermeasures and to evacuate, while at the same time a fire in a tunnel causes the tunnel or the station to rapidly become filled with smoke. More knowledge is needed concerning fire protection of structures, smoke spread, the effects of ventilation, input data for evacuation calculations.

To start with, it was also feared that tunnel boring under the central parts of city could cause disturbance in the form of noise and vibrations which are propagated to the buildings above. However, the problem was much less serious than had been envisaged. Existing forecasting tools are expected to be refined and also used for forecasts regarding rail traffic in the tunnel.

(4) Apart from the specific underground problems, there is a great need of improved knowledge and to some extent standardisation of cost estimates. Experience regarding the costs of design, preliminary investigations, land purchase, permits, indexation, currency hedge and insurance must be used as data in future projects. In spite of the large national investment in underground projects and experiences regarding time and cost overruns in several projects, there is very little national finance earmarked for research in this subject. Nevertheless, underground projects have special conditions which give rise to unique issues where the level of knowledge ought to be better than it is. In view of the fact that large investments will be made below ground for both roads and railways in the next few years, the level of knowledge must be enhanced by allocating a larger proportion of national research funds to research in the field of underground construction.

Or is it so that cost and time overruns and disputes are so generally accepted in connection with underground projects that nobody is interested any longer?

B. CHECK YOUR UNDERSTANDING

I. Define whether the statements are true or false.

A) The cost of a tunnel project is relatively low.

B) It takes a lot of time and money to carry out preliminary investigations in tunnel construction.

C) It's much more difficult to provide safety in the underground tunnel than outdoors.

D) It's a benefit that in the underground construction most of the construction material is already on site.

E) Underground construction is a serial system, where a disturbance in one activity is easily propagated to several subsequent activities.

II. Complete these definitions using the information given in the text.

1. The differences between the underground and outdoor constructions are...
2. To start underground construction you should collect information concerning …
3. The great problem in the underground construction is the ability to evaluate...
4. The experience in the tunnel construction is limited because …
5. Tunnel boring under the central parts of city can cause ...

III. Explain the meaning of the following words and word combinations.

Preliminary investigation

Confined space

Civil engineering

Grouting

Probabilistic calculation method

C. INCREASE YOUR VOCABULARY

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

Prediction, to inquire into, restricted, indispensable, aftermath, to mitigate, a clatter, peculiar, to assign, evaluation.

II. Match the terms with their definitions.

1	Grouting	A	a view or drawing that shows what the inside of something looks like after a cut has been made across it

2	ınnel	B	the planning, building, and repair of roads, bridges, large buildings etc
3	Design	C	allowing fresh air into a room, building etc
4	Cross-section	D	fixing in place by means of special mixture
5	Ventilation	E	to break something into pieces using explosives, especially in order to build something such as a road
6	Blast	F	a drawing, pattern, or sketch of some object
7	Civil engineering	G	a horizontal passageway through or under an obstruction

III. Find the English equivalents in the text.

Геологічне прогнозування

Займати багато часу

Підземне будівництво

Укріплення

Вжити контрзаходів

Перевищення витрат

Обмежений простір

Накопичений досвід

Залізничний тунель

Аеродинамічний ефект

IV. Translate into English.

1. Проекти по будівництву підземних доріг та залізничних тунелів відрізняться від наземних.
2. Обмежений простір ставить ряд вимог щодо проектування зрізу тунелю, безпеки людей, аеродинаміки та вентиляції.
3. Питання безпеки людей є складним і включає в себе технічний проект та психологічні аспекти стосовно того як люди реагують у випадку катастрофи в тунелі.
4. Більшість дорожних та залізничних тунелів робляться методом буріння або підриву, часто із застосуванням грунтоцементних технологій до

вибуху.

5. З метою зниження швидкості повітря на платформі та перепадів тиску слід вжити спеціальних заходів.

D. GRAMMAR REVISION

I. Study the underlined examples in the text. What grammatical phenomenon is it? Paraphrase the following sentences using complex subject. In some cases you are given hints.

1. It is known that most of the construction material is already on site and cannot be selected as in a bridge project.
2. The confined space has given rise to a lot of questions and revealed a lack of knowledge concerning air quality and aerodynamic effects (to be likely).
3. Scientists think that underground projects have special conditions which give rise to unique issues regarding specialized knowledge.
4. Underground construction is also based on sciences that are more recent than for many other civil engineering projects (turn out).
5. People expect to use experience regarding the costs of design, preliminary investigations, etc. as data in future projects.
6. We believe that large investments will be made below ground for both roads and railways in the next few years.

UNIT 6

A. UNDERSTANDING A PRINTED TEXT

I. Now you are going to read the passage about drilling rigs and three subsystems on a rotary drilling rig.

1. How do you understand the title and subtitles of the text?
   a) a rotary drilling rig
   b) a power system
   c) a hoisting system
   d) a circulating system

II. Before you read the passage discuss with your groupmates what a drilling rig is and where it is used. Can you predict the main idea of the text? Now read the text and check your predictions.

ROTARY DRILLING RIGS

There are many individual pieces of equipment on a rotary drilling rig. These individual pieces of equipment can however be grouped together into six subsystems. These systems are: the power system; the hoisting system; the circulating system; the rotary system; the well control system and the well monitoring system. Although the pieces of equipment associated with these systems will vary in design, they will be found on all the drilling rigs.

The power system. Most drilling rigs are required to operate in remote locations where a power supply is not available. They must therefore have a method of generating the electrical power which is used to operate the systems mentioned above. The electrical power generators are driven by diesel powered internal combustion engines (prime movers). Electricity is then supplied to electric motors connected to the drawworks, rotary table and mud pumps. The rig may have, depending on its size and capacity, up to 4 prime movers, delivering more than 3000 horsepower.

Older rigs used steam power and mechanical transmission systems but modern drilling rigs use electric transmission since it enables the driller to apply power more

smoothly, thereby avoiding shock and vibration. The drawworks and the mud pumps are the major users of power on the rig, although they are not generally working at the same time.

The hoisting system is a large pulley system which is used to lower and raise equipment into and out of the well. In particular, the hoisting system is used to raise and lower the drillstring and casing into and out of the well. The system consists of a crown block, a dead line, a fast line, a traveling block, a draw works drum, draw works, a drilling hook, elevators, a dead line anchor and a reserve drum.

The circulating system is used to circulate drilling fluid down through the drillstring and up the annulus, carrying the drilled cuttings from the face of the bit to surface. The main components of the circulating system are: a standpipe, Kelly Hose, swivel, Kelly, pump, discharge, suction, mud mixing hopper, suction pit, ditch, chemical tank, shale shaker, mud line return, annulus, setting pit, drill collar, borehole and a bit.

The two main functions of the drilling fluid are:

- To clean the hole of cutting made by the bit;
- To exert a hydrostatic pressure sufficient to prevent formation fluids entering the borehole.

Drilling fluid (mud) is usually a mixture of water, clay, weighting material and chemicals. The mud is mixed and conditioned in the mud pits and then circulated downhole by large pumps (slushpumps). The mud is pumped through the standpipe, kelly hose, swivel, kelly and down the drillstring. At the bottom of the hole the mud passes through the bit and then up the annulus, carrying cuttings up to surface. On surface the mud is directed from the annulus, through the flowline (or mud return line) and before it re-enters the mudpits the drilled cuttings are removed from the drilling mud by the solids *removal equipment.* Once the drilled cuttings have been removed from the mud it is re-circulated down the hole. The mud is therefore in a continuous circulating system. The properties of the mud are checked continuously to ensure that the desired properties of the mud are maintained. If the properties of the mud change then chemicals will be added to the mud to bring the properties back to

those that are required to fulfil the functions of the fluid. These chemicals will be added whilst circulating through the mud pits or mud with the required properties will be mixed in separate mud pits and slowly mixed in with the circulating mud.

When the mud pumps are switched off, the mud will stop flowing through the system and the level of the mud inside the drillstring will equal the level in the annulus. The level in the annulus will be equal to the height of the mud return flowline. If the mud continues to flow from the annulus when the mud pumps are switched off then an influx from the formation is occurring and the well should be closed in with the Blowout preventer stack. The mud pits are usually a series of large steel tanks, all interconnected and fitted with agitators to maintain the solids, used to maintain the density of the drilling fluid, in suspension. Some pits are used for circulating (e.g. suction pit) and others for mixing and storing fresh mud. Most modem rigs have equipment for storing and mixing bulk additives (e.g. barite) as well as chemicals (both granular and liquid). The mixing pumps are generally high volume, low pressure centrifugal pumps. Once the mud has been circulated round the system it will contain suspended drilled cuttings, perhaps some gas and other contaminants. These must be removed before the mud is recycled. The mud passes over a shale shaker, which is basically a vibrating screen. This will remove the larger particles, while allowing the residue (underflow) to pass into settling tanks. The finer material can be removed using other solids removal equipment. If the mud contains gas from the formation it will be passed through a degasser which separates the gas from the liquid mud. Having passed through all the mud processing equipment the mud is returned to the mud tanks for recycling.

B. CHECK YOUR UNDERSTANDING

I. Answer the following questions to the text:

1. Where are most drilling rigs located?
2. What kind of power systems are used on them?
3. What is a hoisting system?
4. What are the main components of a circulating system?

5. What does drilling fluid consist of?

II. Look at the following words and word groups, which have been taken from the text, and translate them from English into Ukrainian. In what context were they mentioned?

- rotary drilling rig
- circulating system
- standpipe
- kelly hose
- swivel
- suction pit
- drillstring
- solids
- fluid
- pumps

C. INCREASE YOUR VOCABULARY

I. Explain the words and make sentences with them.

Horsepower, electric transmission, pump, vibration, operate, system, function, prevent, elevator, circulating system, mud pumps, swivel, formation, shut down, mud pits, level.

II. Write the synonyms to the words.

A piece, to be grouped, to associate with, to be required, a method, to consist of.

III. Fill in the gaps with the appropriate words.

1. The individual pieces of equipment can … into six subsystems.
2. Most drilling rigs are required … in remote locations where a power supply is not available.
3. They must have … of generating the electrical power which is used to operate the systems mentioned above.
4. The draw works and the mud pumps are the major users of power on the rig, although they are not generally working …..
5. The hoisting system is a large pulley system which is used to lower and … equipment into and out of the well.
6. Drilling fluid is usually a … of water, clay, weighting material and chemicals.
7. One of the main functions of the drilling fluid is … of the hole of cutting made by the bit.
8. One of the main functions of the drilling fluid is … of a hydrostatic pressure

sufficient to prevent formation fluids entering the borehole.

D. GRAMMAR REVISION

I. Read the text again paying attention to the underlined words in it. What grammar forms are they? Transform the following sentences from Active into Passive.

1. The earliest wells were water wells, shallow pits dug by hand in regions where the water table approached the surface.
2. Modern drilling techniques utilize long drill shafts, producing holes much narrower and deeper than could be produced by digging.
3. The effectiveness of a drill bit varies by formation type.
4. The success of this bit led to the founding of the Sharp-Hughes Tool Company.
5. In 1933 two Hughes engineers, one of whom was Ralph Neuhaus, invented the tricone bit, which has three cones.
6. In 1951 other companies made similar bits.
7. However, Hughes'still held 40% of the world's drill bit market in 2000.
8. The superior wear performance of PDC bits gradually eroded the dominance of roller cone bits.
9. Early in 21st century PDC drill bit revenues overtook those of roller cone bits.
10. Several factors affect drill bit selection.

II. Read the sentences aloud. Write "A" for Active Voice and "P" for Passive Voice after the sentences.

1. Some materials like plastics as well as other non-metals and some metals have a tendency to heat up enough to expand making the hole smaller than desired.___
2. Drilling rigs can be used for installation of the sub-surface fabrications._____
3. The manufacturing process and composites used in each type of drill bit make them ideal for specific drilling situations. _____
4. Drilling rigs can be massive structures housing equipment used to drill water wells, oil wells, or natural gas extraction wells._____
5. Hundreds of tons of pipes can be lifted by hoists in the rig.____

III. Transform the following sentences from Passive into Active. Translate them

from English into Ukrainian.

1. Well drilling can be done either manually or mechanically.
2. In 2011 market shares were divided between Hughes Christensen, Smith Bits, REEDHycalog, Security-DBS and other smaller companies.
3. Oil and natural gas drilling rigs can be used not only to identify geologic reservoirs but also to create holes that allow the extraction of oil or natural gas from those reservoirs.
4. Rods were turned by hand, using clamps attached to the rod.
5. In the 1970s, outside of the oil and gas industry, roller bits using mud circulation were replaced by the first pneumatic reciprocating piston Reverse Circulation (RC) drills.

IV. Transform the following sentences from Passive into Active. Not all the sentences have to be transformed, since some of them can only be used in Active Voice. Translate the transformed sentences into Ukrainian.

1. Small mobile drilling rigs are also used to drill or bore piles.
2. Rigs can range from 100 ton continuous flight auger (CFA) rigs to small air powered rigs used to drill holes in quarries, etc.
3. Backed by over 38 years of experience in the drilling industry, our drill rigs are used for water well drilling, geotechnical and environmental drilling, mineral exploration, geothermal wells, geothermal drilling, construction and utility work, and a wide range of other diverse applications.
4. The SIMCO 2400 SK-1 is backed by the best warranty in the water well drilling and the geothermal drilling industry.
5. Large truck rigs also require a much higher over head clearance to operate.
6. This type of rig is commonly used in minerals drilling.
7. This type of rig has been customized for ANDRILL scientific requirements and for Antarctic conditions.
8. The jack-up drill platform was designed by Opus (Christchurch) and constructed by Goughs Engineering in Christchurch.

9. These rigs use the same technology and equipment as the oil drilling rigs, just on a smaller scale.
10. Small mobile drilling rigs are also used to drill or bore piles.

V. Translate the following sentences from Ukrainian into English.

1. Взагалі буріння свердловин можливе у будь-якому місці, куди здатна проїхати техніка, але варто пам'ятати, це не можна робити під гіллям дерев або лініями електропостачання.
2. Тепло гірських порід та підземних вод є найбільш зручним джерелом поновлюваної енергії.
3. Будь-яка сучасна автономна система водопостачання складається з помпи, гідроакумулятора, автоматики управління системою водопостачання, арматури.
4. Для визначення кількості та інтервалів спуску обсадних колон необхідно визначити зони не сумісні з умовами буріння.
5. Кондуктор спускаємо на глибину 350м з метою перекриття верхньої нестійкої частини розрізу свердловини та ізоляції питних вод.
6. Перша проміжна колона спускається до глибини 2150м, для перекриття зон схильних до поглинання, осипів та обвалів стінок свердловини, а також для ізоляції інших зон промивних ускладнень.
7. Експлуатаційну колону спускаємо на глибину 4200м, для перекриття горизонтів схильних до часткового поглинання, осипання стінок свердловини і експлуатації продуктивного горизонту.
8. При виборі відносної густини промивальної рідини, потрібно перевірити чи репресія на пласт не перевищує нормативних значень
9. Для комплектування колони вибираємо труби з трапецієвидною різьбою з муфтами (ОТТМ).

E. WRITING

You have read the article about drilling rig equipment. Using what you have learned from this unit, write a list of safety instructions for the operators on the drilling rig between 250 and 300 words.

UNIT 7

A. UNDERSTANDING A PRINTED TEXT

Read the following text about the escalator design.

I. Before you read the passage discuss with your groupmates what an escalator is and where it is used.

Can you predict the main idea of the text?

II. Now read the text and check your predictions as you read the text pay attention to the words underlined. What grammar form is it?

ESCALATORS

An escalator is a moving staircase - a conveyor transport device for carrying people between floors of a building. The device consists of a motor-driven chain of individual, linked steps that move up or down on tracks, allowing the step treads to remain horizontal.

Escalators are used around the world to move pedestrian traffic in places where elevators would be impractical. Principal areas of usage include department stores, shopping malls, airports, transit systems, convention centers, hotels, and public buildings.

The benefits of escalators are many. They have the capacity to move large numbers of people, and they can be placed in the same physical space as one might install a staircase. They have no waiting interval (except during very heavy traffic), they can be used to guide people toward main exits or special exhibits, and they may be weatherproofed for outdoor use.

Escalators, like moving walkways, are powered by constant-speed alternating current motors and move at approximately (0.30—0.61 m) per second. The typical angle of inclination of an escalator to the horizontal floor level is 30 degrees with a standard rise up to about 18 m. Modern escalators have single-piece aluminium or steel steps that move on a system of tracks in a continuous loop. Escalators have three typical configuration options: parallel (up and down escalators "side by side or separated by a distance", seen often in metro stations and multilevel motion picture

theaters), crisscross (minimizes structural space requirements by "stacking" escalators that go in one direction, frequently used in department stores or shopping centers), and multiple parallel (two or more escalators together that travel in one direction next to one or two escalators in the same bank that travel in the other direction).

Escalators are required to have moving handrails that keep pace with the movement of the steps. The direction of movement (up or down) can be permanently the same, or be controlled by personnel according to the time of day, or automatically be controlled by whoever arrives first, whether at the bottom or at the top (the system is programmed so that the direction is not reversed while a passenger is on the escalator).

A number of factors affect escalator design, including physical requirements, location, traffic patterns, safety considerations, and aesthetic preferences. Foremost, physical factors like the vertical and horizontal distance to be spanned must be considered. These factors will determine the pitch of the escalator and its actual length. The ability of the building infrastructure to support the heavy components is also a critical physical concern. Location is important because escalators should be situated where they can be easily seen by the general public. In department stores, customers should be able to view the merchandise easily.

Furthermore, up and down escalator traffic should be physically separated and should not lead into confined spaces.

Traffic patterns must also be anticipated in the escalator design. In some buildings, the objective is simply to move people from one floor to another, but in others there may be a more specific requirement, such as funneling visitors towards a main exit or exhibit. The number of passengers is important because escalators are designed to carry a certain maximum number of people. For example, a single-width escalator traveling at about 0.46 m per second can move an estimated 170 persons per five-minute period. The carrying capacity of the escalator system must match the expected peak traffic demand, presuming that passengers ride single file. This is crucial for applications in which there are sudden increases in the number of riders. For example, escalators at stations must be designed to cater for the peak traffic flow

discharged from a train, without causing excessive bunching at the escalator entrance. In this regard, escalators help in controlling traffic flow of people. For example, an escalator to an exit effectively discourages most people from using it as an entrance, and may reduce security concerns. Similarly, escalators often are used as the exit of airport security checkpoints. Such an egress point would generally be staffed to prevent its use as an entrance, as well.

It is preferred that staircases be located adjacent to the escalator if the escalator is the primary means of transport between floors. It may also be necessary to provide an elevator lift adjacent to an escalator for wheelchairs and disabled persons. Finally, consideration should be given to the aesthetics of the escalator. The architects and designers can choose from a wide range of styles and colors for the handrails and balustrades.

B. CHECK YOUR UNDERSTANDING

I. Look for the answers to the following questions.

1. What is an escalator?
2. Where are escalators used?
3. What are the benefits of escalators?
4. How are escalators powered?
5. What are the three configuration options of escalators?
6. What is the function of moving handrails?
7. What factors affect escalators design?
8. Why is location of escalators so important?
9. Why is the number of passengers also important?
10. What must be anticipated in escalator designs?

II. In the following, define whether the statements are true or false.

1. Escalators are used to move pedestrian traffic where elevators would be practical.
2. They have no waiting interval (except during very heavy traffic).
3. The typical angle of inclination of an escalator to the horizontal floor level is 80

degrees.

4. The direction of movement (up or down) can't be controlled by personnel according to the time of day.
5. Up and down escalator traffic should be physically separated and should not lead into confined spaces.

C. INCREASE YOUR VOCABULARY

I. Select the item that best completes each of these sentences:

1. The device consists of

a) an electric motor of a car.

b) a motor-driven chain of an individual, linked stops

c) an electric device.

d) a mechanical appliance.

2. The benefits of escalators

a) are few

b) are a few

c) aren't many

d) are many

3. Escalators are required to have

a) moving handrails.

b) moving steps.

c) stable handrails.

d) a moving elevator.

4. In some buildings, the objective is simply to move people from

a) one place to another.

b) one room to the other.

c) one street to the other.

d) one floor to another.

5. It is preferred that staircases be located

a) not far from the escalator.

b) behind the escalator.

c) adjacent to the escalator.

d) in front of the escalator.

II. Match the words in the left column with the words in the right column and translate them into Ukrainian.

1	a moving	a	the world
2	per five-	b	of movement
3	around	c	minutes period
4	the direction	d	in department stores
5	frequently used	e	staircase

III. Find the words which have opposite meaning to those below:

entrance	easy
indoor use	maximize
vertical	down
different	single
crisscross	alternative

IV. Look at these words and phrases and try to explain their meaning in your own words.

- A moving staircase a benefit
- To move pedestrian traffic
- Moving handrails
- A single-width escalator
- Peak traffic flow permanently the same
- Funneling visitors
- An elevator for wheelchairs and disabled persons
- The pitch of the escalator

D. GRAMMAR REVISION

I. Translate the following sentences into Ukrainian paying attention to the functions of gerund:

1. They can be used for guiding people toward main exits or special exhibits, and they may be weatherproofed for outdoor use.
2. Escalators help in controlling traffic flow of people.
3. Traffic patterns must also be anticipated in the escalator designing.
4. The number of passengers is important because escalators are designed for carrying a certain maximum number of people.
5. For example, an escalator to an exit effectively discourages most people from using it as an entrance.

II. Translate the following sentences into English:

1. Він є вирішальним у випадках, коли кількість пасажирів раптово зростає.
2. Ескалатори, що доправляють пасажирів наверх та вниз,мають бути відокремленими.
3. Ескалатори бувають трьох видів: паралельними,перехресними та багато паралельними.
4. Ескалаторами користуються скрізь по всьому світі.
5. Ескалатори працюють на двигунах змінного струму постійної швидкості.
6. Схеми руху мають передбачатися при проектуванні ескалаторів.
7. Ескалатори допомагають керувати пасажиропотоком.
8. Ескалатори на станціях треба проектувати таким чином,щоб швидко обслуговувати збільшення пасажиропотоку з потягу,що розвантажився.
9. Бажано, щоб сходи розміщувались поруч з ескалатором, якщо він є основним засобом транспортування між поверхами.
10. Низка факторів впливає на проект ескалатора включаючи фізичні потреби, розміщення, схеми руху, питання безпеки та естетичні преференції.

E. WRITING

Write a composition using 120-150 words.

Your university newspaper needs an article about the good and bad points of building underground stations. Write your article for the newspaper.

UNIT 8

A. UNDERSTANDING A PRINTED TEXT

This passage will introduce you to the escalator components.

1. **How do you understand the title and subtitles of the text?**
2. **Discuss in the classroom where these are usually used.**
3. **Find the Ukrainian equivalents for the following. Use a dictionary if necessary.**

landing platforms	a hollow metal structure
the gears and motors	to guide the step chain
a series of cleats	an endless loop
resemble the teeth of a comb	degradation from environmental
to allow easy access	conditions

ESCALATOR COMPONENTS

Landing platforms. These two platforms house the curved sections of the tracks, as well as the gears and motors that drive the stairs. The top platform contains the motor assembly and the main drive gear, while the bottom holds the step return idler sprockets. These sections also anchor the ends of the escalator truss. In addition, the platforms contain a floor plate and a combplate. The floor plate provides a place for the passengers to stand before they step onto the moving stairs. This plate is flush with the finished floor and is either hinged or removable to allow easy access to the machinery below. The combplate is the piece between the stationary floor plate and the moving step. It is so named because its edge has a series of cleats that resemble the teeth of a comb. These teeth mesh with matching cleats on the edges of the steps. This design is necessary to minimize the gap between the stair and the landing, which helps prevent objects from getting caught in the gap.

Truss. It is composed of two side sections joined together with cross braces across the bottom and just below the top. The ends of the truss are attached to the top and bottom landing platforms via steel or concrete supports. The truss carries all the

straight track sections connecting the upper and lower sections.

Tracks. The track system is built into the truss to guide the step chain, which continuously pulls the steps from the bottom platform and back to the top in an endless loop. There are actually two tracks: one for the front wheels of the steps (called the step-wheel track) and one for the back wheels of the steps (called the trailer-wheel track). The relative positions of these tracks cause the steps to form a staircase as they move out from under the combplate. Along the straight section of the truss the tracks are at their maximum distance apart. This configuration forces the back of one step to be at a 90-degree angle relative to the step behind it. This right angle bends the steps into a shape resembling a staircase. At the top and bottom of the escalator, the two tracks converge so that the front and back wheels of the steps are almost in a straight line. This causes the stairs to lay in a flat sheet like arrangement, one after another, so they can easily travel around the bend in the curved section of track. The tracks carry the steps down along the underside of the truss until they reach the bottom landing, where they pass through another curved section of track before exiting the bottom landing. At this point the tracks separate and the steps once again assume a staircase configuration. This cycle is repeated continually as the steps are pulled from bottom to top and back to the bottom again.

Steps. The steps themselves are solid, one piece, die-cast aluminum or steel. Yellow demarcation lines may be added to clearly indicate their edges. In most escalator models manufactured after 1950, both the riser and the tread of each step is cleated (given a ribbed appearance) with comb like protrusions that mesh with the combplates on the top and bottom platforms and the succeeding steps in the chain. Seeberger- or "step-type" escalators (see below) featured flat treads and smooth risers; other escalator models have cleated treads and smooth risers. The steps are linked by a continuous metal chain to form a closed loop. The front and back edges of the steps are each connected to two wheels. The rear wheels are set further apart to fit into the back track and the front wheels have shorter axles to fit into the narrower front track. As described above, the position of the tracks controls the orientation of the steps.

Handrail. The handrail provides a convenient handhold for passengers while they are riding the escalator. In an escalator, the handrail is pulled along its track by a chain that is connected to the main drive gear by a series of pulleys. It is constructed of four distinct sections. At the center of the handrail is a "slider", also known as a "glider ply", which is a layer of a cotton or synthetic textile. The purpose of the slider layer is to allow the handrail to move smoothly along its track. The next layer, known as the "tension member", consists of either steel cable or flat steel tape, and provides the handrail with tensile strength and flexibility. On top of tension member are the inner construction components, which are made of chemically treated rubber designed to prevent the layers from separating. Finally, the outer layer - the only part that passengers actually see - is the cover, which is a blend of synthetic polymers and rubber. This cover is designed to resist degradation from environmental conditions, mechanical wear and tear, and human vandalism. In the factory, handrails are constructed by feeding rubber through a computer-controlled extrusion machine to produce layers of the required size and type in order to match specific orders. The component layers of fabric, rubber, and steel are shaped by skilled workers before being fed into the presses, where they are fused together.

In the mid-twentieth century, some handrail designs consisted of a rubber bellows, with rings of smooth metal cladding called "bracelets" placed between each coil. This gave the handrail a rigid yet flexible feel. Additionally, each bellows section was no more than a few feet long, so if part of the handrail was damaged, only the bad segment needed to be replaced. These forms of handrail have largely been replaced with conventional fabric-and-rubber railings.

B. CHECK YOUR UNDERSTANDING

I. Answer the questions to the text:

1. Why is a combplate so called?
2. What are attached to the top and bottom landing?
3. What causes the stair to lay in a flat sheetlike arrangement?

II. In the following, define whether the statements are true or false.

1. These two platforms house the curved sections of the tracks.
2. These sections also anchor the ends of the escalator truss.
3. The combplate is so named because its edge has a series of cleats that differs from the teeth of a comb.
4. The truss is a hollow plastic structure that bridges the lower and upper landings.
5. The track system is built into the truss to guide the step chain, which from time to time pulls the steps from the bottom platform and back to the top.
6. At the top and bottom of the escalator, the two tracks converge so that the front and back wheels of the steps are almost in a curved line.
7. The steps themselves are solid, one piece, die-cast aluminum or steel.
8. The handrail provides a convenient handhold for passengers while they are riding the escalator.
9. The purpose of the slider layer is to allow the handrail to move in the opposite direction to its track.

C. INCREASE YOUR VOCABULARY

I. Match the word combinations in the left column with the ones in the right column and translate them into Ukrainian.

1	between the stationary floor plate	a	polymers and rubber
2	two side sections	b	and the moving step
3	This causes the stairs to	c	or steel
4	a staircase	d	joined together
5	Die-cast aluminum	e	that forms a closed loop
6	a continuous metal chain	f	lay in a flat sheet
7	a blend of synthetic	g	and human vandalism

8	mechanical wear and tear	h	flexible feel
9	to produce layers	i	of the required size and type
10	a rigid yet	j	configuration

II. Select the item that best completes each of these sentences.

1. At the top and bottom of the escalator, the two tracks ……. so that the front and back wheels of the steps are almost in a straight line.

a) connect
b) divide
c) converge
d) unite

2. The floor plate ……..a place for the passengers to stand before they step onto the moving stairs.

a) supports
b) provides
c) improves
d) suppose

3. This design is necessary to …….the gap between the stair and the landing.

a) minimize
b) maximize
c) extend
d) expand

4. The relative positions of these tracks cause the steps to form a …….as they move out from under the combplate.

a) handrail
b) landing platform
c) staircase
d) track

5. The …….edges of the steps are each connected to two wheels.

a) front and back
b) upper and lower
c) wider
d) narrower

III. Match two parts to make expressions from the text.

1	track	a	lights
2	major	b	instructions
3	safety	c	switch
4	demarcation	d	system
5	sensor	e	concern

IV. Match the beginnings of the sentences with their endings.

Beginnings

A) The top platform contains the motor assembly
B) These teeth mesh with matching cleats
C) The combplate is the piece between the
D) At the center of the handrail is a "slider",
E) Some handrail designs consisted of a rubber bellows

Endings

1) also known as a "glider ply", which is a layer of a cotton or synthetic textile.
2) stationary floor plate and the moving step.
3) on the edges of the steps.
4) with rings of smooth metal cladding called "bracelets" placed between each coil.
5) and the main drive gear, while the bottom holds the step return idler sprockets of ends of the escalator truss.

D. GRAMMAR REVISION

I. Now read the text again carefully. As you read, pay attention to the words underlined. What grammar form is it? Translate the sentences into Ukrainian paying attention to the functions of the Infinitive.

1. Рівний майданчик забезпечує пасажирів місцем, де можна стояти перед тим,як ступити на ескалатор.
2. Система доріжки вбудована в трасу, щоб керувати ланцюгом сходинок, який безперервно тягне східці з нижньої платформи назад наверх у безкінечній петлі.
3. Можна додати жовті демаркаційні лінії, щоб чітко вказати краї східців.
4. Передні колеса мають коротші вісі для того,щоб вони підходили для вужчої доріжки.
5. Східці з'єднані кільцевим металевим ланцюгом,щоб утворити закриту петлю.

E. WRITING

A local newspaper is running a competition. To enter the competition you must submit a detailed report about the work of the underground escalator. The prize for the best report is a guided excursion to the London underground.

UNIT 9

A. UNDERSTANDING A PRINTED TEXT

Now you are going to read the text about excavators.

I. Discuss with your partner the safety regulations while working with industrial equipment. Why is it so important to follow these regulations?

II. Who /what is the main factor of the accidents at the industry?

III. Look at these questions and read the passage to find the answers to them.

a) What are excavators?

b) Where was excavators progressed from?

c) Where are excavators used?

EXCAVATOR

Excavators are heavy construction equipment consisting of a boom, bucket and cab on a rotating platform (known as the "house"). The house sits atop an undercarriage with tracks or wheels. All movement and functions of the excavator are accomplished through the use of hydraulic fluid, be it with rams or motors. Their design is a natural progression from the steam shovel.

Terminology

Excavators are also called diggers, a JCB (which is a proprietary name) or 360-degree excavators sometimes abbreviated simply to 360. Tracked excavators are sometimes called "trackhoes" by analogy to the backhoe. In the UK, wheeled excavators are sometimes known as "rubber ducks. "In Japan, the alias **Yumbo (Yunbo**[?]) is sometimes used for excavators, after the 1961 Mitsubishi Yumbo Y35.

Usage

Excavators are used in many ways:

- Digging of trenches, holes, foundations
- Material handling
- Brush cutting with hydraulic attachments

- Forestry work
- Demolition
- General grading/landscaping
- Heavy lift, e.g. lifting and placing of pipes
- Mining, especially, but not only open-pit mining
- River dredging
- Driving piles, in conjunction with a Pile Driver

Configurations

Excavators come in a wide variety of sizes. The smaller ones are called mini or compact excavators. Caterpillar's smallest mini-excavator weighs 3,549 pounds (1,610 kg) and has 19 hp; their largest model weighs 187,360 pounds (84,990 kg) and has 513 hp. The largest excavator available is the Bucyrus RH400, it weighs in excess of 2,160,510 pounds (979,990 kg), has 4500 hp and has a bucket size of about 52.0 m^3.

Engines in excavators drive hydraulic pumps; there are usually 3 pumps: the two main pumps are for supplying oil at high pressure (up to 5000 psi) for the rams, slew motor, track motors, and accessories, and the third is a lower pressure (700 psi) pump for Pilot Control, this circuit used for the control of the spool valves, this allows for a reduced effort required when operating the controls.

The two main sections of an excavator are the undercarriage and the house. The undercarriage includes the blade (if fitted), tracks, track frame, and final drives, which have a hydraulic motor and gearing providing the drive to the individual tracks, and the house includes the operator cab, counterweight, engine, fuel and hydraulic oil tanks. The house attaches to the undercarriage by way of a center pin, allowing the machine to slew 360° unhindered.

The main boom attached to the house can be one of 3 different configurations:

- Most are mono booms: these have no movement apart from straight up and down.
- Some others have a knuckle boom which can also move left and right in line with the machine.

- The other option is a hinge at the base of the boom allowing it to hydraulically pivot up to 180° independent to the house, however this is generally available only to compact excavators.

Attached to the end of the boom is the stick (or dipper arm). The stick provides the digging force needed to pull the bucket through the ground. The stick length is optional depending whether reach (longer stick) or break-out power (shorter stick) is required.

On the end of the stick is usually a bucket. A wide, large capacity (Mud) bucket with a straight cutting edge is used for cleanup and levelling or where the material to be dug is soft, and teeth are not required. A general purpose (GP) bucket is generally smaller, stronger, and has hardened side cutters and teeth used to break through hard ground and rocks. Buckets have numerous shapes and sizes for various applications. There are also many other attachments which are available to be attached to the excavator for boring, ripping, crushing, cutting, lifting, etc.

Before the 1990s, all excavators had a long or conventional counterweight that hung off the rear of the machine to provide more digging force and lifting capacity. This became a nuisance when working in confined areas. In 1993 Yanmar launched the world's first Zero Tail Swing excavator,[3] which allows the counterweight to stay inside the width of the tracks as it slews, thus being safer and more user friendly when used in a confined space. This type of machine is now widely used throughout the world.

Excavator attachments

In recent years, hydraulic excavator capabilities have expanded far beyond excavation tasks with buckets. With the advent of hydraulic powered attachments such as a breaker, a grapple or an auger, the excavator is frequently used in many applications other than excavation. Many excavators feature a quick coupler for simplified attachment mounting, increasing the machine's utilization on the jobsite. Excavators are usually employed together with loaders and bulldozers. Most wheeled, compact and some medium sized (11 to 18 tonne) excavators have a backfill (or dozer) blade. This is a horizontal bulldozer-like blade attached to the undercarriage

and is used for levelling & pushing removed material back into a hole.

Dragline excavator

A dragline excavator is a piece of heavy equipment used in civil engineering and surface mining.

In civil engineering the smaller types are used for road, port construction, and as pile driving rigs. The larger types are used in strip-mining operations to move overburden above coal, and for tar-sand mining. Draglines are amongst the largest mobile equipment ever built on land, and weigh in the vicinity of 2000 metric tonnes, though specimens weighing up to 13,000 metric tonnes have also been constructed.

A dragline bucket system consists of a large bucket which is suspended from a boom (a large truss-like structure) with wire ropes. The bucket is manoeuvred by means of a number of ropes and chains. The hoist rope, powered by large diesel or electric motors, supports the bucket and hoist-coupler assembly from the boom. The dragrope is used to draw the bucket assembly horizontally. By skillful manoeuvre of the hoist and the dragropes the bucket is controlled for various operations. A schematic of a large dragline bucket system is shown below.

B. CHECK YOUR UNDERSTANDING

I. In the following, define whether the statements are true or false.

1. A bucket is usually on the end of the stick.
2. All buckets have the same shape and size for various applications.
3. Hydraulic excavators capabilities have expanded far beyond excavation tasks with buckets in recent years.
4. Excavators are rarely employed together with loaders and bulldozers.
5. A dragline bucket system consists of a small bucket which is suspended from a boom with wire ropes.

II. Read the text about excavators again. While you read choose the item that best completes each of the sentences.

1. Excavators are heavy constructions consisting of

a) a motor;

b) a blade and a pin;

c) a hydraulic pump and a track frame;

d) a bucket, a cab and a boom.

2. The two main sections of an excavator are

a) a hydraulic motor and gearing;

b) final drives;

c) the house and the undercarriage;

d) fuel and hydraulic oil tank.

3. A general purpose bucket has hardened side cutters and teeth used

a) to dig holes;

b) to break through hard ground and rocks;

c) to brush cutting with hydraulic attachments;

d) to lift and place pipes.

III. As you read, pay attention to the structure, paragraphing and subheading of the text and look for the answers to the following questions.

1. How are excavators also called?
4. What are the sizes of excavators?
5. What are the configurations of the main boom attached to the house/
2. What does a dragline bucket system consists of?
3. When was the dragline invented?

C. INCREASE YOUR VOCABULARY

Now read the text again carefully.

I. Try to explain the meaning of the following words and phrases in your own words (native language is possible).

Rotating platform, hydraulic pumps, undercarriage, conventional counterweight, fuel tank, knuckle boom, digging conventional force, dragline excavator, bulldozerlike blade, wire rope.

II. In the text find the words which have the opposite meaning to those below.

Easy, heavy, weight, to drive, to increase, to reduce, to forbid, up, the same, to

exclude.

III. Match the words in column A with the words in column B.

	A		B
1	heavy construction	a	manoeuvre
2	hydraulic	b	boom
3	a knuckle	c	bucket system
4	straight up	d	horizontally
5	three different	e	hoist-coupler assembly
6	excavator	f	equipment
7	a dragline	g	attachments
8	to draw the bucket assembly	h	and down
9	The bucket and	i	configuration
10	skillful	j	fluid

SUPPLEMENTARY TEXT

OPERATION

I. Read the following text looking for the answers to the following questions.

1. Where is the bucket positioned in a typical cycle of excavation?
2. What could a skilled operator make on smaller draglines?
3. What can be reached on larger draglines?
4. What does a chop pass involves?
5. If the wall is blocky, what may this also require?

In a typical cycle of excavation, the bucket is positioned above the material to be excavated. The bucket is then lowered and the dragrope is then drawn so that the bucket is dragged along the surface of the material. The bucket is then lifted by using the hoist rope. A swing operation is then performed to move the bucket to the place

where the material is to be dumped. The dragrope is then released causing the bucket to tilt and empty. This is called a dump operation.

The bucket can also be 'thrown' by winding up to the jib and then releasing a clutch on the drag cable. This would then swing the bucket like a pendulum. Once the bucket had passed the vertical, the hoist cable would be released thus throwing the bucket. On smaller draglines, a skilled operator could make the bucket land about one-half the length of the jib further away than if it had just been dropped. On larger draglines, only a few extra metres may be reached.

Draglines have different cutting sequences. The first is the side cast method using offset benches; this involves throwing the overburden sideways onto blasted material to make a bench. The second is a key pass. This pass cuts a key at the toe of the new highwall and also shifts the bench further towards the low-wall. This may also require a chop pass if the wall is blocky. A chop pass involves the bucket being dropped down onto an angled highwall to scale the surface. The next sequence is the slowest operation, the blocks pass. However, this pass moves most of the material. It involves using the key to access to bottom of the material to lift it up to spoil or to an elevated bench level. The final cut if required is a pull back, pulling material back further to the low-wall side.

Draglines in mining

A large dragline system used in the open pit mining industry costs approximately US$50-100 million. A typical bucket has a volume ranging from 30 to 60 cubic metres, though extremely large buckets have ranged up to 168 cubic metres.[1] The length of the boom ranges from 45 to 100 metres. In a single cycle it can move up to 450 metric tonnes of material.

Most mining draglines are not diesel-powered like most other mining equipment. Their power consumption is so great that they have a direct connection to the high- voltage grid at voltages of between 6.6 to 22 кV. A typical dragline, with a 55 cubic metre bucket, can use up to 6 megawatts during normal digging operations. Because of this, many (possibly apocryphal) stories have been told about the blackout-causing effects of mining draglines. For instance, there is a long-lived story

that, back in the 1970s if all seven draglines at Peak Downs Mine (a very large BHP coal mine in central Queensland, Australia) turned simultaneously, they would black out all of North Queensland. However even now, if they have been shutdown they are always restarted one at a time due to the immense power requirements of startup. In all but the smallest of draglines, movement is accomplished by "walking" using feet or pontoons, as caterpillar tracks place too much pressure on the ground, and have great difficulty under the immense weight of the dragline. Maximum speed is only at most a few metres per minute[2] since the feet must be repositioned for each step. If travelling medium distances (about 30-100 km), a special dragline carrier can be brought in to transport the dragline. Above this distance, disassembly is generally required. But mining draglines due to their reach can work a large area from one position and do not need to constantly move along the face like smaller machines.

II. Fill in the gaps with the appropriate words.

1. In a typical cycle of excavation, the bucket . . . the material . . .
2. A swing operation is then . . . the bucket to the place where the material is to . .
3. The bucket can also be “thrown” by . . . to the jib and then releasing a clutch on….
4. The first is the . . . using offset benches.
5. The second is a . . .

III. Translate the following sentences from Ukrainian into English.

1. Екскаватори - це важке конструкційне обладнання, що складається з стріли, ковша та кабіни на рухомій платформі, що називається ”дім”.
2. Всі рухи та функції екскаватора виконуються за допомогою використання гідравлічгої рідини, будь це гідравлічний таран або двигун.
3. Екскаватори бувають дуже різної величини.
4. Меньші називаються компактними.
5. Стріла забезпечує силу тяги, необхідну, щоб тягнути ковш із землі.
6. На кінці стріли знаходиться ковш.
7. До 1990 року всі екскаватори мали довгу або звичайну противагу, що

звисала ззаду, щоб забезпечити більшу силу тяги і підйомну здатність.

8. Ковши мають різні форми і розміри залежно від області застосування.
9. Система землечерпалки -це великий ковш, що підвішений до стріли за допомогою металевих тросів.
10. Ковш маневрує за допомогою низки тросів та ланцюгів.

D. GRAMMAR REVISION

I. Translate the following sentences into Ukrainian using Conditionals.

1. If excavators didn't have counterweight, these couldn't provide enough digging force and lifting capacity.
2. If the counterweight hadn't been allowed to stay inside the width of the tracks as it slews, this type of machine wouldn't be now widely used throughout the world.
3. If the house weren't attached to the undercarriage by means of a centre pin, it wouldn't allow the machine to slew 360˚ unhindered.
4. If smaller draglines were not so often used before hydraulic excavators came into common use, the smaller draglines were now widely used other than on river and gravel pit works.

E. WRITING

Discuss some of the potential dangers and risks of hazards which could happen on the place of work and write safety instructions for the excavator operators.

UNIT 10

A. UNDERSTANDING A PRINTED TEXT

This text introduces you to the different types of pumps and the characteristics of each type.

I. Before reading the text discuss in the classroom the role of pumps in modern technology. Do you know when and where people began to use pumps?

II. Find the Ukrainian equivalents for the following. Use a dictionary if necessary.

a) a positive displacement pump
b) a discharge pipe
c) a suction side
d) gastrointestinal or other water-borne diseases.
e) encased in a similarly shaped housing
f) a centrifugal pump
g) a rotary vane pump
h) a hydraulic ram
i) a reciprocating pump
j) a centrifugal pump

III. Discuss with your friends safety rules while working with the pumps.

PUMPS

A pump is a mechanical device, used to move fluid, such as gas, liquid or slurry. Pumps operate by displacing a volume by a physical or mechanical action and alone do not create pressure. Pumps only displace fluid, causing a flow. Adding resistance to the flow causes pressure. Pumps are commonly rated by the following criteria: horsepower, flow rate, outlet pressure in feet / meters of head, inlet suction in suction feet / meters of head. The head is the number of feet or meters the pump can raise or lower a column of water at atmospheric pressure. A positive displacement pump causes fluid to move by trapping a fixed amount of it then forcing (displacing)

that trapped volume into the discharge pipe. Some positive displacement pumps work using an expanding cavity on the suction side and a decreasing cavity on the discharge side. Liquid flows into the pump as the cavity on the suction side expands and the liquid flows out of the discharge as the cavity collapses. A positive displacement pump can be classified according to the mechanism used to move the fluid, rotary-type, (e.g., the lobe, external gear, internal gear, screw, shuttle block, flexible vane or sliding vane) or reciprocating-type, (e.g., the piston or diaphragm pump). Positive displacement rotary pumps are pumps that move fluid using the principles of rotation. The vacuum created by the rotation of the pump captures and draws in the liquid.

Rotary pumps are very efficient because they naturally remove air from the lines, eliminating the need to bleed the air from the lines manually. Positive displacement rotary pumps also have their weaknesses. Because of the nature of the pump, the clearance between the rotating pump and the outer edge must be very close, requiring that the pumps rotate at a slow, steady speed. If rotary pumps are operated at high speeds, the fluids will cause erosion. Rotary pumps that experience such erosion eventually show signs of enlarged clearances, which allow liquid to slip through and reduce the efficiency of the pump. Rotary positive displacement pumps can be grouped into three main types: gear pumps - a simple type of rotary pump where the liquid is pushed between two gears. Screw pumps - the shape of the internals of this pump usually two screws turning against each other pump the liquid. Rotary vane pumps - similar to scroll compressors, consisting of a cylindrical rotor encased in a similarly shaped housing. When the rotor turns, the vanes trap fluid between the rotor and the casing, drawing the fluid through the pump.

Reciprocating pumps are those which cause the fluid to move using one or more oscillating pistons, plungers or membranes (diaphragms). Reciprocating-type pumps require a system of suction and discharge valves to ensure that the fluid moves in a positive direction. Pumps in this category range from having "simplex" one cylinder, to in some cases "quad" (four) cylinders or more. Most reciprocating-type pumps are "duplex" (two) or "triplex" (three) cylinder. Furthermore, they can be

either "single acting" independent suction and discharge strokes or "double acting" suction and discharge in both directions. The pumps can be powered by air, steam or through a belt drive from an engine or motor. This type of pump was used extensively in the early days of steam propulsion (19th century) as boiler feed water pumps. Reciprocating pumps are now typically used for pumping highly viscous fluids including concrete and heavy oils, and special applications demanding low flow rates against high resistance.

Hydraulic ram pumps

A hydraulic ram is a water pump powered by hydropower. It functions as a hydraulic transformer that takes in water at one "hydraulic head" (pressure) and flow-rate, and outputs water at a higher hydraulic-head and lower flow-rate. The device uses the water hammer effect to develop pressure that allows a portion of the input water that powers the pump to be lifted to a point higher than where the water originally started. In remote areas where there is both a source of low-head hydropower and a need for pumping water to a destination higher in elevation than the source, the hydraulic ram is sometimes used. In this situation, the ram is often useful, since it requires no outside source of power other than the kinetic energy of flowing water.

Centrifugal pump

A centrifugal pump is a rotodynamic pump that uses a rotating impeller to create flow by the addition of energy to a fluid. Centrifugal pumps are commonly used to move liquids through piping. The fluid enters the pump impeller along or near to the rotating axis and is accelerated by the impeller, flowing radially outward into a diffuser or volute chamber (casing), from where it exits into the downstream piping. Centrifugal pumps are used for large discharge through smaller heads.

Pump repairs

Examining pump repair records and MTBF (mean time between failures) is of great importance to responsible and conscientious pump users. Not all plants are refineries, however, and different results can be expected elsewhere. In chemical plants, pumps have traditionally been "throw-away" items as chemical attack can result in limited life. Things have improved in recent years. Unless the pump user

upgrades the seal chamber, only the more compact and simple versions can be accommodated. Without this upgrading, lifetimes in chemical installations are generally believed to be around 50 to 60 percent of the refinery values. It goes without saying that unscheduled maintenance often is one of the most significant costs of ownership, and failures of mechanical seals and bearings are among the major causes. Keep in mind the potential value of selecting pumps that cost more initially, but last much longer between repairs. The MTBF of a better pump may be one to four years longer than that of its non-upgraded counterpart. Consider that published average values of avoided pump failures range from $2600 to $12,000. This does not include lost opportunity costs. One pump fire occurs per 1000 failures. Having fewer pump failures means having fewer destructive pump fires.

B. CHECK YOUR UNDERSTANDING

I. As you read the text, look for the answers to the following questions.

1. What is a pump?
2. What kinds of pumps do you know?
3. What are the criteria pumps are commonly rated by?
4. How can a positive displacement pump be classified?
5. What is the principle of operation of a rotary pump?
6. What are the drawbacks of positive displacement rotary pump?
7. Why do reciprocating-type pumps require a system of suction and discharge value?
8. What are reciprocating pumps typically used for now?
9. What is the work principle of hydraulic ram pumps and centrifugal pumps?
10. Why is the hydraulic ram sometimes used in remote areas?

II. Read the text again and decide whether the following statements are true or false.

1. Liquid flows into the pump as the cavity on the suction side collapses and the liquid flows out of the discharge as the cavity expands.
2. If rotary pumps are operated at low speeds, the fluids will cause erosion.

3. The vacuum created by the rotation of the pump captures and draws in the liquid.
4. A hydraulic ram is a water pump powered by air.
5. Centrifugal pumps are used for large discharge through smaller heads.

C. INCREASE YOUR VOCABULARY

I. Use a dictionary if necessary and translate the following words or word combinations from English into Ukrainian.

Rotary pumps, reciprocating pumps, scurry, highly viscous fluids, suction hydraulic ram pumps, casing, clearance, plunger, gear pumps, a discharge.

II. Look for the English equivalents of the following in the text.

Рідина, механічна дія, опір, спеціальні застосування, циліндричний ротор, поршень, всмоктування, ефективний компресор, мембрана.

III. Choose the right word and complete the following sentences.

1. Rotary pumps are very efficient because they remove air from the lines, … the need to bleed the air from the lines manually.

a) establishing b) ensuring c) eliminating

2. The pumps can be …by air, steam or through a belt drive from an engine or motor.

a) powered b) displaced c) pressed

3. A positive displacement pump causes fluid to move by trapping a fixed amount of it then … that trapped volume into the discharge pipe.

a) reciprocating b) displacing c)trapping

4. Positive displacement rotary pumps are pumps that move fluid using the principles of …

a) reciprocation b) rotation c) hydropower

5. A centrifugal pump is a rotodynamic pump using a rotating impeller to create flow by the addition of energy to …

a) solid b) liquid c) gas

IV. Translate the following sentences from English into Ukrainian.

1. Pumps only displace fluid, causing a flow.
2. Positive displacement rotary pumps also have their weaknesses.
3. Rotary positive displacement pumps can be grouped into three main types.
4. Reciprocating – type pumps require a system of suction and discharge valves to ensure that the fluid moves in a positive direction.
5. Because water from pitcher pumps is drawn directly from the soil, it is more prone to contamination.
6. If such water is not filtered and purified, consumption of it might lead to gastrointestinal or other water-borne diseases.
7. The ram is often useful, since it requires no outside source of power other than the kinetic energy of flowing water.
8. Rotary pumps that experience such erosion eventually show signs of enlarged clearances, which allow liquid to slip through and reduce the efficiency of the pump.

V. Translate the following sentences into English.

1. Помпи працюють, виштовхуючи об’єм фізичною або механічною дією не створюючи тиску.
2. Поява тиску обумовлена встановленням опору.
3. Напір - це кількість футів або метрів по висоті, на яку помпа може підняти або опустити стовп води при нормальному атмосферному тиску.
4. Об’ємна помпа помпує рідину, захоплюючи її фіксовану кількість і виштовхує її у відвідну трубу.
5. Об’ємні помпи можуть бути класифіковані у відповідності з механізмом, використовуваним для переміщення рідини.
6. Вакуум, створений обертанням, захоплює та переміщує рідину.
7. Поршневі помпи вживаються для перекачування рідин підвищеної в’язкості,включаючи бетон та важкі мастила за низької швидкості та високого напору.
8. Цей прилад використовує ефект водяного молоту для того, щоб розвинути тиск який подає порцію води, що змушує помпу, піднятися до точки вище

тієї, де спочатку знаходилась вода.

9. Відцентрова помпа – це помпа, яка використовує обертальне колесо з лопатками для створення потоку шляхом надання енергії воді.
10. Призначення гідравлічного тарану діяти як гідроперетворювач, що приймає воду з одним тиском і витратою, а випускає з більшим.

D. GRAMMAR REVISION

Read the text again paying attention to the underlined sentences. What type of clauses are they? Translate the following sentences into English using the conditionals.

1. Якщо всі заводи були б очищувальними, можна було б очикувати кращих результатів.
2. На хімічних заводах помпи зазвичай були б «одноразового використання», так як вплив хімічних речовин обмежував би їхній життєвий цикл.
3. Якщо останнім часом ситуація змінилася б на краще, без цих удосконалень строк експлуатації помп в хімічних установках коливався б від 50 до 60 %.

E. DISCUSSION

In pairs speak about where else pumps can be applied and write a short essay about it. Use 200-250 words.

Keys

Unit 1.Automation.

C. I. global, strive to, to distinguish, to threaten, to introduce, to benefit, obscure, to devalue, dramatically, sophisticated.

II. 1 -a, 2-b, 3 – a, 4 – c, 5 – b, 6 – a.

Unit 2. Minimizing human error.

C. I. rrors, to occur, to reduce, injury, to contribute, comprehensive, to eliminate, maintenance, protruding, visibility.

III.1 – a, 2 – b, c – a, 4 – c, 5 – a.

D.I. 1 — although, but, 2 — in fact, 3 — interestingly, 4 — as well as, 5 — happily, 6 – moreover.

Unit 3. Tunnel boring machine.

A. III.1 — c, 2 — a, 3 — e, 4 — d, 5 — b

B. I. 1 — F, 2 — T, 3 — T, 4 — F, 5 - T

C. I. Strata, to drill, advantage, fracture, to push, retraction, segment, to shift, detrimental, to mitigate.

III. 1-c, 2- g, 3- e, 4 — b, 5 — a, 6 — d, 7 – f

D. I. 1- could, 2- can, 3- might, 4- must, 5 - must , 6 - have to, 7-must.

Unit 4. Below ground in the urban environment.

A. II.1 — C, 2 - D 3 -A, 4 -B

B. I. A — T, B — F C — F D — T, E – T

C. I. Vulnerable, to spread out, interaction, attenuate, adjacent, dewatering, to differentiate, survey, distortion, to occur.

II. 1 — C 2- G 3- E 4- A 5- F 6- D 7- B

Unit 5. Tunnels demand special knowledge

A. II. 1 — D, 2 — A, 3 — B, 4 – C

B. I. A-F, B-T, C-T, D-F, E-T

C. I. forecast, to investigate, confined, essential, consequences, to alleviate, disturbance, unique, to allocate, assessment.

II.1- D, 2 — G, 3 — F, 4 — A, 5 — C, 6 — E, 7 – B

III. Geological forecast, time-consuming, underground construction, reinforcement, to take countermeasures, cost overrun, confined space, collected experience, rail tunnel, aerodynamic effect

Unit 6. Drilling.

C. III. 1 - be grouped, 2 - to operate, 3 - a method, 4 - at the same time, 5 - raise, 6 - mixture, 7 - cleaning, 8 - exerting.

Unit 7. Escalators.

B. II. 1 - F, 2 - T, 3 - F, 4 - F, 5 - T

C. I. 1 – b, 2 – d, 3 – a, 4 – d, 5 – c

II. 1 - e, 2 - c, 3 - a, 4 - b, 5 – d.

Unit 8. Escalator components.

B. I. 1 – T, 2 - T, 3 – F, 4 -F, 5 – T, 6 – F, 7 – T, 8 - T, 9 – F.

C. II. 1 - b, 2 - d, 3 - f, 4 - j, 5 - c, 6 - e, 7 - a, 8 - g, 9 - i, 10 – h.

III. 1 - c, 2 - b, 3 - a, 4 - c, 5 - a.

IV. 1 - d, 2 - e, 3 - b, 4 - a, 5 – c.

V. A - 5, B - 3, C - 2, D - 1, E – 4.

Unit 9. Excavator.

B. I. 1 – T, 2 – F, 3 – T, 4 – T, 5 – F.

II. 1 - d, 2 - c, 3 -b.

C. III. 1- f, 2 - j, 3 - b, 4 - h, 5 - i, 6 - g, 7 - c, 8 - d, 9 - e, 10 – a

Supplementary II. 1- is positioned above; to be excavated. 2 - performed to move; be dumped. 3 - winding up; the drag cable. 4 - side cast method. 5 - key pass.

Unit 10. Pumps.

B.II.1 – F, 2 – F, 3 – T, 4 - F, 5 – T.

C.III. 1 - c, 2 - a, 3 - b, 4 - b, 5 – b.

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