ПРАКТИМУМ

для магистров по направлению:
18.04.01 «Химическая технология»
Направленность *Химическая технология топлива и газа*
Курс «Иностранный язык в профессиональной сфере»

Необходимо выполнить приведенные ниже задания по следующим разделам.

Раздел 1. Petroleum industry. Technological process in chemical industry: tools and equipment
Раздел 2. Materials in chemical
Раздел 3. Functions and applications of chemical objects.
Раздел 4. Waste disposal. Safety at work in chemical industry. Safety Equipment.
• Sour gas/ Сероводород
• Acid treatment/ Кислотная обработка
• Well service/ Текущий ремонт скважин
• Drilling rid/Буровой станок
Раздел 5. Refining methods. Refineries
Раздел 6. International oil and gas reserve audit. Exploration risk analysis. Fair Market value of oil and gas properties

РАЗДЕЛ 1

Exercise 1. Read the text and understand it.

Nowadays speaking about all the activities connected with oil and gas business the petroleum experts use three terms: upstream, midstream and downstream. The term «upstream» means oil and gas exploration, drilling and production, «midstream» means transportation, storage, gas processing and «downstream» means refining, distribution, marketing.

To start the story of oil business one should know something about the origin of petroleum. Most geologists believe that oil is of organic origin, i.e. (that is), it originated from decomposition of mainly marine animals and plants buried under thick layers of mud perhaps as long as 400 - 500million years ago. These deposits rich in organic material became the source rocks (sedimentary rocks) for the generation of crude oil. High temperatures and pressures in the sedimentary rocks caused chemical processes that, in turn, resulted in the formation of a waxy substance called kerogen. When heated to a temperature above 100° C kerogen is separated into a liquid (oil) and gas (natural gas). The chemical composition of petroleum is principally hydrocarbons, although a few sulphur-, nitrogen-, and oxygen-containing compounds are usually present.

To look for and to find petroleum is the art of exploration. According to the theories of petroleum origin sedimentary basins are a prime aim for the oil hunters. In general, to form oil and gas pools the following conditions must be fulfilled. 1) The presence of a "source rock" which geologic history allowed the formation of oil. 2) Migration of the oil from the source rock to a «reservoir rock» that is thick,

permeable and porous enough to hold a sizable accumulation of oil. 3) Entrapment. Waters and pressure of overlying layers pushed oil upward until it reached an impermeable layer of rock called a cap rock. A cap rock stops further migration of oil and oil is thus trapped in a reservoir. It is from these reservoirs that people began extracting oil and gas millions of years later.

It should be noted that successful exploration is based on accurate interpretation of the information to be provided by geological and geophysical surveys. Seismic prospect minimizes exploration risk and reduces finding costs. Using complicated tools geologists identify potential traps for oil and gas.

Drilling can prove the presence of oil after the geologists and gee-physicists have found a favorable location for the accumulation of oil. All wells drilled to discover oil and gas accumulations are "exploratory wells", commonly referred to as "wildcats". A successful wildcat is a "discovery well", while an unsuccessful one is a "dry hole".

After oil has been discovered the first wells to be drilled to establish the limits of the field are "appraisal wells". All subsequent wells are "development wells". To determine the reservoir and oil properties geophysical investigations (logging) are to be conducted in the wells. If the first wells "prove" an oilfield, the data from them are used in drawing up plans for the commercial development of the field.

Oil Business

Once oil is found it must be extracted. After the drilling site has been prepared the rig is to be constructed. The rig is known to consist of surface equipment and a derrick which houses drilling tools. The derrick is used to lift sections of pipe which are lowered into the hole made by the drill. To get oil and gas out of the ground is not easy.

Sophisticated techniques and equipment must be used to extract the most out of every oil and gas deposit. Experts consider oil recovery to depend in much on natural pressure. Under natural pressure oil flows freely and it is called the natural flow. It is the most economic period of a well life. If oil wells have too little energy to produce oil efficiently, additional energy must be supplied by pumps or other artificial means.

Crude oil must be transported from the fields where it is produced to the places where it is consumed. Pipelines are likely to be the main means of oil transportation. But tankers, barges, tank tracks, and railroad tank cars are thought to be of no less importance. The latest discoveries of welding methods, construction practices and new materials have extended pipeline transportation into harsh environments and deep waters. All the means of transportation carry oil from wells to storage tanks or directly to refineries. Pipelines also carry petroleum products from refineries to markets. Some of the largest pipelines are to carry more than a million barrels of oil daily.

The basic job of a refinery is to convert petroleum into useful products. As mentioned above, crude oil consists chiefly of hydrocarbons. Refineries are to separate oil into various hydrocarbon groups, or fractions, distillation being the first step of refining. The fractions are then chemically changed and treated with

other substances. The refining processes may be classified as separation, conversion and chemical treatment. The latest improvements in refining maybe said to have saved billions of barrels of crude.

Distribution and marketing appear to be the final links in the petroleum industry chain that begins hundreds of meters below the ground and ends in your home.

Exercise 2. Match the words with the definitions

1. drilling mud	1. ведущая труба
2. contaminant	2. вертлюг
3. Kelly	3. прямоугольный
4. stand pipe	4. вибросито
5. swivel	5. трубопровод
6. shale shaker	6.примесь, загрязнитель
7. roller bearing	7. стояк
8. rectangular	8. буровой насос
9. flow conduit	9. буровой раствор
10. mud pump	10. роликовый подшипник

Exercise 3. Translate into English:

1. Буровой раствор состоит из глины, некоторых других добавок и воды.

2. Система циркуляции удаляет частицы выбуренной породы из ствола скважины.

3. Буровой раствор хранится в емкостях.

4. Специальное оборудование удаляет загрязняющие примеси из раствора.

5. Буровые насосы соединены с бурильными колоннами.

6. Стояк и нагнетательный шланг обеспечивают подвижное соединение с колоннами.

7. Ведущая труба – это труба, прямоугольная или шестиугольная в сечении.

8. Вибросито – это устройство для механического удаления твердых примесей.

9. Сухие присадки вносятся в приемный резервуар через смесительную воронку.

10.Оборудование для удаления примесей включает вибросита, гидроциклоны и фильтрующие центрифуги.

Exercise 4. Find equivalents of the following terms:

A		B	
1.	Периодическая закачка	a)	Gas line
2.	Товарная нефть	b)	Level controller
3.	Газопровод	c)	Hydraulic safety valve

4.	Гидравлический предохранительный клапан	d)	Pipe coating
5.	Регулятор уровня	e)	Batch treatment
6.	Обессоливание нефти	f)	Export oil
7.	Трубное покрытие	g)	Oil desalination

Exercise 5. Complete the text. Use the following words and collocations: accessing oil and gas deposits, but it is important to acknowledge, has been recognized, oil and natural gas, this environmental benefit, oil consumption, to convert natural gas to liquids, petroleum-based products, by providing, petroleum engineers, alternate fuels, per year, drilling era, penetration of new technologies, many other items, is chilled, that will mean, vehicle ownership, fuels, by pipelines.

Petroleum industry: introduction to oil and gas

Since Colonel Drake ushered in the era of drilling for oil with his 1859 well in Pennsylvania, 1) _____ and other industry professionals have made numerous innovations that enable the industry to find and produce the resources that power the world economy.

This was not the first well drilled. Other wells had previously been drilled in several countries around the world, including Azerbaijan and Canada. But this well started the "modern" 2) _____ by attracting the attention and necessary capital investment that enabled the development of new technologies for 3) _____.

4) _____ are an important part of your everyday life. Not only do they give us mobility, they heat and cool our homes and provide electricity. Millions of products are made from oil and gas, including plastics, life-saving medications, clothing, cosmetics, and 5) _____ you may use daily.

In the United States, 97 % of the energy that drives the transportation sector (cars, buses, subways, railroads, airplanes, etc.) comes from 6) _____ made from oil'. Auto manufacturers are developing cars to run on 7) _____ such as electricity, hydrogen and ethanol. However, the electric batteries need to be charged and the fuel to generate the electricity could be oil or gas. The hydrogen needed for fuel cells may be generated from natural gas or 8) _____. Even as alternative fuels are developed, oil will be crucially important to assuring that people can get where they need to be and want to go for the foreseeable future. Barring any increase in the 9) _____, alternative fuels are not expected to become competitive with oil for transportation before 2025.

In areas of the world that are still developing, businesses and individuals are demanding greater mobility for themselves and their products. World 10) _____ is projected to increase from 122 vehicles per thousand people in 1999 to 144 vehicles per thousand in 2020, with the growth occurring in developing nations. In China, for example, the number of cars has been growing by 20 % 11) _____. Airports are being added in these countries as well, expanding jet fuel demand. Oil is expected to remain the primary fuel source for transportation throughout the world for the foreseeable future, and transportation fuels are projected to account for almost 57 % of total world 12) _____ by 2020.

World population is currently around 6 billion people, but is expected to grow to approximately 7.6 billion by 2020. 13) _____ a huge increase in the demand for transportation fuels, electricity, and many other consumer products made from oil and natural gas.

Natural-gas use is growing across all economic sectors. Natural gas burns cleaner than oil or coal, and 14) _____ has encouraged its use. While decades ago, natural gas was seen as an unwanted by-product of oil and may have been wasted, its value 15) _____. Developing nations with gas reserves are finding this resource invaluable to building their economies. Most natural gas is distributed 16) _____, which is a limiting factor for remote resources that are not near the major consuming markets. Some natural gas 17) _____ to a liquid state (LNG) whereby it can be transported across oceans by tanker. Similarly, there is considerable development of technology 18) _____ (GTL) to enable transportation.

The world economy runs on oil and natural gas. These fuels improve your quality of life 19) _____ you with transportation, warmth, light, and many everyday products. They enable you to get where you need to go, they supply products you need, and they create jobs. Without oil and natural gas, quality of life would decline and people in developing nations would not be able to improve their standard of living. Does that mean that alternative energy sources are not necessary? Of course not. 20) _____ the value of oil and gas to the world economy and recognize that it will be decades before the alternatives can replace all of things that oil and natural gas contribute to our lives.

Exercise 6. Complete the text with the words and expressions from the given below and translate the text:

Internals, corrosive products, direction, water vapor, wax, sand, are being sent, be removed from, flowing.

1. Water and dissolved salts can seriously corrode chokes, valves and pipe walls, and must therefore_____ the crude before it is transported.
2. Natural gas may also require treatment at the gathering center, particularly if it contains_____.
3. In product pipelines, pigs can be used to separate two or more different oil products, which_____ at the same time through a single line.
4. Improper selections of _____can reduce the capacity of the separator by as much as 50%.
5. Coalescing devices should not be installed if there is a likelihood they will become plugged with_____ or_____.
6. This device causes the liquid entering the separator to change _____ and prevents it from _____out to the middle of the vessel and thereby reducing the effectiveness of the vapor section.

Exercise 7. Choose the missing words from the given below and complete the sentences

Prime mover, bottom-hole pump, rod string, liquid, polished-rod, natural energy, oil reservoir, pumping unit, artificial lift, up-and-down motion, gas, pitman crank, pumping.

1. When pressures in the _____have fallen to the point where a well will not produce by _____, some method of _____ must be used.
2. The _____ is a complete set of surface equipment necessary to impart an_____ to the sucker-rod string, to which the _____ is connected.
3. Speed reduction between the _____ and the _____ is accomplished by a combination of a V-belt drive and gear reducer.
4. The _____ is lifted by means of a cable looped over the horsehead and connected to the carrier bar to support the _____ clamp.
5. _____wells need a means of sealing off the pressure inside the tubing to prevent leakage of _____ and _____ outside the polished rod.

Exercise 8. Analyze the following text. Complete the text with the words and expressions given in bold:

rig; power; fuelt; driller; transfer; drilling; circulate; mix

Without ***1. power*** nothing on a rig operates. Machinery must have an energy source to make it go. On virtually every drilling rig, the power comes from internal-combustion engines, which are called prime movers. Further, they often use diesel ***2.*** _____. Because of the way diesel engines operate, they deliver more turning force, or torque, than gasoline engines. As a result, many industries, including the ***3.*** _____ industry, use diesels.

A ***4.*** _____may need from two to four prime movers, depending on its size. The bigger the rig, the deeper it can drill and the more power it needs. Thus, big rigs have three or four prime movers. Together, they develop 4,500 horsepower (about 3,300 kilowatts) or more. In comparison, a powerful car engine may put out only 300 horsepower (220 kilowatts) or so; most develop even less.

This power must ***5.*** _____ to the rig's components to make them work. For example, at the same time as the rotary table needs power to turn the bit, the mud pump needs power to ***6.*** _____drilling mud. What is more, to provide maximum power to a component, the ***7.*** _____must also be able to combine the power of two or more engines. Two common methods transfer power on today's rigs and allow the driller to combine engine power: mechanical transmission and electrical transmission.

b) Give written translation of the text.

Exercise 9. Translate the given text into English.

Нефть отправляют на перерабатывающие заводы, чтобы получить различные виды топлива. Следует использовать современные материалы, чтобы значительно уменьшить стоимость трубопроводов. Нефтехимическая промышленность возникла, можно сказать, во время второй мировой войны, чтобы производить синтетическую резину (rubber) для шин (tires). Необходимо провести разведочное бурение, чтобы доказать присутствие нефти. Нужна широкая сеть трубопроводов, чтобы

экспортировать нефть и газ. Необходимо сотрудничество проектировщиков, нефтедобывающих фирм (operators), подрядчиков по прокладке трубопроводов (laying contractors), а также производителей труб, чтобы найти оптимальное решение при сооружении современных трубопроводов. Требуются очень сложные механизмы и оборудование, чтобы сооружать морские (offshore) трубопроводы. Нужно установить вышку с необходимым буровым оборудованием, чтобы пробурить скважину.

Exercise 10. Read the text *'THE IMPACT OF MINING AND OIL EXTRACTION ON THE ENVIRONMENT'. Do the following tasks:*

A. Scan through the text to grasp the main idea and express it in your own words.

B. Read and translate the text.

Coal, oil and gas - fossil fuels - are called conventional fuels because people are accustomed to using them. Today, approximately 80 % of the energy consumed worldwide comes from burning petroleum, natural gas, and coal. However, coal is the dirtiest fuel to burn because it has many impurities which influence the environment.

Mineral deposits represent concentrations of an element or elements to a level at which they can be profitably extractable. As such these deposits represent concentrations of several elements well above crustal abundance. Such naturally occurring high concentrations are reflected in the chemistry of the soils, waters, sediments, plants, etc., close to the deposit. Indeed, measurement of the concentrations of various metals and non-metals in the media such as soil, sediments and waters has been used to locate mineral deposits.

Although there are likely to be significant natural enrichments of several elements in the vicinity of mineral deposits, mining and extraction of the deposit will add greatly to these enrichments. The mining and subsequent beneficiation of minerals and the separation and refining of their various components is one of the most serious sources of contamination of soils, waters, and the biosphere.

Humans have extracted minerals, particularly the metalliferous ores, since ancient times, and the extraction and refining of metals have played a major role in human development. The mining and processing of minerals have increased through time, due to population growth and the greater utilization of raw materials for manufacture. Many areas of past mining activity, in both the Old and New Worlds, bear witness to these extractions in the form of abandoned workings and extensive waste tips. Modern mineral extraction technology is generally far more efficient than past practices, and in many countries such processes are heavily regulated to limit the degree of contamination from extractive industries. However, historical mineral extraction involved less efficient technologies and in those times virtually no environmental regulations were in place. Long-abandoned mineral workings are currently the cause of serious environmental pollution in many countries.

A large number of different materials are extracted from the Earth ranging from fuels such as oil and coal, industrial minerals such as clays and silica,

aggregates for building and roadstone, and minerals for fertilizers as well as sources of non-metals. However, the major cause of concern is the metalliferous ores that are used as sources of metals and metalloids.

The extraction and subsequent processing of ores can be summarized as follows:

Mining — crushing/grinding

Mining — concentration of ore mineral

Mining — smelting/refining.

Ores are extracted from the Earth by either subsurface mining, open pit surface techniques, or in a few cases by solution mining, which carries with it risk of groundwater pollution. Both subsurface and surface extraction result in waste material, which is generally piled on the surface in the vicinity of mine. However, while such waste piles, which frequently contain ore minerals, are sources of environmental contamination, it is the subsequent processing of the ores that result in the greatest environmental problems.

The crushing and grinding (comminution) of mineral processing has the objective of separating the ore minerals from the waste, generally referred to as gangue. To effect separation, the mined ore is finely crushed to liberate individual ore mineral grains to enable concentration of the sought after ore mineral. The very fine waste material left after this concentration process is referred to as tailings, and this material can contain, along with the gangue minerals, residual amounts of the ore minerals and can be a serious source of pollution. The tailings are very fine hence are subject to wind ablation and can easily transported by surface runoff. At many mine sites tailings have been left open to the environment resulting in serious contamination of surrounding soil and water.

Following the mining and processing of the ores, the resultant concentrate is transported to a smelter. Pyrometallurgical smelting involves roasting of the ore concentrate at high temperatures with the subsequent emission of large quantities of potentially harmful elements. The smelter emissions can be in the form of gases, such as sulphur dioxide, aerosols, and larger particulates. Modern smelter stacks are fitted with electrostatic precipitators and other dust recovery mechanisms, which results in the retention of most of the particulates, but some gaseous and aerosolic emissions are still released into the atmosphere. Although any larger particulates released are likely to be deposited close to the source, aerosols and gases can be transported long distances and as a result the smelting of ores has far wider aerial impact than the mining and processing of these ores.

C. Ask your friend if:

- Limestone slurries and caustic solutions are used to control sulphur oxide gas emissions.
- Environmental problems require the expertise of people with differing scientific backgrounds.
- Regulations are concerned with emissions into the atmosphere of gases rather than solids.
- 50 % of air pollutants have natural causes.

- Mining industry is no longer allowed to leave the land surface in a disturbed condition.
- There are many devices on the market which can be used to solve all kinds of air and water problems.
- New methods of producing copper by chemical means have been highly successful.
- The highest proportion of atmospheric pollutants produced by man comprises carbon monoxides.
- Useful by-products can be obtained by treating gas streams from modern copper smelting operations.
- Liquid wastes can be largely recycled after treatment.

D. Summary writing

1. Read the text again and determine the main idea of each paragraph.
2. Underline the key words and collocations.
3. Put the main ideas into your own words. Try to use all the underlined words and collocations.
4. Organize the key points in the form of a plan.
5. Make a summary. Your summary should reflect the key points and the supporting details in a condensed form.

Exercise 11. Read the text '*THE EFFECT OF EXTRACTING, DELIVERING AND USING PETROLEUM PRODUCTS ON THE ENVIRONMENT* **and do the following tasks:**

A. Scan through the text to grasp the main idea and express it in your own words.

B. Read and translate the text.

Oil and natural gas burn cleaner than coal but are heavy polluters, too. Oil and gas are preferred fuels because coal is so polluting, and because it is less useful for many kinds of engines. But these fuels, too, cause a great deal of pollution. Burning gasoline in automobiles produces air pollution and smog. The effect of smog on vegetation and human health are well documented. In addition, oil used in cars, trucks, and airplanes sometimes spills and soaks into soil. Leaking oil and leaking underground gasoline tanks have caused pollution problems and expensive lawsuits; although it now seems that natural soil bacteria are capable of decomposing most oil.

Refineries, also, pollute. What comes out of the ground from a typical oil well is a thick substance that is a mixture of many chemicals from very heavy tars to very light gasoline and natural gas. A refinery is basically a gigantic chemistry set that separates this "crude oil" into its components and can also convert one form of the crude oil into more useful form, usually converting the heavier chemicals to lighter ones. Refineries have accidental spills and slow leaks of gasoline and other products from storage tanks and pipes. Over years of operation,

large amount of liquid hydrocarbons may be released, polluting soil and groundwater below the site.

The pollution continues during delivery. A famous example happened on March 24, 1988 when the supertanker Exxon Valdez, carrying 1.2 million barrels of crude oil, ran aground on Bligh Reef in Prince William Sound, Alaska, and broke open. The ship was full of Alaskan crude oil that had been delivered to it through the Trans-Alaska Pipeline, which itself is a controversial way of transporting oil. The oil poured out of ruptured tanks of the tanker at about 20, 000 barrels per hour, spilling a total of about 250,000 barrels (llmillion gallons) into the sound. An even bigger spill was avoided when the remainder of oil was off-loaded onto another vessel.

The spill killed thousands of fish, birds, and mammals - 13 % of the sound's harbor seals, 28% of the sea otters, and 645,000 seabirds died. Within three days, winds began spreading the huge oil slick so widely that there was no hope of containing it. Of the 11 million gallons of spilled oil, about 20% evaporated and 50% was deposited on the shoreline. Only 14% was collected by skimming and other waste recovery. The *Exxon Valdez* spill showed that the technology for dealing with oil spills was inadequate. The spill disrupted the lives of the people who live and work in the vicinity of Prince William Sound. Even after more than $3 billion was sent to clean up, few people were satisfied with the results.

Long-term effects of large oil spills are probably not devastating. There is no evidence that the Ocean's ecosystems are seriously threatened by oil spills. Nevertheless, the effect can last several decades. Toxic levels of oil have been identified in salt marshes 20 years after a spill.

The Exxon Valdez spill led to the Oil Pollution Act of 1990 and new technology. More modern tankers are being built with double hulls designed to prevent or limit the release of oil in case of collision or grounding. We now also have new techniques to collect oil at sea, using floating barriers and skimmers (oil is lighter than water and so floats on water), but even the best methods are difficult to use in high winds and rough seas. Oil on beaches may be collected by spreading absorbent material, such as straw, waiting for the oil to soak in, and then collecting and disposing the oily straw.

C. Discuss with your group –mates the following issues:

1. Modern mineral extraction technology is heavily regulated in many countries.
2. Waste material is the greatest environmental problem.
3. Aerosols and gases can be deposited close to the source.
4. Geologists can define mineral deposits by concentration of some elements.
5. Mining and subsequent beneficiation of minerals do not affect the environment.
6. The major cause of concern is mineral extraction such as clays and silica.
7. Mineral extraction is a modern human activity.

8. Tailings are subject to wind ablation and can easily transported by surface runoff.

D. Summary writing

1. Read the text again and determine the main idea of each paragraph.
2. Underline the key words and collocations.
3. Put the main ideas into your own words. Try to use all the underlined words and collocations.
4. Organize the key points in the form of a plan.

Make a summary. Your summary should reflect the key points and the supporting details in a condensed form.

Exercise 12. Speak on the topic "Biotechnology. What does it mean?".

Exercise 13. Read and translate the text.

Cell is a structural and functional unit of organisms

Scientists grouped the whole diversity of living organisms into four kingdoms: viruses, fungi, plants and animals. The representatives of the last three kingdoms have cellular structure that indicates their relationship. Virus is a non-cellular life form.

Some organisms can be represented by a single cell (simple) or may consist of many cells. Unicellular organisms appeared earlier than the multicellular ones but their structure and functions are almost equal that suggests their phylogenetic relationship (multicellular evolved from single-celled). The advantage of multicellular organisms lies in the fact that all the properties and characteristics of the cells (metabolism, movement, reproduction, death) repeat many times that leads to an increase in the duration of life and the possibility to leave more descendants and less dependent on the external conditions.

The cells of different organisms have a similar structure. All the living organisms are divided into two major groups: prokaryotes and eukaryotes. Prokaryotes do not have the clearly drawn nucleus, organelles (except ribosome) are replaced by membrane structures. The cells of eukaryotic organisms have nuclei and a set of organelles depending on the type and function of cells. Despite the common principle of structure and similar chemical composition there are significant differences between the cells of eukaryotic organisms of different kingdoms. All the cells have plasma. The cells of plants and fungi have rigid cell membrane -a cell wall. In fungal cells it is composed of chitin while in plant cells it is composed of cellulose. Bacterial cells are surrounded by the mucous capsule. The animal cells have no cell wall. The shape and size of cells are different and depend on the performed functions. Similarly, all cells have a nucleus and the cytoplasm with the main set of organelles: endoplasmic network, Golgi apparatus, ribosomes, mitochondria, lysosomes. Each of these organelles perform its function, but their activity depending on the needs of the cell weakens or strengthens.

Cell is not only structural but also a functional unit of a living organism, because it can consume and transform energy and matter. All materials received

from outside the cell are involved into metabolism consisting of plastic and energy exchange. These two processes are linked. Synthetic reactions during which the substances necessary for the cells are produced require energy. The energy is released in the decay (oxidation) of substances in the course of dissimilation. Decomposition reactions occur in the presence of enzymes, formed during the assimilation. The relationship of plastic and energy metabolism determines the functional integrity of cells.

All cells grow and multiply. Reproduction occurs by mitosis. Mitosis in multicellular organisms is a way of growth.

Having read the text, say, what you think about:

1. Extracting, screening and modifying active substances of natural origin help to identify the mechanisms by means of which some drugs help to prevent or cure a number of diseases.
2. The term "downstream" relates to all processes that follow synthesis in a bioreactor.
3. The present demand for biotechnologists and bioengineers significantly exceeds the expected supply

Summary writing

1. Read the text again and determine the main idea of each paragraph.
2. Underline the key words and collocations.
3. Put the main ideas into your own words. Try to use all the underlined words and collocations.
4. Organize the key points in the form of a plan.
5. Make a summary. Your summary should reflect the key points and the supporting details in a condensed form.

Задание для аннотации по теме № 3 раздела № 1.

Прочтите текст, определите его основную идею. Выделите ключевую информацию. Оформите письменную аннотацию (5-7 предложений).

FORMATION OF OIL

A) Crude oil is a complex mixture of hydrocarbons with minor proportions of other chemicals such as compounds of sulphur, nitrogen and oxygen. To use the different parts of the mixture they must be separated from each other. This separation is called refining.

B) Crude oils from different parts of the world, or even from different depths in the same oilfield, contain different mixtures of hydrocarbons and other compounds. This is why they vary from light colored volatile liquids to thick, dark oils - so viscous that they are difficult to pump from the ground.

C) Hydrocarbons vary in structure depending on the number of carbon atoms and the way in which the hydrogen atoms combine with them. Hydrocarbons can

be arranged as straight chains, branched chains or closed rings. There are two main chemical families of hydrocarbons - the alkanes and the alkenes.

D) As the structure of hydrocarbons varies so much, thousands of synthetic products can be manufactured with many different properties. Hydrocarbons with small molecules make good fuels. Methane (CH4) has the smallest molecules, and is a gas, used for cooking and heating and generating electricity. Gasoline, diesel, aviation fuel and fuel oil are all liquid fuels.

E) Hydrocarbon molecules can be split up into smaller ones, or built up into bigger ones, or altered in shape, or modified by adding other atoms. This is why they are a very useful starting point (called a chemical feedstock) for making other materials. Even the thick black tarry residue left after distillation is useful. It is called bitumen, and is used in tarmac for road surfacing, and for roofing.

F) Oil is formed from the remains of tiny plants and animals (plankton) that died in ancient seas between 10 and 600 million years ago. After the organism died, they sank into the sand and mud at the bottom of the sea. Over the years, the organisms decayed in the sedimentary layers. In these layers there was little or no oxygen present. So microorganisms broke the remains into carbon-rich compounds that formed organic layers. The organic material mixed with the sediments, forming fine-grained shale, or source rock. As new sedimentary layers were deposited, they exerted intense pressure and heat on the source rock. The heat and pressure distilled the organic material into crude oil and natural gas. The oil flowed from the source rock and accumulated in thicker, more porous limestone or sandstone, called reservoir rock. Movements in the Earth trapped the oil and natural gas in the reservoir rocks between layers of impermeable rock, or cap rock, such as granite or marble.

Раздел 2: Biotechnology: definition and evolution

Развитие навыков аналитического чтения и перевода английских текстов по темам:

Тема: Molecular modeling

Тема: Processes of preservation

Тема: Реферирование статей, составление аннотаций

Exercise 1. Read the text and understand it.

The term “biotechnology” is defined as 'processes that produce, preserve and/or transform biological materials of animal, vegetable, microbial or viral origin into products of industrial, commercial, economic, social and/or hygienic utility and value'. Biotechnologists and bioengineers are men and women qualified to design, develop, operate, maintain and control biotechnological processes.

The term “biotechnology” first appeared in 1897 in Yorkshire, England, where the Bureau of Biotechnology provided the local analytical services with the processes of fermentation. The early development of the principal biotechnology industries – food, drugs and textiles – display marked similarities, though their

modes of development have differed over the centuries. First hard men made technologies were used. There were different patterns of them. Gradually they were mechanized and soon human hands were replaced by mechanical devices and machines driven successively by animal power, water, wind, steam engines, fossil fuels and electricity.

For many centuries technologies and industries that processed food and drugs have been closely associated. The standards of quality and safety for food and drugs are frequently administered by the same regulatory agency, the US Food and Drug Administration is a typical example.

Molecular modeling

Pharmaceutical industries began by extracting, screening and chemically modifying pharmacologically active substances of natural origin. These traditional processes allow to identify what the specific diseases are caused by, the mechanisms by means of which some drugs help to prevent or cure them. At the end of the last century using classical organic chemistry, a scientist could synthesize about 50 new active compounds a year. Today by means of the computer it's possible to generate several thousand new compounds.

"Downstream processes"

In biotechnological nomenclature the term "downstream" relates to all the processes that follow synthesis in a bioreactor: fractionation, isolation, purification and sterilization of synthesized products. The most difficult and expensive processes are scale-up processes. In North America the downstream processes absorb about 80 per cent of factory production costs. Highly skilled bioengineers are in urgent demand to improve the efficiencies and economies of downstream processes. The recent studies of skilled human resource needs indicate that the present and predicted demand for biotechnologists and bioengineers significantly exceeds the expected supply.

Processes of preservation

Most kinds of food and pharmaceuticals are susceptible to deteriorative change: through microbial infection, pest infestation, biochemical reaction, chemical contamination and atmospheric pollution. In order to preserve the most sensitive food and pharmaceuticals it is necessary to destroy, remove or prevent the entry of harmful microorganisms; to restrict the adverse biochemical and biophysical change.

Biochemical spoilage induced by the microbial infection or catalyzed by enzymes can be restricted by 1) thermal destruction or inactivation of an offensive microbe or enzyme, 2) reducing the temperature of the product and ambient atmosphere below the freezing point lowering the active water content (i.e., product vapor pressure) by partial dehydration, 3) control of gaseous ambient atmosphere within the package or container.

IT IS INTERESTING TO KNOW

Cell is a structural and functional unit of organisms

Scientists grouped the whole diversity of living organisms into four kingdoms: viruses, fungi, plants and animals. The representatives of the last three

kingdoms have cellular structure that indicates their relationship. Virus is a non-cellular life form.

Some organisms can be represented by a single cell (simple) or may consist of many cells. Unicellular organisms appeared earlier than the multicellular ones but their structure and functions are almost equal that suggests their phylogenetic relationship (multicellular evolved from single-celled). The advantage of multicellular organisms lies in the fact that all the properties and characteristics of the cells (metabolism, movement, reproduction, death) repeat many times that leads to an increase in the duration of life and the possibility to leave more descendants and less dependent on the external conditions.

The cells of different organisms have a similar structure. All the living organisms are divided into two major groups: prokaryotes and eukaryotes. Prokaryotes do not have the clearly drawn nucleus, organelles (except ribosome) are replaced by membrane structures. The cells of eukaryotic organisms have nuclei and a set of organelles depending on the type and function of cells. Despite the common principle of structure and similar chemical composition there are significant differences between the cells of eukaryotic organisms of different kingdoms. All the cells have plasma. The cells of plants and fungi have rigid cell membrane -a cell wall. In fungal cells it is composed of chitin while in plant cells it is composed of cellulose. Bacterial cells are surrounded by the mucous capsule. The animal cells have no cell wall. The shape and size of cells are different and depend on the performed functions. Similarly, all cells have a nucleus and the cytoplasm with the main set of organelles: endoplasmic network, Golgi apparatus, ribosomes, mitochondria, lysosomes. Each of these organelles perform its function, but their activity depending on the needs of the cell weakens or strengthens.

Cell is not only structural but also a functional unit of a living organism, because it can consume and transform energy and matter. All materials received from outside the cell are involved into metabolism consisting of plastic and energy exchange. These two processes are linked. Synthetic reactions during which the substances necessary for the cells are produced require energy. The energy is released in the decay (oxidation) of substances in the course of dissimilation. Decomposition reactions occur in the presence of enzymes, formed during the assimilation. The relationship of plastic and energy metabolism determines the functional integrity of cells.

All cells grow and multiply. Reproduction occurs by mitosis. Mitosis in multicellular organisms is a way of growth.

IT IS INTERESTING TO KNOW

GENETICS

The science studying heredity and variability, as well as properties inherent in all live organisms, is called genetics. A great variety of kinds of plants, animals and microorganisms is supported according to the principle that each species preserves its characteristic features through generations: in the cold north and in tropical countries a cow always gives birth to a calf, a hen reproduces a chicken, and wheat gives wheat. However, living beings are individual: all people differ

from each other, all cats are not similar and even wheat cones, if you look at them attentively, have distinctive features. These two major properties of plants and living beings are: to look like their parents and to differ from them. This makes an essence of concepts "heredity" and "variability".

Since people had been engaged in animal husbandry and agriculture, they began to understand that signs of descendants depended on properties of their parents. Selecting and crossing the best species, a man had been creating breeds of animals and sorts of plants with improved properties from generation to generation. In the second half of 19th century animal breeding and plant growing heightened interest to phenomenon of heredity. At that time it was considered that the material substratum of heredity was a homogeneous substance, and hereditary substances of parental forms mixed up in posterity just like soluble liquids mixed up with each other. It was considered also that in animals and human beings heredity was somehow related with blood: expressions "half-blooded", "thoroughbred", have remained up to now.

The founder of a new science – genetics – is considered the prior of a monastery in Brno Gregor Mendel, the person who opened fundamental biological laws. These laws of genetics describe the transfer of signs from parents to children. They assert that all inherited signs are defined by genes.

Genes are certain fragments of DNA. Each kind of plants or animals has a certain number of chromosomes. For example, each person has 23 steams of the chromosomes. Features of transfer of the hereditary information are defined by two processes: mitosis and meiosis. Mitosis is a process of distribution of chromosomes to daughter cells during cellular division. As a result of mitosis, each chromosome of a parental cell doubles; thus, hereditary information is completely transferred from one cell to two daughter cells. So there takes place cell fission in ontogenesis, i.e. process of individual development. Meiosis is a specific form of cellular division which takes place only during formation of gametes.

Exercise 2. Match the words with the definitions.

Genetic code	ядро
Can be inherited	ткани тела
alternate molecules,	может быть унаследован
Produce protein	вырабатывать белок
cell division	биологическая функция
characteristics required	генетический код
biological function	Требуемые параметры
bonded together by atoms of hydrogen	клеточное деление
nucleus	Точность генетической информации
body tissues	звенья цепи
accuracy of genetic information	различная последовательность букв
blueprint for life	проект на всю жизнь
links in a chain	чередующиеся молекулы
different sequences of letters	связанный атомами водорода

Exercise 3. Give Russian equivalents to the following words and expressions:

Biological, structure, function, chemical,, viruses, genetic information, form, formation, ribonucleic, molecule, organisms, instruction, fundamental, phosphate, genetic code, DNA replication, separation, identical, enzymes, polymerase, termination/initiation signal, characteristics, practice.

Exercise 5. Now read the text again and decide whether these sentences are true or false.

a) The scholars complained: "The disease of this age is the multiplicity of books; we cannot digest the abundance of written matter"

b) Less than 350 bio-information debates operate around the world.

c) Some companies posses the molecular libraries that offer the computerized molecular structures.

d) There isn't a serious impediment to rational databases and cogent bio-scientific communication.

e) There is an urgent need to accept an international dictionary of precise bio-definitions.

f) Database curators must delete outdated accessions and interpret the needs of the potential users.

Exercise 6. Comprehension. Answer the following questions.

1. What does biotechnology deal with?
2) What is biotechnology identified with?
3) How does biotechnology help the farmers?
4) Where does biotechnology find its application?
5) Are there some application of biotechnology that do not use living organisms? What are they?
6) What is biotechnology?
7) What are the functions of biotechnologists and bioengineers?
8) When did the term "biotechnology" first appear?
9) How did the principal biotechnology industries develop at the beginning?
10) What were the men made technologies replaced by?

Exercise 7. Complete the text with the words and expressions from the given below and translate the text:

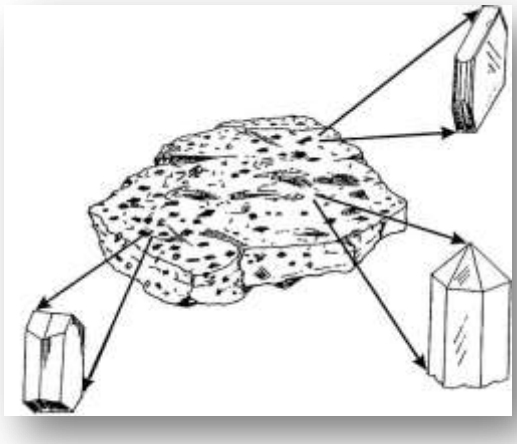
The representatives of the last three kingdoms have a cellular structure, which indicates their … .Prokaryotes do not have the clearly drawn … .The cells of plants and fungi have rigid… - cell wall. Cell is not only structural but also a functional …of a living organism as it can … and … energy and matter. Relationship of … and energy … determines the functional integrity of cells.Reproduction occurs by … . Biotechnology is also used to recycle, … … , clean the areas … by industrial activities.Biotechnology assists the … to …the amount of chemical fertilizers.Today's biotechnology is identified with its application in … and… . … used in making bread, bear and … is an example of biotechnology.There are

concerns about … . Different types of crops have been produced using the … .Technology is the ability to … .Another example of biotechnology's usage is the bacteria's … . … and produce biological weapons.

Exercise 8. Analyze the following text. Answer the questions and do exercises.

Rocks and Minerals

The earth is composed of rocks, which are aggregates of small grains or crystals called minerals. Minerals are naturally occurring, relatively pure chemical compounds. Examples of minerals are quartz (SiC_2) and calcite ($CaCO_3$). Rocks can be composed of numerous grains or several different minerals. **Granite**, for example, is composed of quartz, **feldspar**, **hornblende** and **biotite**. Rocks can also be composed of numerous grains of the same mineral.



The rock limestone consists only of calcite mineral grains. Rocks have been formed throughout the billions of years of earth's history. The same chemical and physical processes that form rocks today formed rocks throughout geological time. The **molten** lava flowing out a volcano in Hawaii or Italy today is similar to lava rock formed millions and billions of years ago. Ancient sandstone is a rock composed of sand grains was formed the same way as sand is deposited today: along **beaches**, in river channels, and on desert **dunes**. There is nothing unusual about ancient rocks. They formed the same way as rocks are forming today.

A. Exercises

Answer the questions based on the text.

1. What can rocks be composed of?
2. How are rocks formed?

B. Read the text. Then mark the following statements as true (T) or false (F).

1__Granite is composed of quartz, feldspar, hornblende and biotite.

2__Ancient sandstone rock is composed of minerals.
3__Rocks have been formed throughout the billions of years of the earth's history.
4__The article is about the extraction of minerals from rocks.
5__Rocks are formed in the result of physical and chemical processes.
6__The composition of volcanic lava has not changed through millions of years.

C. Fill in the blanks with the correct words from the word bank.

Feldspar Quartz Biotite Hornblende Mineral Dune

1. A positive form of relief; a sandy hill formed by the action of wind is _____.
2. _____is a mineral that contains potassium-aluminum-magnesium-iron mica.
3. _____is a rock-forming mineral from the class of silicates. _____.
4. Magmatic rock-forming mineral, a complex silicate of calcium, magnesium and iron is a _____.
5. The most common mineral in the earth's crust, the chemical formula is SiO_2; it is a _____.
6. _____ is a naturally occurring substance, representable by a chemical formula, that is usually solid and inorganic, and has a crystal structure.

D. **Read the conversation between the speaker A and the speaker B. Mark the following statements as true (T) or false (F).**

A: Is soil the product of its environment? Or is it just a mixture of weathered rocks and decayed organic matter?
B: Of course, soil is a natural object. It contains a greater variety of minerals than rocks.
A: What does the mineral composition of soil depend on?
B: A number of factors influence the composition of soil. The main are a type of material breed, its age and soil-forming processes.
A: How can we explain a great variety of soil mineral composition in comparison with rocks?
B: The parent rock of the soil originates from several kinds of rocks. Hence the variety.
A: How do soil-forming processes affect the mineral composition of soil?
B: Usually soils with lower content of minerals resistant to changes, are developing where chemical weathering is intense. And in conditions of less intense weathering there are more such minerals in the soil.
A: What changes occur in the minerals of the parent rock in the process of soil development?
B: It is caused by physical and chemical reactions. The size of particles decrease. In the result it prompts the chemical activity of minerals.

1____ The dialogue is about the types of minerals.
2____ The age of the soil does not affect its mineral composition.
3____ The mineral composition of rocks changes during the process of soil development.

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Exercise 9. Read the text 'Types of Rock *s'* and do the following tasks:

Rock is one of the solid materials of which the earth's crust is mainly composed. It is made up of minerals. The majority of rocks are **heterogeneous aggregates** of more than one kind of mineral, but some rocks consist largely of a single kind mineral.

Rock occurs both in the form of layers (strata) and irregular masses of various sizes and shapes. They originate by many ways. According to their origin, three major categories of rock are recognized. They are **igneous rocks** (Latin "igne" means "fire"), **sedimentary rocks** and **metamorphic rocks**. ("Metamorphic" in Greek means "changed form".)

It is believed that millions years ago the Earth was **molten** (liquid or almost liquid). It is considered that some of molten material cooled to form the **solid crust** of the Earth. Any material formed from a liquid rock is called igneous rock.

During a long period of geologic time, igneous rocks were eroded. The forced of **erosion** carried away the particles of **eroded** rock-**coarse and fine-grained** and set them down by layers either on dry land or under water. In course of time, some of these materials were subjected to high pressure. As a result they changed into another type of solid material known as sedimentary rock.

Igneous and sedimentary rocks were often subjected to heat, pressure or movement. As a result, their **original** qualities were changed. Thus, new materials known as metamorphic rocks were formed.

A. Answer the questions, using the information from the text. Discuss it with your group mates.

1. What do we mean by the word "rock"?
2. What categories of rocks do you know?
3. What is the title of the material, which was formed from a liquid rock?
4. How did igneous and sedimentary rocks become metamorphic rocks?

B. Read the text. Then mark the following statements as true (T) or false (F).

1. All rocks consist largely of a single kind of mineral.
2. "Metamorphic" in Greek means "constant form".
3. It is believed that millions years ago the Earth was liquid or almost liquid.
4. The forces of erosion carried away just the coarse-grained particles of eroded rocks

C. Match the words (1-8) with the definitions (A-H).

1__ original
2__ eroded
3__ heterogeneous aggregate
4__ molten
5__ rock
6__ crust
7__ igneous rock

8__ sedimentary rock

A source, initial
B natural mineral composing the lithosphere of the Earth
C different types of something
D that was subjected to erosion
E the outermost solid shell of a rocky planet or natural satellite, which is chemically distinct from the underlying mantle
F being in a liquid state, between the temperatures of melting and boiling
Gtype of rock that was formed be the deposition of material at the Earth's surface and within water
H type of rock that was formed through the cooling and solification of magma or lava

D. Read the sentence pairs. Choose where the words best fit the blanks.

1. rocks/igneous rock

A. Any material, which was formed from a liquid rock, is referred to as___.
B. The earth crust mainly consists of ___.

2. **metamorphic rock/ sedimentary rock**

A. After magma cools and solidifies, ___ is formed.
B. ___ arise from the transformation of existing rock types.

3. **molten / erosion**

A. There was the equipment to work with the___ metal in the laboratory.
B. Soil___ reduces the area of arable land.

4. **eroded / fine-grained**

A. Reduction of fertility at 50% was registered on ____ solid.
B. ____ structure of soil promotes better moisture retention.

E. Summary writing

1. Underline the key words and collocations.
2. Put the main ideas into your own words. Try to use all the underlined words and collocations.
3. Organize the key points in the form of a plan.
4. Make a summary. Your summary should reflect the key points and the supporting details in a condensed form.

Exercise 10. Read the text '*Types of mineral deposits***' and do the following tasks:**

A. Scan through the text to grasp the main idea and express it in your own words.

B. Read and translate the text.

Mineral deposits are generally classified on the basis of the geological processes responsible for their formation. They may be **magmatic**, **contact**,

metasomatic, **pegmatitic**, **hydrothermal**, **sedimentary**, **residual** and regional metamorphic deposits.

Magmatic deposits originated in the result of cooling and crystallization of magma and concentrated minerals, from parts of the body of igneous rocks. Magmatic deposits are relatively simple in mineral composition and few in number. Pegmatites are relatively coarse-grained rocks found in igneous and metamorphic regions. The great majority of them consist of **feldspar** and quartz, often accompanied by **mica**, but complex pegmatites contain unusual minerals and rare elements. Many **pegmatites** are regular **tabular** bodies; others are highly irregular.

At the earth`s surface the action of the atmosphere and hydrosphere alters minerals and forms the new ones that are more stable under the existing condition. Sedimentary deposits are bedded deposits derived from pre-existing material by **weathering**, **erosion**, transportation, deposition and consolidation. The mineral deposits that are formed in the result of sedimentary processing and weathering are commonly grouped as follows: 1) sedimentary deposits, not including the products of evaporation, 2) chemical evaporates, 3) **placer** deposits, 4) residual deposits, and 5) organic deposits.

Sedimentary deposits include the extensive coal beds of the world, great petroleum resources, clay deposits, limestone, dolomite beds and sulphur deposits, etc.

Chemical **evaporates** consists of soluble salts, formed by evaporation, in closed or partly closed shallow basins. Deposits of gypsum and common salt (**halite**) are found in many countries.

Large residual deposits of clay bauxite, from which aluminum, phosphate, iron and manganese are extracted, have been worked in many parts of the world. Smaller deposits of nickel and other minerals have also been worked.

Organic deposits are formed by the remains of animals and plants. Plants and animals collect and use various inorganic substances in their live processes, and the concentration of certain of these substances after the death of the organisms may lead to the formation of a mineral deposit. Coal and peat are formed from plant remains and represent the concentrations of carbon from the carbon dioxide of the atmosphere.

C. Answer the questions, using the information from the text. Discuss it with your groupmates.

1. How are mineral deposits classified?
2. How were magmatic deposits originated?
3. What do chemical evaporates consists of?
4. Which minerals are formed by the activity of organisms?

D. Read the text. Then mark the following statements as true (T) or false (F).

1 ___ Magmatic deposits are relatively complex in mineral composition and few in number.

2___ Peat is formed plant remains.

3___ Hydrothermal deposits were originated in the result of cooling and crystallization of magma.

4___ The great majority of pegmatites consist of feldspar and quartz.

E. Match the words (1-8) with the definitions (A-H).

1___ to classify	3___quartz	5___magma	7___erosion
2___mineral deposits	4___crystallization	6___weathering	8___minerals

A the destruction of rocks and soil surface by the action of water flows and wind.

B solid natural formations that make up the rocks of the Earth, Moon and other planets and meteors and asteroids.

C natural, most often silicate, liquid melt formation composing magmatic rocks by cooling.

D the process of destruction and changes of rocks and minerals under the influence of temperature, air movement.

E the process of crystal formation from gases, solutions, melts of glasses.

F one of the most common minerals in the earth`s crust, rock-forming mineral for most magmatic and metamorphic rocks.

G to divide into classes, categories, groups according to key characteristics or properties.

H accumulation of mineral substances on the surface or in the depths of the earth.

F. Read the sentence pairs. Choose where the words best fit the blanks.

1. pegmatites/evaporates

A._____ contain relatively rare minerals.

B._____ are the rocks composed of salts deposited on the bottom of pool as the water evaporates.

2. represents/found

A. Often ore minerals are _____ in the mountainous regions.

B. Halite _____ a rock or common salt.

3. mica/minerals

A. Weathering is one of the important factors in the formation of new _____.

B. _____ is a mineral that visually resembles glass and has a layered crystal structure.

Exercise 11. Read the conversation. Mark the following statements as true (T) or false (F).

Student 1: Hi! Please, help me! What do you know about residual deposits?

Student 2: Well, residual deposits of minerals consists of products of rock weathering. They are accumulated in the result of the removal of soluble compounds by the surface water.

Student 1: Can you tell me what minerals residual rocks contain?

Student 2: In fact, all residual rocks contain metals. For example, iron and manganese are found in every residual rock.

Student 1: What other metals can be found in residual rocks?

Student 2: Well, copper, lead, zinc, nickel and tin are also present in the most residual rocks. In some rocks one can find even small amount of gold, silver and platinum.

Student 1: I wonder in what form those metals occur.

Student 2: As far as I know, metals occur as constituents of dark-colored silicates. The more common metals occur in the form of sulphides and oxides.

Student 1: Thank you very much for your explanation.

Student 2: You are welcome.

1___ Residual deposits contain nonmetals and the remains of animals and plants.

2___ The second student can`t help his friend.

3___ In some residual deposits you can find small amount of gold, silver and platinum.

Exercise 12. Speak on the topic "Rocks".

Make up a communication of 150 –200 words.

РАЗДЕЛ 3

Развитие навыков аналитического чтения и перевода английских текстов по темам:

Тема: *Происхождение и накопление углеводородов.*

Тема: *Инновации в химической промышленности*

Тема: *Реферирование статей, составление аннотаций*

Exercise 1. Read the text and understand it.

Sedimentary rocks

Sedimentary rock is one of the three main rock groups (the others being **igneous** and **metamorphic rocks**). Rock formed from **sediments** covers 75 – 80% of the Earth's land area, and includes common types such as chalk, limestone, **dolomite**, sandstone, **conglomerate** and shale.

Sedimentary rocks are formed from the deposition of particles, eroded from older rocks also from precipitates, solutions or from calcareous remains or organisms. Throughout the history of the earth the rocks of the land masses were subjected to erosion by wind, water and other agents. Some of these agents were transported to lakes and seas, the broken down material **settled** in the water as **gravel**, sand and clay, extremely fine particles being silt. The **gradual** deposition of these sediments on the bottom of lakes and seas and their compaction by **overburden pressure** produced sedimentary rocks. In the process, sand and clay

became porous, granular rocks, forming conglomerate, sandstone and shale, respectively. The framework of porous **granular** rocks is generally called the «matrix» or «skeleton».

Other sedimentary rocks are limestone, dolomite, **gypsum**, anhydrite, salt, coal and **lignite**. Limestones were formed principally by the deposition of **calcareous** materials in seas or lakes; most dolomites resulting from the deposition of limestone alteration.

Gypsum, anhydrite and salt being deposited as a result of **evaporation** of water from restricted lakes and seas are called evaporates. Some limestones and dolomites were also formed during this evaporation process. Coal and lignite result from gradual changes produced by pressure and heat in beds of vegetation. In **logging**, the **mineralogical composition** of rocks is frequently referred to as «lithology».

Rocks made up of particles that do not **adhere** to each other are said to be **unconsolidated** or **soft**. When held together into coherent mass by cementation or by compaction, these rocks are called **consolidated** or **hard**. A rock with no compaction is called unconsolidated or soft. If the grains of a rock may be nearly uniform by size, distribution and mineralogical composition, the rock being called «**uniform**» or «**homogeneous**», otherwise it is «non – uniform». If the physical properties of a rock do not change with the direction, the rock is «**isotropic**»; if there is a variation with the direction, it is called «**anisotropic**». A layer of rock of one kind is a **bed**. A thick bed or a series of beds constitutes a «formation».

IT IS INTERESTING TO KNOW

Metamorphic rocks

Rocks, which have been changed so that their characters are altered, are known as **metamorphic rocks.** All rocks change after they are formed. Atmosphere, the circulating water, the pressure of overlying rocks-all these factors have some effect.

Many forces of the earth's crust change rocks. The most important of these forces are heat and pressure. Magma at the temperature 2000 degrees or more flows into the **overlying** rocks. The heat of magma burns and **alters** the nearby rock. When hot, **intruded rocks** alter the rock on both sides, the effect is described as a contact metamorphism. Metamorphism may also take place due to hot gases and hot liquids, arising from hot rocks heated by magma. The hot gases pass through **cracks**, making a closer contact with the nearby rocks and materials. These **volatile deposits** may produce many new minerals. Hot solutions make the same and are likely to transport even more new minerals than hot gases. Heated waters have a lower temperature than magma and bring their own kinds of minerals with them. The **zeolites** and **arsenic minerals** are the examples of low-temperature deposits.

The effect of heat and hot chemical solutions is sometimes called local metamorphism in contrast from the regional metamorphism, which affects large areas. Regional metamorphism usually involves the movements of the earth's crust. The origin of these movements is related to a **shift** in the earth's crust. Regional metamorphism can raise or lower the level of rocks. Rocks may be **tilted**, folded, stretched or broken. Therefore, regional metamorphism is responsible for the most varied physical and chemical changes going on in rocks. Under pressure rocks may be cut by numerous cracks that conceal bedding and may run at different angles to the strata. This latter phenomenon is known as **cleavage**.

Metamorphic rocks are hard to describe and harder to classify. Their appearance depends on the kind and the degree of changes. The alteration of soft sandstones to **quartzite**is an example of metamorphism. Quartzite is harder, **tougher** and more durable than the sandstone from which it was formed. Therefore, unless these rocks are studied carefully, geologists cannot be sure of their origin.

Exercise 2. Answer the questions, using the information from the text. Discuss it with your groupmates.

1. What do we call contact metamorphism?
2. What is regional metamorphism related to?
3. What is cleavage?
4. Why are metamorphic rocks difficult to describe and classify?

Exercise 3. Read the text. Then mark the following statements as true (T) or false (F).

1__The most important forces of the earth's crust are heat and tension.

2__ Volatile deposits may produce many new rocks.

3__ Local metamorphism is the effect of heat and hot chemical solutions.

4__ Appearance of metamorphic rocks depends on the kind and the degree of change.

Exercise 4. Read the sentence pairs. Choose where the words best fit the blanks.

1. ***Shifting / cleavage***

A. _____ is the phenomenon at which cracks cut the rock under pressure.

B. _____ is a change of the earth's crust location.

2. ***Zeolite /quartzite***

A. _____ is an example of low-temperature deposit.

B. _____ is an example of metamorphismin nature.

3. ***Volatile deposits / magma***

A. _____ can burn and alter the nearby rock.

B. _____ may produce many new minerals.

Exercise 5. Match the words (1-7) with the definitions (A-G).

1. __ quartzite 3. __ sandstone 5. __ magma 7. __ crack
2. __ arsenic 4. __ zeolite 6. __ metamorphosis

A. a very toxic agent.
B. a liquid fusion in the upper level of the earth's crust.
C. transformation, change of something.
D. a strong rock of gray color.
E. a mineral with glass gloss.
F. the sedimentary rock made from grains.
G. defect with the violation of interatomic bonds.

Exercise 6. Read the dialogue between a student and a specialist. Then mark the following statements as true (T) or false (F).

St:I've got a very important question concerning metamorphic rocks. Can you help me?

Sp: Yes. What specifically do you want to know?

St: By means of what forces do metamorphosis occur in nature?

Sp: The most important are heat and pressure.

St: Incredibly. What substances contribute metamorphism?

Sp: There are a lot of them. I can name a few. They are magma, hot gases and liquids.

St: I like reading about them. Can you give a simple example of metamorphism?

Sp: Yes, it is the transformation of soft sandstones to quartzite.

St: Thank you very much. I've learned a lot from you.

1.__The student knows very little about metamorphosis.
2.__ Metamorphosis occur because of exposure of high temperatures.
3.__ Magma is one of the substances that can cause metamorphosis.
4.__ Sandstone is transformed into zeolite.

Exercise 7. Analyze the following text. Answer the questions to each part of the text.

Generation of hydrocarbons

The source of gas and oil is the **organic matter** that is **buried** and **preserved** in the ancient **sedimentary rocks**. These rocks contain not only inorganic particles such as sand **grains** and **mud**, but also dead plant and animal material. The most common organicmatter is rich sedimentary rock (the **source rock** for the most part of gas and oil) is black **shale**. It was the depositionof the organic – rich mud on the

ancient ocean bottom. In the subsurface layer, **temperature** is the most important factor in turning organic matter into oil. The source rock is covered with more sediments and buried deeper in the earth. It becomes hotter and hotter. The minimum temperature for oil formation is about 150**°F** (65°C), occurs at the depth of about 7000 **ft** (2130 m) below the surface. Oil is generated from there and down to about 300°F (150°C) at about 18000 ft (5500 m). The reactions that change organic matter into oil are complex and take a long time. If the source rock is buried deeper where the temperatures are above 300°F (150°C), the **remaining** organic matter will generate natural gas.

Gas and oil are relatively light in **density** compared to water that also occurs in the subsurface sedimentary rocks. After oil and gas have been generated, they rise due to **buoyancy** through **fractures** in the subsurface rocks. The rising gas and oil can **intersect** a layer of **reservoir rock**. A reservoir rock is a type of sedimentary rocks that contains billions of **tiny** spaces called pores. A common sedimentary rock is **sandstone** composed of sand grains similar to the sand grains on a beach or in a river channel. Sand grains are like spheres, and there is no way the grains will **fit** together perfectly. There are pore spaces between the sand grains on a beach and in a sandstone rock. **Limestone**, another common sedimentary rock, is deposited as shell beds or **reefs**, and there are pores between the shells and corals. Gas and oil flow into the pores of the reservoir rock.

Answer the questions, using the information from the text. Discuss it with your groupmates:

1. What conditions are necessary for oil and gas to be generated?
2. What happens after oil and gas have been formed?
3. What does a common sedimentary rock consist of?
4. How is limestone deposited?

Exercise 8. Match the terms (1 – 8) with the definitions (A – H).

1. shale	5.reef
2. sandstone	6.mud
3. limestone	7. organic matter
4. sedimentary rocks	8. source rock

A. clastic sedimentary rock, which is a homogeneous or layered clastic unit grain sizes ranging from 0,1 mm to 2 mm (grains of sand) related by any mineral substance;

B. the lowermost horizon of the soil where there are basic soil – forming processes;

C. rocks that exist in thermodynamic conditions typical for the surface of the earth's crust, and the resulting redeposition products of weathering and destruction

of various rocks, chemical and mechanical precipitation of the water of life organisms or all three processes simultaneously;

D. a class of chemical compounds, which include carbon;

E. soft fine – grained rock from a mixture of mineral and organic matter deposited on the bottom of streams and reservoirs;

F. underwater or floating elevation of the seabed in shallow water;

G. sedimentary rock organic rarely chemogenic origin, composed mainly of calcium carbonate ($CaCO_3$) as crystals of calcite different sizes;

H. the rock characterizing by a parallel arrangement of their constituent elongated or plate – like minerals.

Exercise 9. Translate the given text into English.

Камень это природный материал и горная порода, использующийся во многих областях промышленности, в том числе в строительстве.

Горные породы в зависимости от условий образования подразделяются на три группы: первичные (изверженные), вторичные (осадочные) и видоизмененные (преобразованные или метаморфические).

Изверженные горные породы образовались непосредственно из магмы, а осадочные - в результате физического, химического и органического выветривания (разрушения) изверженных пород, а также из продуктов жизнедеятельности растительных и животных организмов, населявших большие водные бассейны. Метаморфические горные породы образуются в результате воздействия высокой температуры, давления и химических процессов на изверженные или осадочные горные породы.

Exercise 10. Read the text '*A SHORT HISTORY OF OIL TANKER AND STORAGE TANK CONSTRUCTION'* **and do the following tasks:**

A. Scan through the text to grasp the main idea and express it in your own words.

B. Read and translate the text.

A SHORT HISTORY OF OIL TANKER AND STORAGE TANK CONSTRUCTION

Part 1

The earliest building of oil barges to transport oil products first appeared in Russia at the end of the 1870`s and the beginning of the 1880`s. This was a period when Russian oil industry began to develop and the problem of transporting crude and refined oil products was particularly acute.

The engineering firm A.V. Bary was established in 1880. Its main office was in Moscow with branch office in Petersburg. In addition the firm had an engine building works in Orenburg and a shipyard in Saratov where the large oil barges were constructed. Production was started in 1884 to provide the Baku oil fields with much needed cargo transport to deliver oil to the central regions of Russia.

The shipyard in Saratov was located on two separate construction sites. The first being situated on the bank of the river Volga and the second one in the Uleshi area where the tanks in which the oil would be stored were produced. Both sites were in the open air. The first shipyard had enough space to build up to ten or eleven barges at one time while the second one in Uleshi had the capacity to build eight. The main body of the ship would be built between October and April at the Volga's lowest ebb.

Then at the beginning of the thaw these structures would gently float off their cradles thus dispensing with the need to build complex and expensive launching equipment. The rest of the ship would then be finished off during the summer period. The barges and all important storage tanks within them were the design of V.G. Shukhov, a very talented Russian engineer, who was the firm's chief engineer. Bary, the owner of the company was an American citizen, but Russian by birth.

Bary and Shukhov first met in 1878 in Boston, where both men had come to see an industrial exhibition and to find out the latest technical innovations. After this initial meeting they met up again on numerous occasions and after extensive negotiations agreed to become partners. The firm they set up was called "A Bary`s engineering and construction office". Bary was a highly talented administrator and manager and soon turned his chief engineer's original technical projects into a very profitable business. There were some wits at that time who dubbed the business: "Bary`s construction office for the exploitation of Shukhov`s ideas".

However Shukhov himself was perfectly happy with the set up. He was much more interested in the engineering and design side of the business and was quite happy to leave the administrative side to Bary in return for his substantial salary.

Vladimir Grigoryevich Shukhov (1853 – 1939), was an outstanding Russian scientist and engineer who made an enormous contribution to many branches of Russian industry. He was born in Graivorony, a small town in Belgorod province, in a family of a modern clerk. In 1876 he graduated from the Moscow High Technical College and soon went to the USA for further training. There he met Bary. During those fifty five years he worked for Bary`s firm, over 35000 oil storage tanks were built according to his design specifications all over the Russian empire. Shukhov`s innovative oil storage tank design saved millions of rubbles.

Unlike the storage tanks designed in the West, Shukhov`s were made of metal sheets of various thickness. For the upper part of the tank thinner sheets were used because this part of the tank was under less pressure from the liquid cargo than the lower part. This bold innovation enabled Shukhov to make considerable savings on his building material costs. Bary`s Saratov factory alone produced 2800 oil storage tanks based on Shukhov`s design. Shukhov`s storage tank design soon became a vital chain in a transportation link that ensured the constant flow of oil between the Caspian Sea and Saratov.

Part 2

Shukhov had never seen an oil field in his life, but when he went to Baku, he had no qualms about designing a continuous action oil extraction pump and

devising an ingenious air lift system which used compressed air to drive the oil to the surface. It was also Shukhov who designed one of the first oil pipelines which was eleven kilometers long and commissioned by the Nobel Brothers. It was Shukhov who suggested heating viscous liquids such as crude oil and fuel oil with steam before pumping them.

He also invented an oil refining technique which later became known as "cracking". These are some of the hundreds of technical innovations that this extraordinary engineer came up with. Among his most important achievements were the construction of the stage for the Moscow Art Theatre and an arched steel bridge with a span of over one hundred meters.

Shukhov also did a lot for marine and river transport. An oil burner designed by him in 1884 to burn fuel in a dispersion steam jet made it possible for steam boats to start using oil as their main source of fuel instead of wood thus saving the forests along the banks of the Volga and other rivers from being destroyed completely.

The demand of oil tankers, the first of which were built for the Nobel Brothers, increased continuously and A.V. Bary`s office decided to get more involved with this potentially lucrative business. At first the firm used some modest repair yards in Tsaritsyn. However it was later decided to build a whole ship yard in Saratov. Saratov was specifically chosen because it was one of the largest and best developed economic center in the province with direct access to the Ryasan-Ural railroad.

In 1884 a ship yard with a construction site that had direct access to the river was built on the former site of D.T.Dynkov`s repair yard. Shukhov often came to Saratov to oversee the construction of his oil storage tanks and oil barges. A production line construction method was designed and used by Shukhov. The designs were drawn up in Moscow and then sent on to the ship yard in Saratov where the construction and assembly work was carried out. For each separate part of each oil tanker or storage tank a full scale paper pattern was made in order to insure that each part was made to exactly the correct specification. The whole process was so simple that the tankers and tanks could be assembled comparatively poorly educated workers.

C. Answer the following questions:

1. When did the earliest building of oil barges to transport oil products first appear?
2. Where was the main office of Bary`s firm?
3. Where were two sites of Saratov`s shipyard situated?
4. When would the main body of the ship be built?
5. What was V.G. Shukhov?
6. Where and when did Bary and Shukhov first met? And how did they become partners?
7. What was Bary?
8. Was Shukhov perfectly happy with the set up?
9. What Shukhov storage tanks were made of?

10. What enabled Shukhov to make considerable savings?

D. Translate into English:

1. Это был период, когда русская нефтяная промышленность начала развиваться и проблема транспортировки сырья, и переработанных нефтяных продуктов была особенно острой. 2. Судоверфь в Саратове располагалась на двух отдельных участках. 3. Барии, владелец компании, был американским гражданином, русским по происхождению. 4. Он гораздо больше интересовался инженерной и дизайнерской стороной бизнеса. 5. Новаторский проект резервуара для хранения нефти Шухова сэкономил миллионы рублей. 6. Один только саратовский завод Барии производил 2800 нефтяных резервуаров, сделанных по проекту Шухова. 7. Барии был талантливым администратором и менеджеров, способным обратить любой проект в очень выгодный бизнес. 8. В.Г.Шухов был выдающимся русским ученым и инженером, внесшим огромный вклад во многие отрасли русской промышленности. 9. Первая верфь имела достаточно места, чтобы строить одновременно 10-11 барж. 10. Главный офис был в Москве с филиалом в Санкт-Петербурге.

E. Speak on the topic "HISTORY OF OIL TANKER".

Раздел 4: *Утилизация. Безопасность при работе в области химической промышленности. Оборудование по безопасности.*

Развитие навыков аналитического чтения и перевода английских текстов по темам:

Тема: *Экологическая безопасность.*
Тема: *Промышленная и экономическая безопасность.*
Тема: *Использование отработанных материалов*
Тема: Реферирование статей, составление аннотаций

Exercise 1. A. Read and translate the text. Having read the text, speak about the difference between public and quasi-public goods and the role of government in providing these goods.

Health, safety, environment

In the modern business world the abbreviation HSE stands for Health, Safety and Environment. In practice this means that any business has legal responsibilities to ensure the health and safety of employees and other people affected by their business activities while operating in an extremely friendly manner towards the environment.

If you happened to be present at any meeting in a western oil company the first thing you would notice is that the meeting starts with a brief safety introduction, that is to say an action plan that you have to follow in case of emergency. Another example of how seriously HSE is taken is that at every operational meeting or meeting related to the general company performance one of

the first indicators to be discussed is performance in HSE. The lower the number of incidents or accidents, the better it is for the company.

Oil companies put HSE first amongst their priorities because the stock market and the shareholders consider the HSE performance of companies to be a main indicator of the professionalism of the company. Everybody who works in companies like these, anywhere, is responsible for getting HSE right. Good HSE performance and the health, safety and security of everyone who works for the Company arc critical to the success of its business.

Goals can be simply stated: no accidents, no harm to people, no damage to the environment. Under these circumstances companies continue to improve the environmental and health impact of their operations by reducing waste, 50 emissions and discharges, and using energy efficiently. They will produce quality products that can be used safely by their customers. ЛИ leaders within companies are held accountable for accomplishing the HSE goals by demonstrating correct HSE behaviors, by clearly defining HSE roles and responsibilities and by providing needed resources and by measuring, reviewing and continuously improving HSE performance. In many companies the yearly bonus is not paid, if the HSE targets are not achieved.

The leadership is responsible for the HSE performance of its workforce. They should do this by personal example, by developing employee's positive attitude towards HSE, setting clear goals and objectives, and creating an environment where employees understand it is all right for them to stop the work if they think HSE rules are not being followed.

All accidents, incidents or any other event causing danger to health safety or environment (including near misses an accident that nearly happens), no matter how severe, need to be reported. Once reported they should be investigated and analyzed to develop learnings which can be used to prevent the same accident from occurring again. These learnings are distributed throughout the company.

Personal protective equipment (PPE) provides the last line of defense in protecting employees from injury and illness in the workplace. It does not replace prevention of an accident in the first place but it is an essential part of the HSE management system.

Alcohol and drug use is not permitted by the company and leaders shall ensure people under the influence of alcohol or drugs are not permitted to work on any company location. Storage or distribution of alcohol is not permitted anywhere under the company control. The company will carry out random testing for alcohol and searches for drugs and alcohol. If an employee is found to be addicted to drugs or alcohol the company will contribute to medical treatment.

No work shall commence until the number of HSE conditions are met. Risk and safety assessment have been done. All personnel are appropriately trained to do the work. The correct PPE is being worn. An escape plan form the place of work is in place. A permit to work for hazardous areas has been obtained. If any changes are made to the work conditions after the relevant permissions are obtained then work will stop.

When work is to be carried out at less than 2 m from the edge at a height of 1.3 m or more the following HSE rules must be followed: a fixed platform with hand rails shall be used; a preventer (safety line) shall be used that can bear the weight of at least 700 kg per person attached; special instructions and training for persons working at height shall be given.

Lifting operations utilizing cranes, hoists, or other mechanical devices can be carried out under the following conditions: risk assessment has been carried out prior to the work starting; all involved staff (crane operators, assistants etc) have been trained and certified (and carry the certificates) to operate the lifting machinery. The lifting equipment should have an up to date technical inspection certificate.

Vehicle Requirements: all vehicles must be fit for the purpose and be maintained and in a safe condition; scat belts must be present and functional and the vehicles should be fitted with a fire extinguisher and first aid kit; the number of passengers and loads should not exceed the manufactures specifications.

Drivers Requirements: seat belt must be worn by all the occupants at all times, whenever a vehicle is in motion; drivers must hold the appropriate licenses; drivers must not be under the influence of drugs or alcohol; headlights are to be used day and night during the winter; mobile phones arc not to be used when the vehicle is on motion.

Contractors are one of the key factors in the company's HSE performance. Contractors are expected to follow the same HSE requirements as the employees; therefore contracts will contain an HSE section. The company will use contractors that meet the standards of HSE required and will work with other contractors to help them improve. The company will also continuously monitor the contracts HSE performance and demand improvements when identified.

The crisis and emergency management system is a system of interaction between various company units to manage the company's activities in the event that various incidents, accidents and other emergencies arise.

In the air protection area the company will monitor all polluting emissions including green house gas emission, eliminate continuous flaring of associated gas, strive to avoid working in environmentally protected or sensitive areas, strive to avoid installing impassable obstacles that may prevent migration of animals, minimize the impact on wildlife, minimize the consumption of fresh water; not discharge waste water into the water table, carry out its operations in a manner that doesn't contaminate water sources, continuously monitor its water usage and discharge, optimize land usage to minimize the industrially effected area, avoid operating in native habitation areas or sites of archeological or cultural value, minimize soil erosion.

B. Fill in the gaps with the word(s) from the list below. Explonation to these terms are given in the brackets. Translate them into Russian.

1. The accident took place because of the absence of _____ and other necessary equipment at the workplace (**safety line**).

2. At the beginning of field development an oil company should assess the possible _____ to the environment **(influence**).
3. To prevent accidents from occurring again it is necessary to investigate not only incidents, but also _____ (**an accident that nearly happens)**.
4. Before starting oil exploration a company should perform _____ including identification of risks and hazards as well as the ways of removing them (**defining risks out of the work**).
5. The personnel of our company is specially trained in safety method of work _____ (**doing, fulfillment**).
6. The drivers are required to hold the _____ driving licences (**proper, relevant**).
7. Labour protection includes application of _____ in the process of operation (**safety clothes and footwear**).

C. Match the problems with the ways of their solutions. Translate them.

<u>The problems:</u>

1. The employee was found drunkard on the company location
2. Great damage is done to landscape of the area in the process of field development
3. The operator collapses in the process of pumping fluid
4. The accident happened because the driver was distracted by mobile phone call
5. The crewmember can fall from the platform at 2 meter height

<u>The ways of the problems' solutions:</u>

1. Mobile phones are not to be used when vehicle is on motion.
2. The employee should contribute to medical treatment.
3. The company will remediate the impact to the environment.
4. A preventer shall be used that can bear the weight of at least 700 kg per person attached.
5. The personnel should wear PPE.

D. Summary writing

1. Read the text again and determine the main idea of each paragraph.
2. Underline the key words and collocations.
3. Put the main ideas into your own words. Try to use all the underlined words and collocations.
4. Organize the key points in the form of a plan.

Make a summary. Your summary should reflect the key points and the supporting details in a condensed form.

Exercise 2. A. Read and translate the text. B. Scan through the text to grasp the main idea and express it in your own words.

ACID TREATMENT

An acid pumper arrives to a remote location to perform an acid wash and squeeze. The well is known to have a concentration of 20 000 ppm H_2S. There is a service rig on location with a five man crew, an air trailer with a safety operator, one customer representative, one tank trunk operator, and a three man acidizing

crew. The pumper is spotted upwind of the wellhead, 25 meters from the rig tank. A Kelly hose is run from the rig pump to the pumper unit. The pumper unit is rigged into a manifold to allow the pumping of fluid to either the tubing or casing.

The safety operator has a portable H_2S monitor on site with sensors located at the rig tank and wellhead. There are SCBA units located in the safe area. The day before the alarms had sounded at the rig tank when the well was being circulated. The safety operator checks over the rig with a personal monitor before the safety meeting and finds no H_2S. He feels there is no need to supply the pumper operator with a SABA and air hose.

During the safety meeting, the dangers of H_2S are discussed and emergency procedures are reviewed. The pumper and rig pump operators get their units ready to transfer fluid from the rig tank. The rest of the personnel meet in the rig shack for coffee.

The rig pump operator starts to pump fluid from the rig tank to the pumper. The pumper operator looks in the tank to check the level and collapses on the far side of the truck. The rig pump operator does not see the operator fall and continues to pump. The supervisor comes out of the doghouse and sees his operator down and runs toward the pumper. The supervisor goes down as he reaches the unit. The rig pump operator sees the supervisor go down and stops pumping. The portable monitor at the wellhead then goes off.

A rig crew and air trailer attendant arrives to a location at the same time to start the day. The air trailer attendant unlocks the trailer and proceeds to stretch out the air lines. The rig crew goes into the doghouse to change their clothes.

One man, however, decides to check the shut-in tubing and casing pressure before changing his clothes. Once he records the pressure, he decides to bleed off pressure to an open tank. The return and kill lines had been drained the night before and not reconnected. The build-up pressure is released to the atmosphere. Approximately 2000 ppm of H_2S is released to the atmosphere. It migrates downwind directly into the path of the air trailer attendant. He is instantly overcome and collapses near the end of the catwalk.

The second crewman sees the air trailer attendant slump to the ground. He rushes over to assist and is also knocked down. The first crewmember realizes what is happening and shuts the wellhead valve.

A rig crew was pulling a wet test. The crewmembers were all masked up. A safety supervisor, also masked up, was testing the floor area with a detector tube device. Several wet stands were pulled, and no H_2S had been detected. The safety supervisor suggested the crew take off their masks, as they were tiring quickly. The situation was discussed with the rig manager and the well site representative. All agreed the crew should take off their masks. The safety supervisor would remain masked up and would continue testing.

The crew went back onto the floor without masks. A stand was pulled and the tool joint broken. The mudcan was put on, and the crew left the floor. The driller picked up on the stand and the mud drained. The safety supervisor opened the mudcan and tested. No H_2S was detected. The crew was called back on the floor to hoist another stand. As they were about to hook on the elevators, a small

mud burp was observed. The safety supervisor told the crew to leave the floor and he began to test.

Three of the crewmembers were going into the doghouse when the first one went down. Two more went down on top of him. The well was immediately shut in. The three crewmembers were revived shortly afterwards and taken to hospital. The safety supervisor detected 32% H_2S.

C. Decide whether the statements are true or false. Correct them if necessary.

1. Oil spill response operations on soils include spill identification, containment and cleanup.
2. Adsorbents facilitate oil degradation and neutralization.
3. In order to reduce harmful releases gas is burnt in flares.
4. The main difference between industrial safety and labor protection is that industrial safety deals with safety issues and labor protection deals with security.
5. By severity injuries can be classified as micro traumas, light and serious injuries and fatalities.
6. Incident investigations primarily performed to identify the guilty persons in order to punish them and thus to prevent the incident recurrence.
7. Improper handling of hazardous materials may result in health damage, injuries and even fatalities.
8. Contamination sources can be classified as point sources (wells, pits), linear sources (pipelines) and areal sources (oil fields).
9. Detergents are bacteria used for microbiological oil degradation.
10. Remediation is performed to remove effects of adverse impacts of man-caused factors on soil vegetation cover.

D. Connect the terms with their definitions.

1. hazard	1. an unexpected event that results in physical harm or damage to property
2. risk	2. damage to the body. Commonly as a result of an incident
3. waste disposal	3. key causes of an incident
4. minor injury	4. the general state of harm caused by the effects on the body of a toxic substance
5. workplace certification	5. likelihood or probability that the harm from a particular hazard will be realized
6. intoxication	6. an unexpected event that results in physical harm or damage to property
7. injury	7. something with a potential to cause harm

8. root causes	8. storage and landfill of wastes
9. incident	9. a small injury, like finger cut, that does not result in lost time
10. accident	10. inspection of workplace to identify if it is in compliance with safety regulations

Exercise 2. Translate from English into Russian.

1. Key contaminants of the environment in the process of oil production are crude oil and oil products, sulfurous gases and hydrogen sulfide containing gases, formation waters and wastewaters, oil sludge and chemicals.
2. Water treatment facilities include wastewater gathering and treatment, control over treatment quality and discharge of treated waters.
3. Physico-chemical methods of oil contamination cleanup include application of adsorbents, capable to adsorb oil well and remain on water surface after adsorption.
4. Collected with pump and vacuum trucks crude oil is subject to processing or neutralization and disposal.
5. Wastes are divided into liquid (used and contaminated process fluids, domestic and industrial wastewaters) and solid (solid domestic wastes, drilling cuttings, construction garbage, scrap metal) wastes.
6. A standard set of safety clothes includes a working coveralls or a suit, safety footwear with steel toes, gloves or mitts, warm clothes for protection against cold weather and of fire resistant or inherent fire resistant materials.
7. Concentration of a toxic substance in the air, at which no changes occur in a human body even in case of prolonged exposure to that substance, is called maximum permissible concentration.
8. Incident investigation is performed to identify immediate and system (root) causes and undertake corrective actions in order to prevent recurrence of such incidents.
9. Risk assessment must be conducted and a work-permit obtained prior to implementation of a high risk production task or operation.
10. Key air contaminants in oil and gas industry include vehicles (greenhouse gases), and also atmospheric releases during gas flaring.

Exercise 3. Translate from Russian into English.

1. Сульфид водорода является высокотоксичным бесцветным газом, тяжелее воздуха, с запахом тухлых яиц, который парализует дыхательную систему и приводит к летальному исходу за считанные минуты.
2. Промышленная безопасность – это система обеспечения безопасной работы производственного оборудования и опасных производственных объектов.
3. Экологическая безопасность подразделяется на охрану недр и охрану окружающей среды, которая включает охрану водных ресурсов, охрану земельных ресурсов и охрану воздушной среды.

4. Методы защиты и восстановления нарушенных и загрязнённых земель включают уборку замазученности, управление отходами и рекультивацию земель.
5. Управление отходами – это комплекс мероприятий, направленных на снижение объёмов отходов, их хранение, вывоз, переработку или утилизацию на полигонах захоронения.
6. Под рекультивацией понимают комплекс мероприятий, направленных на восстановление первоначальных свойств почв, нарушенных или загрязнённых в процессе разработки нефтегазовых месторождений.
7. Сероводород, углеводород и сернистый ангидрид являются наиболее характерными компонентами для нефтедобывающих объектов и преобладают по токсикологическому воздействию и объёмам.
8. Система управления промышленной безопасности включает предотвращение и ликвидацию аварий, извлечение уроков из происшествий и подготовку отчётности.
9. Операции повышенного риска включают работы с электрооборудованием, огневые работы, земельные работы, работы в замкнутом пространстве, работы на высоте, грузоподъёмные операции, управление транспортными средствами, работы с пожароопасными, взрывоопасными и токсичными материалами.
10. Средства индивидуальной защиты включают ушные вкладыши, наушники, респираторы, противогазы, дыхательные аппараты, очки безопасности, лицевые щитки, каску и другое оборудование.

Exercise 4. Make up your own sentences using the following word combinations:

Equipment failure, emergency rescue team, gas contamination, hot job, multiple injuries, releases, self-contained breathing apparatus, waste disposal site, work at height, oil sludge, maximum permissible concentration.

Exercise 5. Find Russian equivalents for the given English ones.

1. natural disaster	1. сжатый газ
2. gas flaring	2. негативное воздействие
3. compressed gas	3. ушные вкладыши
4.buddy system	4. наряд-допуск
5. adverse impact	5. стихийное бедствие
6.occupational disease	6. система взаимного наблюдения друг за другом при работе
7.work permit	7. сжигание газа на факеле
8.ear-plugs	8. профессиональное заболевание

Раздел 5: Переработка. Нефтеперерабатывающие предприятия.

Развитие навыков аналитического чтения и перевода английских текстов по темам:
Тема: *Состав сырой нефти. Процесс переработки и перегонки бензина.*
Тема: *Молекулы в газах и жидкостях. Молекулы в твердых веществах.*
Тема: *Равновесие жидкость – пар. Зависимость температуры от равновесия пара.*

Exercise 1. A. Read and translate the text. B. Scan through the text to grasp the main idea and express it in your own words.

Pipeline Construction

Oil pipelines are made from steel or plastic tubes with inner diameter from 30 to 120 cm (about 12 to 47 inches). Where possible, they are built above the surface. However, in more developed, urban, environmentally sensitive or potentially dangerous areas they are buried underground at a typical depth of about 1.3 - 1.6 meters (about 3 feet). The oil is kept in motion by a system of pump stations built along the pipeline and usually flows at speed of about 1 to 6 m/s. Multi-product pipelines are used to transport two or more different products in sequence in the same pipeline.

Here are the following steps in pipeline construction:

1) Survey, setting out - marking the centerline of the pipeline ditch and edges of the right-of-way.

2) Right-of-way (ROW), clearing, grading - ROW width is determined by the diameter of the pipeline to be installed and includes room for the pipeline and working space for the construction equipment used to install the pipeline. A low silt fence protects it against corrosion.

3) Ditching - excavated soil {spoil) is deposited on the ditch bank. In certain areas, particularly farmland, the ditch will be excavated in two passes with a first pass removing topsoil and the second pass excavating the remaining soil to the required pipeline burial depth.

4) Stringing - laying sections of pipe along the ROW (stringing) uses pipe in varying lengths (joints). Stringing trucks transport pipe from a stockpile to the ROW where a pipe layer or crane lays them along the ROW.

5) Bending- joints of pipes can be bent to accommodate elevation changes, horizontal direction changes or both along the ROW. If a change cannot be designed within the field-bending constraints special pipe bends (factory bends, hot bends) must be manufactured for the special location.

6) Road crossing - boring beneath a road does not damage the road surface, and traffic flow is not interrupted by the boring activity. Line pipe used for the road crossing has a thicker external coating to provide extra protection during installation. The road crossing pipe is joined to the welded strings of line pipe by a tie-in crew using manual welding.

7) Skidding the pipe before being welded, line pipe is lifted onto skids made of timber and stockpiles along the ROW so that the entire circumference is accessible.

8) Welding - the work here assumes use of automatic welding to join the sections of line pipe, which provides consistency, uniform welds and fewer repairs. To prepare the line pipe for automatic welding, a beveling and facing machine trims, cuts and grinds the pipe ends with the special edge preparation required by the process. Line pipe comes from the pipe mill with a standard edge preparation or with a plain end if the pipe is specially ordered for automatic welding.

9) Line-up, internal welding - a series of pneumatically operated pistons radially spaced around the internal clamp centers the joints and correctly aligns the pipe ends for welding. The first welding pass is made with the internal welding torches and is called the "root"; this is the primary strength weld that fuses the two pipes.

10) External welding (firing line back end) - the external torches make the next welding pass {hot pass). Together the root and hot passes provide the required fusion and strength to join the pipes permanently. The remainder of the weld passes (fill passes) is made from the outside. The final welding pass (cap) completes the weld and forms a cap over the bevel. The number of welding stations for the automatic welding crew varies depending upon the wall thickness of the line pipe.

11) Horizontal directional drilling (HDD) - is often the preferred method for constructing the pipeline across such obstacles as streams or wetlands.

12) Non-destructive testing (NDT) after welding the joints are inspected by non-destructive methods to verify weld integrity. How many welds are inspected varies depending on the code to which the pipeline is designed, the service of the pipeline (gas or oil products), its location (environmentally sensitive areas, highly populated areas or other risk factors) and the requirements of the pipeline owner. Inspection of 100% of the welds is not uncommon. Customary inspection is by internal X-ray, external gamma ray or ultrasonics.

13) Field-joint-coating - the factory-applied external coating does not cover a few inches of each pipe to allow for welding. After NDT inspection, field – joint coating is applied to the bare sections at the pipe welds covering the exposed pipe and the weld.

14) Padding, lowering and backfilling- welded strings of pipe vary in length depending on the terrain conditions but are typically hundreds of feet long. Before the pipe strings are lowered into the ditch, selected padding, usually sand, is placed on the ditch bottom to cushion the pipe. In rocky soil, the fill may be placed around and on top of the pipe (shading). A fleet of sidebooms lifts the string off the timber skids and lowers it into the ditch. The sidebooms use special slings that cradle the pipe on rollers allowing the sideboom to travel down the ROW as the pipe slides into the ditch. The ditch spoil is pushed back into the ditch to cover the pipe except for certain sections that must be left uncovered to make tie-in welds and allow for hydrostatic testing.

15) Tie-in welding - individual pipe string ends are cut and trimmed to join the pipe strings with external clamps accurately aligning the pipe. NDT inspection is performed after the pipe has been welded and the field-joint coating applied. Tie-in welding is also required at road crossings, river crossings and other

intersections along the ROW where the main production welding crew cannot access the pipe.

16) Hydrostatic testing, final tie-in - the pipeline is filled with water until the internal pressure in the pipeline exceeds the internal pressure to which the line will be subjected during operation. The elevation profile of the pipeline determines the lengths of the hydrostatic test sections because elevation changes affect the internal pressure. Water for hydrostatic testing is typically taken from rivers and lakes along ROW. Dry areas may require a well to be drilled or water to be delivered by truck along the ROW. After sections have been hydro statically tested, they are joined with a manual tie-in weld. These final welds are NDT inspected. After hydrostatic testing and final tie-in, open sections of the ditch are filled in.

17) Final clean-up, ROW restoration - grading the ROW smooth and clear, placing marker signs to identify the pipeline location, repairing any fences or other structures temporarily removed for construction and seeding the soil to reintroduce vegetation are the final activities. Special attention is paid to drainage and erosion control so that ROW, with time, is restored as closely as possible to its pre-construction while allowing access for regular visual inspections.

C. Match the Russian equivalents to the following English words and word-combinations.

A) последнее соединение секции
B) восстановление
C) планировка, выравнивание
D) разведка
E) сварка
F) отвод земли
G) пересечение дорог
H) горизонтально-направленное бурение
I) пересечение дорог
K) изоляция сварного шва
L) внутренняя сварка
M) опрессовка
N) опорная рама для сварки трубопровода
O) подвижной участок фронта нефтепроводных работ
P) укладка плетей трубопровода (вдоль трассы)
Q) присыпка
R) наружная сварка
S) неразрушающие испытания
T) сгибание труб
U) засыпка траншеи трубопровода
V) расчищение

1. trenching (ditching)
2. hydrostatic testing
3. padding
4. setting out
5. line-up
6. clearing
7. skidding the pipe
8. survey
9. ROW restoration
10. stringing
11. grading
12. lowering
13. welding
14. external welding
15. Field – joint – coating
16. road crossing
17. ROW
18. firing line
19. internal welding
20. tie-in welding
21. HDD
22. land backfilling

W) соединение секции
X) спуск трубопровода в траншею
Y) центровка
Z) установка

23. final tie-in
24. bending
25. NDT

D. Match the English equivalents to the following Russian words and word-combinations.

There is one extra Russian word.

1.	thickness	**A)** ручная сварка
2.	pass	**B)** подъем уровня
3.	topsoil	**C)** изгородь
4.	constraints	**D)** толщина
5.	pipe bend	**E)** пахотный слой
6.	manual welding	**F)** лотковая опора трубопровода
7.	skid	**G**) проход
8.	timber	**H**) место
9.	circumference	**I**) гладкий конец, ненарезанный конец
10.	uniform	**K**) подготавливать кромки
11.	consistency	**L**) колено трубопровода
12.	plain end	**M**) длина окружности
13.	strength	**N**) врезка в магистральный трубопровод
14.	room	**O**) ограничения
15.	low silt	**P)** сплошной
16.	fence	**Q)** штабель, склад труб
17.	root	**R)** илистые отложения
18.	cap	**S)** опорная рама для сварки трубопровода
19.	bevel	**T)** прочность
20.	burial depth	**U)** передний край
21.	leading end	**V)** глубина залегания
22.	stockpile	**W)** вершина сварного шва
23.	elevation	**X)** лесоматериал
24.	cradle	**Y)** трубная головка
		Z) устойчивость

Exercise 2. Read and translate the sentences, using the active vocabulary.

1. How many welds are inspected varies depending on the code to which the pipeline is designed.

2. Crews attach a reaming device to enlarge the pilot hole to accommodate the line pipe.

3. The ditch will be excavated in two passes with a first pass removing topsoil and the second pass excavating the remaining soil to the required pipeline burial depth.

4. After NDT inspection, field-joint coating is applied to the bare sections at the pipe welds covering the exposed pipe and the weld.

5. Line pipe used for the road crossing has a thicker external coating to provide extra protection during installation.

6. NDT inspection is performed after the pipe has been welded and the field-joint coating applied.

7. Together the root and hot passes provide the required fusion and strength to join the pipes permanently.

8. For installing the line pipe, a cap is connected to the leading end of the pipe string.

9. Line pipe is lifted onto skids made of timber and stockpiles along the ROW so that the entire circumference is accessible.

10. The swivel joint is connected to the reamer and the drilling rig again pulls the reamer back through the hole from the pipe side to the rig side, along with the pipe string connected to the reamer.

11. Working space for the construction equipment is used to install the pipeline.

12. Tie-in welding is also required at road crossings, river crossings and other intersections along the ROW where the main production welding crew cannot access the pipe.

Exercise 3. Find the definitions to the key words, using the information from this chapter and translate them into Russian.

The definitions:

A) customary inspection by internal X-ray, external gamma ray or ultrasonic.

B) ditch spoil pushed back into the ditch to cover the pipe except for certain sections that must be left uncovered to make tie-in welds and allow for hydrostatic testing.

C) line pipe lifted on skids along the ROW so that the entire circumference is accessible.

D) width determined by the diameter of the pipeline to be installed and includes room for the pipeline and working space for the construction equipment used to install the pipeline.

E) sand placed on the ditch bottom to cushion the pipe.

F) the primary strength weld that fuses the two pipes.

G) laying sections of pipe along the ROW.

H) individual pipe string ends that are cut and trimmed to join the pipe strings with external clamps accurately aligning the pipe.

I) join sections of line pipe providing consistency, uniform welds and fewer repairs.

J) excavated soil (spoil) deposited on the ditch bank.

K) bare sections at the pipe welds covering the exposed pipe and the weld.

L) method for constructing the pipeline across such obstacles as streams or wetlands.

The key words:

1. **HDD**
2. **padding**
3. **ROW**
4. **welding**
5. **trenching (ditching)**
6. **stringing**
7. **skidding**
8. **backfilling**
9. **field-joint coating**
10. **NDT**
11. **root**
12. **tie-in welding**

Exercise 4. A. Read and translate the text.
B. Scan through the text to grasp the main idea and express it in your own words.

Exploring of Oil and Gas

Earth scientists in the petroleum industry – including geologists, geophysicists, geochemists and paleontologists – study what has happened to rocks that may be buried thousands of meters below surface, how those rocks were formed and affected by events stretching back millions of years, and how to identify traps where oil and gas accumulated within rock formations. An explorer may have a well-developed theory or intuition why an area should contain oil and gas. A first-hand look at outcrop geology and surface features sometimes helps to confirm the basic requirements – that there may be sedimentary rocks, potential reservoirs and hydrocarbon-bearing source in a sedimentary basin.

Within a basin, the explorer's first step is to examine all the information already known about the area. This might include academic papers, surface geology observations, any wells drilled, data from relevant agencies or departments and previous exploration results from nearby or similar areas. Geophysicists can identify the structure, configuration, thickness and depth of new sedimentary basins by measuring slight variations in the Earth's gravitational and magnetic fields and by measuring the time taken for seismic energy waves to pass through and be reflected from sedimentary layers.

In a typical trap, gas accumulates on the top of the reservoir as a "gas cap" over the oil, which in turn overlies the water-saturated zone in the reservoir. This occurs because natural gas is lighter than oil which is lighter than water. However, all three fluids are often intermingled in parts of the reservoir. Porosity is the ability of rock to hold oil and gas like water in a sponge. A trap requires three elements:

- ✓ A porous reservoir rock to accumulate the oil and gas – typically sandstones, limestones and dolomites
- ✓ An overlaying impermeable rock to prevent oil and gas from escaping
- ✓ A source for the oil and gas, typical black waxy shales.

There are 6 common oil and gas traps: 1) thrust fault; 2) normal fault; 3) stratigraphic pinch-out; 4) reef; 5) anticlines; 6) salt dome.

It is impossible to obtain the geophysical data from regulatory bodies, the seismic survey is required. In a seismic survey it is necessary to lay out a line or several lines of sensitive receivers, called geophones or jugs, on the ground. Then explosions or mechanical vibrations are created on the surface. The geophones record the energy reflected back as seismic waves from rock layers at various depths. Geophysicists and geologists examine the seismic data for the presence of suitable traps and for similarities with other petroleum-producing areas. If the results seem promising, they use the seismic data to pinpoint where to drill a well.

The aim of oil prospecting is discovering, geological and economic estimation, and preparation to oil development. Oil prospecting is done with the help of geological, geophysical, geochemical and drilling works in rational combination and consequence.

B. Answer the following questions:

1. What do geologists, geophysicists, geochemists and paleontologists study?
2. What are the basic requirements for presence of oil and gas?
3. What is it necessary to know about a basin?
4. How can geophysicists identify the structure, configuration, thickness and depth of new sedimentary basins?
5. In which form does natural gas accumulate?
6. What is lighter: oil, water or gas?
7. How is the seismic survey conducted?
8. When is it possible to drill a well?
9. What is the aim of oil prospecting?

C. Compose your own questions to each paragraph of the text above.

Exercise 2. Translate the following sentences into Russian, paying attention to the Voice usage:

1. Geologists, geophysicists, geochemists and paleontologists study what has happened to rocks that may be buried thousands of meters below surface and how to identify traps where oil and gas accumulated within rock formation.
2. All three fluids are often intermingled in parts of the reservoir.
3. The basic requirements of oil or gas presence must be sedimentary rocks, potential reservoirs and hydrocarbon-bearing source rocks in a sedimentary basin.
4. The explorer’s first step is to examine all the information already known about the area.
5. Geophysicists can identify the structure, configuration, thickness and depth of new sedimentary basins.
6. Gas accumulates on the top of the reservoir as a “gas cap” over the oil.
7. The seismic survey is required when it is impossible to obtain the geophysical data from regulatory bodies.

8. In case if the results of seismic survey seem promising, they use the seismic data to pinpoint where to drill a well.

Exercise 3. Translate the following sentences in English, using new words and word-combinations:

1. Сейсморазведка – это один из способов обнаружить нефть и природный газ.
2. Перед бурением скважины геологоразведчики собирают всю геологическую информацию.
3. На поверхности производят взрывы и механические вибрации.
4. Геофизики и геологи сравнивают сейсмические данные с данными других нефтедобывающих районов.
5. Для сейсморазведки нужны сейсмофоны и чувствительные приемники.
6. Пористость – это свойство породы удерживать нефть и газ, как воду в губке.
7. Для ловушки необходимы следующие три элемента: пористая порода, непроницаемая порода и воскообразный сланец.

Exercise 4. Translate the text and say in English how oil and gas are spread:

Миграция нефти и газа.

В процессе седиментации происходит накопление слоистых пород с дисперсным органическим веществом. Одновременно (at the same time) формируются благоприятные для залегания (occurrence) нефти и газа пористые породы (известняки и песчаники).

Поры между частицами заполняются смесью нефти, газа и воды. Породы с крупными порами, в которых собирается нефть, называются резервуарными или коллекторами.

Залежи образуются обычно там, где высокопористые пески залегались над отложением органического ила (silt), например, в дельте Миссисипи. Здесь пески находятся в речных руслах и на морских побережьях, а между ними располагаются большие соленые купола, где в иле захороняют органический материал.

Крупные нефтяные и газовые залежи Луизианы, Техаса, Персидского залива и тюменского Севера относятся к дельтовым отложениям древних рек.

Система рифов – это другой пример общей обстановки, благоприятной для образования, как пород-коллекторов, так и нефтематеринских (petroleogenetic) пород. В зарифовой области отлагается (to deposit) известковый ил, обогащенный органическим веществом. Такие нефтяные месторождения обнаружены в провинции Альберта (Канада), западнее Флориды и в Мексике. Крупные месторождения нефти и газа в рифах открыты в Прикаспийской впадине (Precaspian trough), в Ливии, Узбекистане и многих других районах.

Exercise 5. Read text below and answer the questions:

1. What does science of oil and gas geology study? When was oil geology formed as a separate science?
2. What does prospecting stage of oil exploration include?
3. What is the main purpose of the searching stage?
4. What are gravimetrical methods based on?

Separation of Oil and Gas

Well fluids must be separated into oil, gas, and water and each of them must be measured. In the early days of the oil industry, separators were not used. The production from wells was discharged directly into storage tanks. Although this resulted in separation of the liquids and gases, the practice was both wasteful and dangerous. The separators were developed to reduce such waste and the danger of fire and explosion.

Petroleum mixtures are often complex and difficult to separate efficiently. The equipment used to separate the liquids from the gases is referred to as a separator. The simplest form of an oil and gas separator is a small tank in which the force of gravity is used to separate the oil and gas[1]. Oil, being heavy compared to the gas, falls to the bottom of the tank from which it goes into storage tanks. Gas, being lighter, rises to the top of the tank and goes from there into gas-gathering system.

In addition to using the force of gravity, modern separators make use of other forces to get the best possible separation of oil and gas. The way in which each of those forces is used can be better understood by following the flow of mixture of oil and gas through a separator.

Vertical separator: the mixture of oil and gas enters inlet, where it given a swirling motion by a spiral inlet baffle in the separator space or chamber. As this point there are two forces tending to separate the oil from gas. The first is the effect of gravity; the second is the centrifugal action, which causes the heavy oil particles to collect on the walls of the separator. Gas, which still contains some oil, rises through chamber and then enters the swirl cylinder and oil drains through tubes to the bottom of separator. The gas then passes through another chamber and leaves the separator through gas outlet.

Oil leaves separator at the oil outlet. The oil is regulated by a float and control valve, so liquid covers the drain tubes and the oil outlet.

Horizontal separator: separators of horizontal type are also common; although of different design, they have the same uses as the vertical separator. There are single tube and double tube separators. Horizontal separators of the two tube design are often used. The unit is made if two horizontal tubes mounted one above the other. The tubes are jointed by flow channels near the ends of the tubes. The mixed stream of oil and gas enters at one end of the upper tube. The liquids fall through the first connecting flow pipe into the liquid reservoir, which occupies the lower potion of the bottom tube. Oil separated from gas, goes to stock tanks. Gas leaves the separator through the gas outlet.

Single-tube separator.

Stage separator: under certain conditions it is often desirable to use more than one stage of separation in order to obtain more complete recovery of liquids. For instance, three-stage separation system operates as follows: the first stage operates at the highest pressure and the second and third at lower pressures.

Low temperature separators: low-temperature separation is a method of separation sometimes used to handle the production of high-pressure gas wells that produce some light liquids. The liquid separation is made possible by cooling the gas stream before separation.

Exercise 6. Match two parts of the sentences:

1. In the early days of the oil industry,
2. The separators were developed
3. Petroleum mixtures are often
4. Gas rises to the top of the tank and
5. Modern separators use force of gravity
6. There are several types of separators:

a) to reduce waste and danger of fire and explosion.
b) to get the best possible separation of oil and gas.
c) complex and difficult to separate efficiently.
d) goes from there into gas-gathering system.
e) separators were not used.
f) vertical, horizontal, stage and low-temperature separators.

Exercise 7. Answer the following questions:

1. What is the separator?
2. What is the operating principle of vertical-type separator?
3. Why is it necessary to use separators?
4. What is the difference between single-tube and double-tube separator?
5. What is the simplest form of separator?
6. How operates three-stage operation system?

Exercise 8. Translate the following sentences into English:

1. Нефтяные смеси часто бывает сложно отделить.
2. Оборудование, с помощью которого отделяют жидкость от газов, называется сепаратором.
3. Сила тяжести используется для отделения нефти и газа.
4. Газ, будучи легче нефти, поднимается наверх резервуара и поступает в газосборную систему.
5. Современные сепараторы используют и другие силы, помимо силы тяжести.
6. Горизонтальные сепараторы могут иметь конструкцию с одной и с двумя трубами.
7. Нефть, будучи тяжелее газа, стекает на дно резервуара, откуда она попадает в резервуар-хранилище.

8. При определенных условиях часто желательно использовать более одной стадии сепарации для того, чтобы получить наиболее полный выход жидкостей.

Exercise 9. Read, translate the text "How are oil and natural gas produced?" and make the annotation of it.

How are oil and natural gas produced?"

Once an oil or gas reservoir is discovered and assessed, production engineers begin the task of maximizing the amount of oil or gas that can ultimately be recovered from it. Oil and gas are contained in the pore spaces of reservoir rock. Some rocks may allow the oil and gas to move freely, making it easier to recover. Other reservoirs do not part with the oil and gas easily and require special techniques to move the oil or gas from the pore spaces to a producing well. Even with today's advanced technology, in some reservoirs more than two-thirds of the oil in the reservoir rocks may not be recoverable.

Before a well can produce oil or gas the borehole must be stabilized with casing, which is lengths of pipe cemented in place. The casing also serves to protect any fresh water intervals that the well passes through, so that oil cannot contaminate the water. A small-diameter tubing string is centered in the well bore and held in place with packers. This tubing will carry the hydrocarbons from the reservoir to the surface.

Reservoirs are typically at elevated pressure because of underground forces. To equalize the pressure and avoid the "gushers" of the early 1900s, a series of valves and equipment is installed on top of the well. This wellhead, or "Christmas tree", as it is sometimes called, regulates the flow of hydrocarbons out of the well.

Early in its production life, the underground pressure will often push the hydrocarbons all the way up the well bore to the surface, much like a carbonated soft drink that has been shaken. Depending on reservoir conditions, this "natural flow" may continue for many years. When the pressure differentia! is insufficient for the oil to flow naturally, mechanical pumps must be used to bring the oil to the surface. This process is referred to as artificial lift. In the U.S., above-ground pumping units are often called "horse head" pumps because of their unique shape and movement.

Most wells produce in a predictable pattern called a decline curve. Production will increase for a short period, then peak and follow a long, slow decline. The shape of this decline curve, how high the production peaks, and the length of the decline are all driven by reservoir conditions. Some wells may stop producing in economic quantities in only a few years. In the U.S., 8 oil and gas fields have been producing for more than 100 years.

Engineers can do a variety of things to affect a well's decline curve. They may periodically perform an operation called a "work over", which cleans out the well bore to help oil or gas move more easily to the surface. They may fracture or treat the reservoir rock with acid around the bottom of the well bore to create better pathways for the oil and gas to move through the subsurface to the producing well.

As a field ages, the company may choose to use a technique called water flooding. In this case, some of the wells in the field are converted from production wells to injection wells. These wells are used to inject water (often produced water from the field) into the reservoir. This water tends to push the oil out of the pores in the rock toward the producing well. Water flooding will often increase production from a field.

In more advanced cases, the company may use more sophisticated techniques, collectively referred to as enhanced oil recovery (EOR). Depending on reservoir conditions, various substances [from steam to nitrogen, carbon dioxide to a surfactant (soap)] may be injected into the reservoir to remove more oil from the pore spaces and increase production.

Throughout their productive life, most oil wells produce oil, gas, and water. This mixture is separated at the surface. Initially, the mixture coming from the reservoir may be mostly oil with a small amount of water. Over time, the percentage of water increases. On average in the United States, oil wells produce 8 barrels of water for each barrel of oil. Some older wells may produce as much as 100 barrels of water for each barrel of oil. This produced water varies in quality from very briny to relatively fresh. In arid areas of the western U.S., produced water may be used for agricultural purposes, such as livestock watering or irrigation. Where it cannot be used for other purposes, this produced water may be reinjected into the reservoir — either as part of a water flooding project or for disposal (returning it to the subsurface).

Natural gas wells usually do not produce oil but do produce some amount of liquid hydrocarbons. These natural gas liquids are removed in the field or at a gas processing plant (which may remove other impurities as well). Natural gas liquids often have significant value as petrochemical feed stocks. Natural gas wells also often produce water, but the volumes are much lower than is typical for oil wells.

Once it is produced, oil may be stored in a tank and later moved by means of truck, barge, or ship to where it will be sold or enter the transportation system. Most often, however, it goes from the separation facilities at the wellhead directly into a small pipeline, which then feeds into a larger pipeline. Often, pipelines are used to bring the production from offshore wells to shore. Pipelines may transfer oil from a producing field to a tanker loading area for shipping. Pipelines also may be used to move oil from a port area to a refinery to be processed into gasoline, diesel fuel, jet fuel, and many other products.

Natural gas is almost always transported through a pipeline. Because of the difficulty in moving it from where it exists to where potential consumers are, some known gas deposits are not currently being produced. Many years ago, the gas may have been wasted as an unwanted by-product of oil production. The industry recognizes the value of clean-burning natural gas and is working on improved technologies for getting gas from the reservoir to the consumer. Gas-to-liquids (GTL) is an area of technology development that will allow natural gas to be converted to a liquid, transported by tanker. Some countries have installed facilities to export gas as liquefied natural gas (LNG), but the number of countries with facilities to use LNG is still limited

Раздел 6: Система международного аудита нефти и газа.

Развитие навыков аналитического чтения и перевода английских текстов по темам:

Тема: *Наиболее крупные категории запасов нефти и газа в соответствии с классификацией SPE.*

Тема: *Взаимодействия в электролитных растворах.*

Exercise 1. A. Read and translate the text.

B. Scan through the text to grasp the main idea and express it in your own words.

INTERNATIONAL OIL AND GAS RESERVE AUDIT. RISK ANALYSIS OFEXPLORATION OPERATIONS . FAIR MARKET VALUE OF OIL AND GAS OBJECTS.

The estimation of Fair Market Value (FMV) begins with the collection and review of available data. The evaluators are concerned with the type, quantity, and quality of data available because these characteristics determine the valuation approach employed and provide a basis for establishing confidence in the value obtained through the evaluation process. After the data have been collected and examined, a method to estimate FMV must be selected. There are two commonly accepted methods for FMV estimation: the comparable sales approach and the income approach.

The comparable sales approach is a valuation procedure in which the prices paid in prior transactions of similar oil and gas rights or properties are used to value the rights or property to be disposed of through leasing, exchange, or other means. This procedure generally is preferred to income procedures, if prior sales data are available, since it is thought that prices paid in prior transactions of similar oil and gas properties provide the best indication of value. However, in developed oil and gas areas, where tracts tend to be unique and information good, the income approach described below is often used instead. In comparable sales, similar oil and gas rights or properties are those of similar geologic, engineering, and oil or gas marketing prospects. These characteristics are usually heavily dependent on time and geographic proximity.

The income approach is the alternative approach to the comparable sales approach, and it involves the estimation of annual net income from the expected annual costs and revenues associated with the development of the oil and gas rights or property under realistic conditions. Annual net cash income from the difference between expected annual revenues and costs are discounted to their present value. Thus, the rights or property`s net income potential, discounted to the present, provides an estimate of current tract sale value if similar tract sales data are not available.

The largest uncertainties probably attend forecasts on reserve size, and the smallest are associated with predictions of finding costs. Predictions as to reserves and discovery probability lie almost entirely within the geotechnical purview,

whereas finding-cost estimates require input from several other disciplines as well. All three types of predictions are made routinely by geologists, geophysicists, and engineers, and have enormous financial consequences, in as much as they directly impact key elements of risk ventures.

Accordingly, it is somewhat surprising that few data seem to be available as to actual performance records of explorationists` predictions. Most exploration organizations and individuals do not examine predictive performance, and the few that do have been reluctant to publicize their records. The reasons are mostly due to human nature: the forward press of exploratory events, lack of staff continuity, corporate politics, intra-organizational trepidation, individual chagrin, perceived proprietary advantage, and even professional modesty!

C. Answer the following questions.

1. What does the estimation of Fair Market Value begin with?
2. Why are the evaluators concerned with the type, quantity and quality of data available?
3. How many methods are commonly accepted for FMV estimation? Name them.
4. What is the comparable sales approach?
5. What characteristics are usually heavily dependent on time and geographic proximity?
6. The income approach is the alternative approach to the comparable sales approach, isn`t it?
7. What does it involve?

D. Decide whether the statements are true or false. Correct them if necessary.

1. Reserves are categorized by their recoverability.
2. Multi-reservoir pays are more attractive for exploration since the probability of success is higher than for a single-reservoir structure.
3. Risk analysis forms a basis for developing Prospect Inventories and implementing Portfolio Management.
4. Proved resources are those quantities of petroleum which, by analysis of geological and engineering data, can be estimated with 50% certainty to be commercially recoverable.
5. Economic analysis does not take into account the taxes subtracted from the oil price.
6. Fair market value assessment has nothing to do with reserve audit.
7. There are four methods to determine recoverable resources.
8. Exploration efficiency is better determined by annual estimation as compared to a long-term history.

E. Summary writing

Read the text again and determine the main idea of each paragraph.

Underline the key words and collocations.
Put the main ideas into your own words. Try to use all the underlined words and collocations.
Organize the key points in the form of a plan.
Make a summary. Your summary should reflect the key points and the supporting details in a condensed form

Тестовое задание
Вариант 1

1. *Read the textbook excerpt and choose the correct answer, using the information from it.*

1.1 What is the purpose of the passage? _____

A. to explain the methods for measuring reserves
B. to describe current global reservoir estimates
C. to give advice on graphing production data
D. to compare oil in place and reserve growth.

1.2 What is NOT part of the volumetric method? _____

A. other fields' assumptions
B. amount of oil in place
C. previous years' production data
D. estimated recovery factors.

1.3 What is part of the materials balance method equation? _____

A. a reserve number
B. petroleum pressure
C. reserve growth
D. volumetric method

Oil workers cannot extract all of the oil in place in a reservoir. The recovery factor is the fraction of petroleum that they can collect. This fraction is also called a reserve. Oil workers measure reserves in several different ways.

In the volumetric method, engineers measure the reservoir's dimensions. They figure in the properties of liquid and rock in the reservoir. This gives them the amount of OIP. Next, they estimate the recovery factor. They figure in assumptions from other reservoirs. Finally, they multiply the recovery factor by the quantity of oil in place. The result is a reserve number. There is a lot of diversity in the kind of liquid in reservoirs. Therefore, recovery factors are different at all reservoirs.

The second process is the materials balance method. Engineers utilize specific equation. The equation computes amounts of produced fluid and the changes in reservoir pressure. This gives them the amount of oil left.

The production decline curve method is the final method. Engineers rely on production data. With it, they measure the decline in oil production over a few years. Then, they graph the numbers. After that, they estimate oil production and reserve growth. They can also speculate about a production trend that is statistically significant.

2. *Match the words or phrases (A-H) with the definitions (2.1-2.8).*

A. assumption	1_____the increase of collected oil
B. diversity	2.2_____the estimate of oil in place
C. graph	2.3_____a decrease or reduction
D. decline	2.4_____a variety in something
E. reserve number	2.5_____an important set of numbers
F. reserve growth	2.6_____the recovery factor times oil in place
G. statistically significant	2.7_____statistics about reservoir production
H. production data	2.8_____to chat numbers or results.

3. *Read the webpage about the drillship and mark the following statements as true (T) or false (F), using the information from it.*

3.1 _____ The new drill ship can drill in water six miles deep.
3.2_____ The Endeavor IV uses a shorter riser pipe than other drill ships.
3.3_____ The drill ship has anchors that can be used in shallow water.

Why choose Noble Oceanic?

If you are looking for easy mobility while drilling at sea, look no further. Noble Oceanic has built a state-of-the-art fleet of ultra deepwater drill ships. Our newest ship, Endeavor IV, is capable of drilling in water two miles deep. It can reach oil six miles below the drill floor.

The ship uses 135 meter long stretchers of riser pipe. Other drill ships use 93 meter long pipes. The longer pipes allow for fewer connections.

Currents, winds and tides will not affect the ship's position. The ship has a dynamic positioning system (DPS). This computer system monitors the winds and waves. When necessary, it turns on its six thrusters to compensate for these changes. Our ships also have extensive mooring equipment. This includes 12 anchors suitable for shallower waters.

We are able to modify any of the ships in our fleet to suit your needs. Just send us your design specifications.

4. ***Read the sentences and fill in the blanks with the correct words or phrases before them.***

A) dynamic positioning system
B) anchor
C) modified
D) thrusters
E) design specifications
F) fleet

4.1. The _____ uses computers to ensure that the ship does not move.
4.2 The _____ turn on when currents are strong and move the ship into position.
4.3 The _____ state that there must be accommodations for 230 staff.

4.4 The ship raised the _____ before setting sail.
4.5 The company owns a(n) _____of over forty ships.
4.6 The ship has been _____ to give it better maneuverability.

5*. Read the excerpt and choose the correct answer, using the information from it.*

Each type of well has a slightly different role to play. Before beginning production, drillers need to find oil reservoirs. They use appraisal wells to sample the underground rock. After evaluating the samples, they may drill a production well. These use pumps to get the oil. Occasionally, these flow naturally. Such wells are called flowing wells. However, sometimes the oil does not flow naturally. In that case, they can then drill injection wells to stimulate production. To expand production from a reservoir, drillers often drill offset wells. Regulations determine the spacing of these. For very large reservoirs, they may also put in satellite wells.

5.1 What is the article mainly about? _____
A. the different functions of oil wells
B. why drillers use appraisal wells
C. how to increase oil well flow
D. the regulations used to drill wells.

5.2 Which of the following is NOT a reason for drilling a well? _____
A. to increase production
B. to study rocks
C. to create an oil reservoir
D. to stimulate production.

5.3 When is an injection well drilled? _____
A. when samples are needed
B. when oil does not flow naturally
C. when production is expanded
D. when the reservoir is very large.

6. *Match the words or phrases (A-H) with the definitions (6.1-6.8).*

A. stimulate	6.1_____a well near a main well
B. spacing	6.2_____a law limiting activity
C. satellite well	6.3_____to increase activity
D. offset well	6.4_____the distance between things
E. evaluate	6.5_____being without any artificial means
F. regulation	6.6_____to test a part of something
G. sample	6.7_____a well at the edge of a reservoir
H. naturally	6.8_____to judge the value of something

7. Choose which word or phrase best fits each blank.

7.1. The company drilled its first successful _____.
7.2. Water was forced down the _____ to stimulate production.
A) injection well

B) production well

7.3. The geologist studied the rocks taken from the _____.

7.4. A pump is not needed for a(n) _____.

A) appraisal well

B) flowing well

8. ***Match the words or phrases (A-D) with the definitions (8.1-8.4).***

8.1 __ leakage

8.2 __ detect

8.3__ seepage

8.4__ breach

A. to break or get through a barrier of some kind

B. the instance of a liquid oozing or trickling out of something

C. to find or discover a fact, or that something exists

D. the instance of a liquid escaping from an object

Вариант 2

1. ***Read the article and choose the correct answer, using the information from it.***

1.1 What is the main idea of the article?

A. different ways to create artificial drive mechanisms

B. how to best use reservoir drive mechanisms

C. different types of drive mechanisms

D. how drive mechanisms have improved

1.2 Which of the following is NOT part of a naturally occurring drive mechanism?

A. a gas cap forming

B. water compressed and expanded

C. water or gas injected

D. gas cap expanding and pushing down

1.3 According to the article, why would an artificial drive be necessary?

A. an aquifer does not push up the oil

B. a natural drive does not maintain pressure

C. the pressure drops below the bubble point

D. a gas cap has already been formed

Natural reservoir drive mechanisms

Oil and Gas Digest

Drive Mechanisms by E. Ford.

Natural reservoir drive mechanisms are an important part of producing oil and gas. A virgin reservoir can use the natural pressure to release fluids. Natural drive mechanisms occur to maintain pressure that is lowered due to the release of fluids. Each reservoir can have different pressure points that cause fluids to be released.

One type of drive mechanism is a solution gas drive. In this case, gas is naturally formed due to drops in pressure. Once the pressure drops below the bubble point, gas and liquid can be released, creating a flow.

Another drive mechanism is a gas cap drive, where a gas cap is already formed. This can occur when the pressure is already below the bubble point. The gas cap expands which pushes down and releases the oil.

In some instances, aquifers containing water are present. This can induce a type of drive mechanism known as a water drive. Water can become compressed and then expand to push up the oil.

If natural drive mechanisms are not sufficient to maintain pressure, humans can intervene. An artificial drive can be created by using injections of water or gas.

2. *Match the words or phrases (A-I) with the definitions (2.1-2.9).*

2.1 __ gas cap
2.2 __ aquifer
2.3 __ drive mechanism
2.4 __ water drive
2.5 __ virgin reservoir
2.6 __ gas cap drive
2.7 __ solution gas drive
2.8 __ pressure point
2.9 __ bubble point

A a type of drive mechanism that releases gas when pressure is dropped
B the temperature at which the first bubble appears
C a type of drive mechanism that expands the gas cap which forces out oil
D the layer of gas over an oil zone
E an underground rock through which water can pass or be stored
F a type of drive mechanism that forces oil out due to the expansion of water
G the point at which the pressure is high enough to release fluids
H a reservoir that produces fluids under pressure with pressure declining as fluids are released
I something that causes fluids to leave reservoir rock

3. Read the sentence pairs. Choose which word or phrase best fits each blank.

3.1 If a reservoir does not _____ pressure, the oil will not flow as well.
3.2 The gas cap _____ , causing the oil to be released.
A) maintain B) expanded
3.3 The pressure _____ on the water causing it to compress.
3.4 The water drive caused the oil to be _____ to the surface.
A) pushed down B) pushed up
3.5 If something is _____ , it was created to look or act like something else.
3.6 _____ air takes up far less space than air in the atmosphere.
A) Compressed B)artificial

4. Read the webpage and mark the following statements as true (T) or false (F), using the information from it.

4.1 _____ This company`s mines are located in areas with a lot of oil share.
4.2_____ The company prefers to use surface mining techniques.
4.3_____ The company retorts the oil shale inside the mine.

Oil shale

Petro-eX inc.

At Petro-Ex, we specialize in extracting petroleum from oil shale. We use underground mining techniques to harvest our abundant oil shale deposits. Our preferred method is room and pillar mining. It causes very little environmental surface damage. We pride ourselves on being a company that cares about our Earth. In addition, we use ex situ retorting. This protects our workers from dangerous and combustible oil shale. We have a state-of-the-art extraction plant. There, we use pyrolysis to remove shale oil and shale gas from the rock. The oil and gas are then processed. Finally, they are offered as substitutes for petroleum and natural gas.

5. ***Read the sentences and fill in the blanks with the correct words or phrases (A-F)before them.***

A. oil shale
B. retorting
C. shale oil
D. shale gas
E. combustible
F. room and pillar mining

5.1. Many see _____ as a new form of natural gas.
5.2 The workers use heavy machines to crush the _____ .
5.3_____ is one way to remove the liquid from the shale.
5.4 The company used _____ to prevent tunnels from collapsing.
5.5 Some companies provide _____ as a substitute for natural gas.
5.6 Lighting a match around _____ materials may start a fire.

6 *Read the email and choose the correct answer, using the information from it.*

Indicators of petroleum: Seepage

To: Robert Bollinger r.bollinger@blackwelloil.com
From: Jocelyn Hauser j.hauser@blackwelloil.com
Re: Petroleum Seepage

Hi Bob,

The team found indicators of petroleum at the proposed drill site. We detected seepage, indicating a seal failure. The petroleum was near the surface and already in the dissipation stage. We have not measured pressure in the reservoir yet. We don`t know if the breach is a fracture failure or a capillary failure. Obviously there is tertiary migration occurring if there is visible seepage.

From that we have observed, the extent of the seepage is small. My guess is the leakage is the result of a fracture failure. We will need to do further testing to ensure there is a worthwhile petroleum reservoir in the area. However, due to the seepage we know two things:

- this basin has mature petroleum source rock

- which part of the basin contains hydrocarbons

Based on statistics, 75% of the world`s producing oil fields have seepage. I`m fairly certain this area will yield a profit if we drill here.
Regards, Jocelyn

6.1 What is the main purpose of the email?

A. to compare capillary and fracture failures
B. to describe the tertiary migration stage
C. to notify of a possible petroleum reservoir
D. to explain why further testing is needed

6.2 How does the writer describe the seepage?

A. it is due a capillary failure
B. it is a minimal amount
C. it is still far below the surface
D. it is not visibly noticeable

6.3 Which of the following is NOT mentioned in the email?

A. what stages of seepage have occurred in the reservoir
B. what the seepage tells the team about the reservoir
C. what the pressure measurement of the reservoir is
D. what percentage of oil fields have seepage

7. ***Read the sentences and fill in the blanks with the correct words or phrases (A-F)before them.***

A. seal failure
B. stages
C. extent
D. dissipation
E. tertiary migration

7.1 The oil leaking to a great _____ .
7.2 The petroleum is moving towards the surface in the _____ stage.
7.3 There are three _____ in petroleum seepage.
7.4 The geologist saw evidence of a(n) _____ at the site.
7.5_____ happens when oil disperses above ground

8. *Match the words or phrases (A-D) with the definitions (8.1-8.4).*

8.1 __ indicator
8.2 __ fracture failure
8.3 __ capitally failure
8.4 __ leakage

A act of a capitally breaking so that petroleum escapes
B something that points to or reveals something else
C the instance of petroleum escaping through a fracture

D to break or get through a barrier of some kind

Задание: Подготовить письменное изложение

Petroleum processing and refining.

Petroleum is a mixture of gaseous, liquid, and solid hydrocarbon compounds that occurs in sedimentary rock deposits throughout the world. In the crude state, petroleum has little value but, when refined, it provides liquid fuels (gasoline, diesel fuel, aviation fuel), solvents, heating oil, lubricants, and the distillation residuum asphalt, which is used for highway surfaces and roofing materials.

Crude petroleum (oil) is a mixture of compounds with different boiling temperatures that can be separated into a variety of fractions. Since there is a wide variation in the composition of crude petroleum, the proportions in which the different fractions occur vary with origin. Some crude oils have higher proportions of lower-boiling components, while others have higher proportions of residuum (asphaltic components).

Petroleum processing and refining involves a series of steps by which the original crude oil is converted into products with desired qualities in the amounts dictated by the market. In fact, a refinery is essentially a group of manufacturing plants that vary in number with the variety of products in the mix. Refinery processes must be selected and products manufactured to give a balanced operation; that is, crude oil must be converted into products according to the demand for each. For example, the manufacture of products from the lower-boiling portion of petroleum automatically produces a certain amount of higher-boiling components. If the latter cannot be sold as, say, heavy fuel oil, these products will accumulate until refinery storage facilities are full. To prevent such a situation, the refinery must be flexible and able to change operations as needed. This usually means more processes, such as thermal processes to change excess heavy fuel oil into gasoline with coke as the residual product, or vacuum distillation processes to separate heavy oil into lubricating oil stocks and asphalt.

In a petroleum distillation unit, a tower is used for fractionation. The feedstock of crude oil flows through one or more pipes arranged within a large furnace where it is heated to a temperature at which a predetermined portion of the feed changes into vapor. The heated feed is introduced into a fractional distillation tower where the nonvolatiles or liquid portions pass downward to the bottom of the tower and are pumped away, while the vapors pass upward through the tower and are fractionated into gas oils, kerosene, and naphthas.

Задание – составить аннотацию текста.

Because of its low density, it is not easy to store natural gas or transport by vehicle. Natural gas pipelines are impractical across oceans.

LNG carriers transport liquefied natural gas across oceans, while tank trucks can carry liquefied or compressed natural gas (CNG) over shorter distances. Sea transport using CNG carrier ships that are now under development may be competitive with LNG transport in specific conditions.

Gas is turned into liquid at a liquefaction plant, and is returned to gas form at regasification plant at the terminal. Shipborne regasification equipment is also used. LNG is the preferred form for long distance, high volume transportation of natural gas, whereas pipeline is preferred for transport for distances up to 4,000 km over land and approximately half that distance offshore.

CNG is transported at high pressure, typically above 200 bars. Compressors and decompression equipment are less capital intensive and may be economical in smaller unit sizes than liquefaction/regasification plants. Natural gas trucks and carriers may transport natural gas directly to end-users, or to distribution points such as pipelines.

In the past, the natural gas which was recovered in the course of recovering petroleum could not be profitably sold, and was simply burned at the oil field in a process known as flaring. Flaring is now illegal in many countries. Additionally, companies now recognize that gas may be sold to consumers in the form of LNG or CNG, or through other transportation methods. The gas is now re-injected into the formation for later recovery. The re-injection also assists oil pumping by keeping underground pressures higher.

Natural gas is often stored underground inside depleted gas reservoirs from previous gas wells, salt domes, or in tanks as liquefied natural gas. The gas is injected in a time of low demand and extracted when demand picks up. Storage nearby end users helps to meet volatile demands, but such storage may not always be practicable.

Worldwide, liquefied natural gas production has been largely driven by progressive gains in economics of shipping large LNG volumes by sea from major gas producers to (mostly remote) countries without their own gas production capacity.

In general terms, marine gas shipments to consumers can be summarized as follows. An onshore liquefaction plant is to be built, to deliver LNG to local storage. Then, using cryogenic pumps, LNG should be loaded into tankers. On delivery to a receiving terminal, LNG will be pumped into storage from which, as necessary, the volumes will be regasified and delivered by pipelines to consumers.

With 15 countries accounting for 84% of the worldwide extraction, access to natural gas has become an important issue in international politics, and countries vie for control of pipelines. In the first decade of the 21st century, Gazprom, the state-owned energy company in Russia, engaged in disputes with Ukraine and Belarus over the price of natural gas, which have created worries that gas deliveries to parts of Europe could be cut off for political reasons.

Письменное сообщение

Проработайте учебный материал и изучите дополнительную литературу к теме. На иностранном языке в письменном сообщении раскройте следующие аспекты содержания изученной темы (каждый студент выбирает одну тему из списка, в группе у студентов темы не должны совпадать: у всех разные):

1. Открытия в области нефтехимической промышленности.
2. Нефтяная промышленность и машиностроение: общая информация и история.
3. Очистка нефти на месторождении. Основные требования к безопасности использования оборудования при переработке нефти и газа.
5. Последствия извлечения, доставки и использования нефтяных продуктов на окружающую среду.
6. Основные элементы системы трубопроводов. Обеспечение безопасности трубопровода.
7. Назначение и принцип работы электрообессоливающей установки.
8. Техника безопасности на нефтехимических предприятиях.
9. Типы ректификационных установок.
10. Типы теплообменников.
11.Резервуары высокого давления в нефтяной и газовой промышленности.
12. Шламоуловители.

Устное сообщение

Проработайте учебный материал и изучите дополнительную литературу к теме. На иностранном языке в устном сообщении раскройте следующие аспекты содержания изученной темы (каждый студент выбирает одну тему из списка, в группе у студентов темы не должны совпадать: у всех разные):

Перечень тем для подготовки к устному опросу:

№ п/п	Специфика нефтегазовой отрасли
1	Технологические процессы в химической промышленности
2	Материалы, используемые в химической промышленности
3	Взаимодействия в электролитных растворах
4	Функции и применение химических обьектов
5	Инновации в химической промышленности
6	Нефтепераработка
7	Равновесие жидкость - пар
8	Использование отработанных материалов
9	Международный аудит нефти и газа

Составить краткий обзор темы 150-200 слов и рассказать. По существу, без воды. Опорные вопросы и идеи приводятся ниже.

Перечень примерных вопросов по каждой теме:
Тема № 1: «Информационные технологии и достижения в нефтехимической промышленности. Открытия и изобретения. Достижения в жизни и профессии».
1.Where was the first well drilled?
2.Who started the "modern" drilling era?

3.Why do we need oil and gas?
4.What alternative energy sources do you know?
5.How can the oil and gas industry be improved?
6.What is the future of the oil and gas industry?
7. What is the best method to suppress an offshore gas pipeline fire?
8. How long will the oil and gas industry continue to use the fracking method of drilling for oil and gas?
9. Is it wise to work in oil and gas industry now?
10. What sections of chemistry are studying Oil and Gas?
11. How is oil and gas industry historically regarded?
12. When did the development of the Russian oil and gas industry begin?
13. What does oil industry present for firms?
14. What is the most important task set for the gas industry?
15. What can gas industry initiate?
16. What led to a significant increase in the volumes of oil extraction in the first half of the 20th century?
17. The oil industry plays a significant role in Russia's politics and foreign policy, does not it?
18. Are oil and gas more than commodities?
19. What is still a system-forming industry?
20. Why does Russia play an important part in the formation of word prices?

Тема № 2: «Происхождение и накопление углеводородов. Очистка нефти на месторождении».

1. Who usually finds oil?
2. What is the task of this kind of specialist?
3. How do modern specialists examine surface rocks?
4. What for do geologists use new methods to find oil?
5. What does seismology deal with?
6. Where and how do the shock waves travel?
7. By what are the reflections of the shock waves detected?
8. By whom are the readings interpreted?
9. What equipment is used in searching onshore oil and gas?
10. What methods are used to search for oil and gas?
11. How do specialists work?
12. How can you explain the term "seismic survey"?
13. What do surveys show?
14. What kind of activity is drilling? Can you prove it?
15. What kind of drilling equipment can you enumerate?
16. What for is a carefully constituted mud?
17. What is the main principle of fluid movement?
18. What is the bottom hole flowing pressure?
19. What is the wellhead pressure?
20. What is the static pressure?

21. Is the pressure within a column of fluid greater at the bottom or at the top of the column?
22. What is the hydrostatic pressure?
23. How great should reservoir pressure be to allow fluid flow up the well bore?
24. What does the flow rate of oil and gas depend on?
25. How does the energy of gas and salt water influence on oil production?
26. When do vast quantities of salt water exist in surrounding parts of the formation?
27. What cases is the energy of salt water considered to be more important?
28. What does the displacement of oil and gas in an upward direction depend on?
29. What fields allow getting 50% of oil?
30. What types of drive do you know?
31. What are the main chemical elements in the composition of oil?
32. What is the general formula of a hydrocarbon?
33. What is the chemical composition of natural gas?
34. What is heavier natural gas or air?

Тема № 3: «Обработка нефти, транспортировка и хранение. Последствия извлечения, доставки и использования нефтяных продуктов на окружающую среду».

1. What is the common procedure to measure separated oil and gas at the tank battery?
2. Who does the final gauging of a full tank and what is the reason for that?
3. What are the main responsibilities of the lease operator during oil measuring operations?
4. Who usually supplies and maintains the gas metering equipment?
5. Describe how you understand tank topping out.
6. Why must water and dissolved salts be removed from crude?
7. When can gas cause formation of hydrates?
8. What do trunk lines connect?
9. How are the devices which test, log, unblock and clean oil pipelines known?
10. Why it is necessary to make a proper selection of internal devices in separators?
11. What does the selection of internal devices depend upon?
12. Why should each liquid outlet have vortex breakers installed?
13. Is it possible to develop the civilization without mining industry?
14. It has been known before that it is not advantageous for the Man to destroy the Nature. So, why does he do that?
15. What Is The Environmental Impact Of The Petroleum Industry?
16. What is the influence of the oil refining and petrochemical industry on an environment?

Тема № 4: «Нефтяные трубопроводы. Основные элементы системы трубопроводов. Обеспечение безопасности трубопровода».

1. What way is the most economically to transport large quantities of oil or natural gas?
2. What types of pipelines do you know?
3. What materials are oil pipelines made from?
4. What three groups can be pipelines classified in?
5. What does transportation pipeline network include?
6. Do feeder lines distribute gas to homes and business downstream?
7. What are pipeline networks composed of?
8. Where is the product injected into the pipeline?
9. What is the first line of protection for pipelines?
10. What is pipeline transport?
11. What can be sent through a pipeline?
12. Who first suggested using a pipe for transporting petroleum?
13. What types of pipelines do you know?
14. Can pipelines be built under the sea?
15. What are oil pipelines made from?
16. How is oil at sea transported?
17. Where are multi-product pipelines used?
18. What is used to detect anomalies in the pipe?
19. Are pipelines generally the most economical way to transport oil, refined oil products or natural gas over the land?

Тема № 5: «Электрообессоливающая установка. Атмосферно-ваккумная перегонная установка».

1.What pressure is maintained in the electric dehydrating tank?
2.What temperature is maintained in the electric dehydrating tank?
3. What refining operation comes after electric desalting?
4. What is the capacity of the desalting unit described above?
5. What are the water requirements for crude washing?
6. How much caustic solution is required per ton of crude oil?

Тема № 6: «Компании и профессии в сфере нефтехимической промышленности. Охрана труда, окружающей среды и техника безопасности на нефтехимических предприятиях».

1. How do people grow in oil & gas industries? Is it good to start a career in the oil and gas industry?
2. How do oil and gas industry make money?
3. What is the future of the oil and gas industry?
4. How important is the oil and gas industry for any country?
5. Can industrial engineers work in oil and gas industries? And if they work there, what can they really do?
6. What areas (sectors) of the oil and gas industry does BP operate in?
7. What volume of oil and gas is produced per day by the BP Company?
8. Name the key locations of oil and gas fields where BP operates.

9. Describe the marketing part in BP's business model. How does it work?
10. Does the BP Company invest in renewable energy projects?
11. Would like to work for dependent Oil and Gas Company?
12. Can you explain what OPEC is?
13. Can you name the members of OPEC currently?
14. Who controls or decides the Oil prices?
15. How U.S dollar contribute to the rising Oil prices?
16. What are the factors that can fluctuate in gasoline price?
17. Who analyses and does research of the Oil and Natural gas supply in U.S?
18. What is **API** gravity?

Тема № 7: «Ректификационные установки. Насосы. Реакторы».

1. What are chemical reactors designed for?
2. Can you name two main basic vessel types?
3. What are the three basic models of chemical reactors?
4. What do key process variables include?
5. What do you know about the work of Continuous Stirred-Tank Reactor (CSTR)?
6. Can you name any important aspects of the CSTR?
7. What do you know about the work of Plug Flow Reactor (PFR)?
8. What are the most important aspects of the PFR?
9. What other models of chemical reactors do you know? What way do they work?
10 Can you give the definition to such device as pump?
11. What way do the pumps operate?
12. What types of pumps do you know? Name them.
13. Can you give other name of constant flow machine?
14. Why is safety valve necessary on the discharge side of the positive displacement pump?
15. Can you give the classification to the positive displacement pumps according to the mechanism used to move the fluid?
16. What are the three main types of rotary positive displacement pumps?
17. What typical reciprocating pumps do you know?
18. Can you describe the operation of the screw pumps?
19. What do you know about plunger pumps?
20. What pumps do the conventional impulse pumps include?
21. Can you give the definition for the fractionating column?
22. Where are fractionating columns used?
23. What is a laboratory fractionating column used for?
24. What allows more cycles, improving separation?
25. What types of industries are fractionating columns widely used in?
26. Where is industrial distillation typically performed?
27. Do all industrial fractionating columns have outlets at intervals up the column?
28. What purpose do industrial fractionating columns use external reflux?

29. What does the design and operation of a fractionating column depend on?
30. What purpose are bubble-cap "trays" or "plates" used for?
31. What is used in the column instead of trays in industrial uses?
32. What affects packing performance?

Тема № 8: «Резервуары высокого давления в нефтяной и газовой промышленности. Промышленные ректификационные колонны. Типы теплообменников. Шламоуловители».

1. Can you explain what the dust collector is used for?
2. What are the main types of industrial dust collectors?
3. Can you name the primary types of inertial separators?
4. What are three basic configurations of wet scrubbers?
5. Can you name four main components of all electrostatic precipitators?
6. What affects the efficiency of electrostatic precipitators?
7. Can you give the definition for the pressure vessel?
8. What testing is the most preferred and for what reason?
9. What shapes can pressure vessels be?
10. Many pressure vessels are made of wood, aren't they?
11. What composite materials can some pressure vessels be made of?
12. Where are pressure vessels used in?
13. What is heat exchanger used for?
14. What can heat exchangers be according to their flow arrangement?
15. Why are heat exchangers designed to maximize the surface area of the wall between the two fluids?
16. What does shell and tube heat exchanger consist of?
17. What is the tube bundle?
18. What is the plate heat exchanger composed of?
19. What purpose are reboilers used for in chemical plants and refineries?

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