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Английский язык для инженеров горнодобывающей промышленности

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Петрозаводск
2021

Министерство науки и высшего образования
Российской Федерации
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Английский язык для инженеров горнодобывающей промышленности

Учебное электронное пособие для обучающихся
по направлению подготовки бакалавриата
«Горное дело»

Петрозаводск
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И. Н. Кузина, Н. К. Дмитриева

А647 **Английский язык для инженеров горнодобывающей промышленности** [Электронный ресурс] : учебное электронное пособие для обучающихся по направлению подготовки бакалавриата «Горное дело» / М-во науки и высшего образования Рос. Федерации, Федер. гос. бюджет. образоват. учреждение высш. образования Петрозавод. гос. ун-т ; сост.: И. Н. Кузина, Н. К. Дмитриева. – Электронные данные. – Петрозаводск : Издательство ПетрГУ, 2021. – 1 электрон. опт. диск (CD-R) ; 12 см. – Систем. требования : PC, MAC с процессором Intel 1,3 ГГц и выше ; Windows, MAC OS X ; 256 Мб ; видеосистема : разрешение экрана 800 × 600 и выше ; графический ускоритель (опционально) ; мышь или другое аналогичное устройство. – Загл. с этикетки диска.

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Учебное пособие направлено на развитие профессионально-ориентированной и коммуникативной компетенции. В его основу положены компетентностный, модульный подходы и проектная деятельность обучающихся. Освоение профессиональной лексики и развитие умений профессионального общения способствует овладению английским языком на профессиональном уровне. Формирование и развитие вышеперечисленных навыков и умений происходит благодаря системе упражнений. Контроль сформированности навыков и умений профессиональной коммуникации осуществляется посредством тестовых заданий.

Пособие предназначено для обучающихся 1–2 курсов по направлению подготовки бакалавриата «Горное дело».

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Содержание

UNIT 1

Surface mining: open-pit mining, highwall mining, dredging

Read and translate texts

Surface Mining

Surface mining is a form of mining in which the soil and rock covering the mineral deposits are removed. It is the other way of underground mining, in which the over lying rock is left behind, and the required mineral deposits are removed through shafts or tunnels. Surface mining accounts for two thirds of the world's solid minerals, and is used in obtaining sand, gravel, crushed stone, phosphates, coal, copper, iron and aluminum.

There are 5 main types of surface mining, which are used in various degrees and for different resources.

These mining categories are:

1) strip mining
2) open-pit mining
3) mountaintop removal
4) dredging
5) high wall mining

All methods of surface mining will remove the waste material, or overburden, above the desired resource. Surface mining is often preferred to sub-surface (underground mining) by mining companies for several reasons. It is less expensive, there are fewer complications in terms of electricity and water, and it is safer [12].

Open-pit mining

Open-pit mining is exactly what the name implies: a big hole (or pit) in the ground. The pit in an open-pit mine is created by blasting with explosives and drilling. This type of mining is typically used to mine gravel and sand and even rock (when open-pit mining is used to extract rock from the earth, the pit is often called a quarry) [12].

High Wall Mining

High wall mining is a combination of surface mining techniques and sub-surface techniques. The basic idea is you start with an open-pit mine, and then drill or bore into those walls to extract more resources. High wall mining is performed remotely by a person in a cabin at the surface who uses a television camera to monitor and control the continuous miner machine [12].

Dredging

Dredging is the process of mining materials from the bottom of a body of water, including rivers, lakes and oceans.

Dredging is underwater excavation of a pacer deposits by floating equipment. Dredging systems are classified as mechanical or hydraulic, depending on the method of material transport.

The bucket ladder, bucket-line dredge has been the traditional placer mining tool. It consists of a single hull supporting an excavating and lifting mechanism. The excavation equipment consists of an endless chain of open buckets that travel around a truss or a ladder. The lower end of the ladder rests on the mine face, the bottom of the pond, that is where excavation takes place and the top end is located near the center of the dredge, at the feed hopper of the treatment plant. The chain of the buckets passes around the upper end of ladder at a drive sprocket (called the upper tumbler) and loops downward to an idler sprocket (the lower tumbler) at the bottom. The filled buckets, supported by rollers are pulled up the ladder and dump their load into the hopper. After the valuable material has been removed by the treatment plant, waste is dumped of the back end of the dredge.

The clam shell dredge is characterized by a large single bucket operating at the end of cables. Although it can operate in deeper water than other systems and handles large particles and trash well.

In pure hydraulic dredging systems, the digging and lifting force is either pure suction, suction with hydro-jet assistance, or entirely hydro-jet. They are best suited to digging relatively small-sized loose materials, such as sand, gravel, marine shell deposits and unconsolidated overburden.

Hydraulic dredging has also been applied to mining of deposits containing diamonds, tin, tungsten, niobium, tantalum, titanium, monazite [12].

Vocabulary

Read and learn the words and word combinations:

- surface mining – открытая добыча, открытая разработка
- soil – почва
- rock – порода
- cover – покрывать
- to remove – удалять
- underground mining – подземная добыча
- overlying rock – вышележащая порода
- is left behind – остается позади
- removed through shafts or tunnels – удалены через шахты и тоннели
- solid minerals – твердые минералы
- obtain – получать
- sand – песок
- gravel – гравий
- crushed stone – щебень
- phosphates – фосфаты
- coal – уголь
- copper – медь
- iron – железо
- aluminum – алюминий
- in various degrees – в различной степени
- for different resources – для различных природных ресурсов
- strip mining – разработка пластов
- mountaintop removal – удаление горных вершин
- dredging – выемка грунта
- high wall mining – добыча с высоких стен
- waste material / overburden – пустая порода / вскрышная порода, вскрыша
- complications in terms of electricity and water – сложности с электричеством и водой
- imply – подразумевать, означать
- a big hole in the ground – большая яма / карьер в земле

- to blast – взрывать
- explosives – взрывчатые вещества
- drilling – бурение
- a quarry – карьер, каменоломня
- surface mining techniques – методы открытой добычи
- sub-surface techniques – методы подземной добычи
- to bore – бурить
- extract more resources – добывать больше природных ресурсов
- is performed remotely – производится удаленно
- to monitor – следить, проверять, наблюдать
- continuous miner machine – непрерывно работающее горное оборудование
- dredging – выемка грунта
- a body of water – водоем
- underwater extraction – подводная выемка
- a placer deposits – месторождения сыпучих пород
- floating equipment – плавучее оборудование
- dredging systems – системы выемки грунта, системы дноуглубления
- mechanical or hydraulic – механический или гидравлический
- the bucket ladder – конвейер с ковшами
- bucket-line dredge – драга ковшевого конвейера
- tool – инструмент
- single hull – одиночный корпус
- supporting –поддерживающий
- excavating and lifting mechanism – экскаваторный и подъемный механизм
- an endless chain of open buckets – бесконечная цепь открытых ковшей
- travel around a truss or ladder – перемещаются по фермам и лестницам
- the lower end of a ladder rests on mine face – нижний конец конвейера находится на поверхности шахты
- the bottom on the pond – на дне водоема
- the feed hopper – загрузочный бункер

- treatment plant – очистное сооружение
- a drive sprocket – ведущее цепное колесо, блок
- upper tumbler – верхний тумблер
- loop downward to an idler sprocket – спускаются вниз к промежуточному блоку
- roller – вал, ролик
- are pulled up the ladder – поднимаются по конвейеру
- dump their load into the hopper – сбрасывают груз в бункер
- valuable material – ценный материал, порода
- is dumped of the back end of the dredge – сбрасываются с задней части драги
- the clam shell dredge – грейферный землечерпательный снаряд, экскаватор-раскладушка
- operating at end of cables – работающий на конце конвейера
- handle large particles and trash – справляться с крупными частями пород и мусором
- in pure hydraulic dredging systems – гидравлические дноуглубительные системы в чистом виде
- suction – всасывание
- suction with hydro-jet assistance – всасывание с частичным использованием гидроструйного двигателя
- entirely hydro-jet – полное использование гидроструйного двигателя
- small-sizes loose materials – сыпучие породы небольших размеров
- marine shell deposits – залежи морских раковин
- unconsolidated overburden – рыхлые пустые породы
- tin – олово
- diamonds – алмазы
- tungsten – вольфрам
- niobium – ниобий
- tantalum – тантал
- titanium – титан
- monazite – монацит

Tasks

Exercise 1

Match columns A and B:

A	B
1) soil and rock covering the mineral deposit	a) удаляются через шахты и тоннели
2) the overlying rock is left behind	b) выемка грунта
3) the required mineral deposit	c) разработка пластов
4) are removed through shafts or tunnels	d) требующееся месторождение минерала
5) two thirds of the world's solid minerals	e) вышележащая порода остается позади
6) is used in obtaining	f) используется для добычи
7) dredging	g) две трети твердых минералов в мире
8) strip-mining	h) удаление горных вершин
9) overburden	i) почва и породы, покрывающие месторождение минерала
10) mountaintop removal	j) пустая горная порода (вскрыша)

Exercise 2

Match the words and their definitions:

1) methods of extracting minerals near the surface of Earth	a) copper
2) naturally occurring accumulations or concentrations of minerals	b) aluminum
3) rock or soil overlying a mineral deposit	c) surface mining
4) get, acquire	d) phosphate
5) a red-brown metal	e) overburden
6) a chemical compound that contains phosphorus	f) obtain
7) a long, narrow, typically vertical hole that gives access to a mine	g) mineral deposit
8) a light silvery-grey metal	h) shaft

9) a series of buckets that move in a continuous chain, used to dredge riverbeds, ponds to excavate land	i) placer deposit
10) a method of mining, in which the waste and ore are completely removed from the sides and bottom of a pit which gradually becomes enormous canyon-like hole	j) to blast
11) a wheel with teeth around the outer edge that fit into the holes in a chain	k) bucket-ladder
12) to blow up or break apart something solid with explosives	l) open pit mining
13) an accumulation of valuable minerals formed by gravity separation from a specific source rock during sedimentary processes	m) to extract
14) to take something out or put it out	n) a sprocket

Exercise 3

Read the texts and decide if the statements are true or false ones. Correct the false statements:

1. Surface mining is a form of mining in which the soil and rock covering the mineral deposits are dug in.
2. Surface mining is the other way of sub-surface mining.
3. The overlying rock is left behind and the required mineral deposits are removed through shafts and tunnels.
4. Surface mining is used in obtaining sand, gravel, crushed stone, phosphates, coal, copper, iron and aluminum.
5. All methods of surface mining will remove the waste material or overburden above the desired resource.
6. Surface mining is not preferred to sub-surface by mining companies because it it rather dangerous method of mining.

Exercise 4

Translate from Russian into English:

1. Ямы /карьеры в открытых шахтах создаются путем взрывных работ или бурения.
2. Этот способ используется при добыче гравия и песка.
3. Добыча с высоких стен – это комбинация открытых методов добычи и методов подземной добычи.

4. Выемка грунта – это процесс добычи со дна водоема, включая реки, озера и океаны.

5. Выемка грунта – это подводное выкапывание сыпучих месторождений с помощью плавучего оборудования.

6. Конвейер с ковшом является традиционным оборудованием для добычи сыпучих пород.

7. Он состоит из одного корпуса, поддерживающего механизм выемки и поднятия.

8. Оборудование выемки состоит из бесконечной цепи открытых ковшей, которые перемещаются по фермам или конвейерам.

9. Нижняя часть конвейера остается на поверхности шахты, на дне водоема, где происходит выемка, а верхняя часть расположена около драги, у загрузочного бункера очистного сооружения.

10. Полные ковши, поддерживаемые валом, поднимаются вверх по конвейеру и сбрасывают груз в бункер.

Exercise 5

Find the endings to the beginnings of the following sentences:

1. Dredging is the process of	a) a big-hole (or a pit) in the ground
2. High wall mining is	b) mining materials from the bottom of water, including rivers, lakes and oceans
3. Dredging systems are classified as	c) created by blasting with explosives and drilling
4. The bucket ladder consists of	d) mechanical or hydraulic depending on the method of material transport
5. Open pit mining is	e) single hull supporting an excavating and lifting mechanism
6. The excavation equipment consists of	f) a combination of surface mining techniques and sub-surface techniques
7. The chain of buckets passes	g) an endless chain of open buckets that travel around a truss or a ladder
8. The filled buckets supported by rollers are pulled up	h) either pure suction with hydro-jet assistance or entirely hydro-jet
9. The pit in an open-pit mine is	I) the upper end of ladder at a drive sprocket and loops downward to an idler sprocket at the bottom
10. In pure hydraulic dredging systems the digging and lifting force is	j) the ladder and dump their load into the hopper

Individual Task

Make the projects and Power Point Presentations on the following topics:

1. Strip mining in the world.
2. Strip mining in Russia.
3. Strip mining in Karelia.
4. Mountain top removal in the world.
5. Mountain top removal in Russia.
6. Open-pit mining in the world.
7. Open-pit mining in Russia.
8. Open-pit mining in Karelia.
9. Dredging in Russia.
10. Dredging in the world.
11. High wall mining in the world.
12. High wall mining in Russia.

UNIT 2

Conventional methods of surface mining: strip mining, mounting top removal, stripping overburden. Mining development. Mining equipment selection

Vocabulary

Read and learn the words and word combinations:

- strip mining – добыча пластами
- dump the removed overburden behind the deposit – сбрасывать удаленную пустую породу за месторождениями
- clay – глина
- tar-mining – добыча смолы
- alternative and more recent version – альтернативная и более современная версия
- steep mountain – крутая, отвесная гора
- to expose desired deposits below – обнажить, раскрыть нужные месторождения
- valley fills – насыпные долины, насыпи
- economic goal – экономическая цель
- remove the least amount of material – удалять наименьшее количество материала
- gain the greatest return on investment – добиваться наибольшего возвращения инвестиций
- to process – обрабатывать
- the most marketable mineral product – самый ликвидный (ходовой) минерал
- ore deposits – залежи руды
- uniform shape – однородная форма
- to be preceded – предшествовать
- exploratory drilling – исследовательское (разведывательное) бурение
- to profile – представить, охарактеризовать
- ore body – рудное тело

- layout – расположение, планировка
- mineralogy – минералогия
- a series of concentric ledges or benches – серия концентрических выступов
- an access – доступ
- haulage roads – транспортные дороги
- stripping overburden – удаление вскрышной породы
- expose the underlying ore body – расчистить, раскрыть лежащее снизу рудное тело/пласт
- most removal techniques – самые лучшие методы удаления
- involve extraction and removal phases – включать фазы извлечения и удаления
- loading – погрузка
- haulage – перевозка
- an exception to this cyclical effect – исключение из этого цикличного процесса
- dredge – драга
- bucket wheel-excavators – ковшевые экскаваторы
- selection – выбор, отбор
- topography of the pit and surrounding area – топография шахты и окружающей территории
- the ore must be transported for processing – руда должна быть перевезена для обработки
- rely on mobile drill rig – полагаться на мобильные буровые установки
- hydraulic shovels – гидравлические экскаваторы
- front-end loaders – фронтальные погрузчики
- scrapers – шаберы, скреперы
- haul trucks – погрузочные самосвалы
- conventional methods – традиционные методы
- mode of mechanical extraction – режим, способ механического удаления
- running in series – производится поэтапно
- continuous process – непрерывный процесс
- discontinuous process – прерываемый процесс
- loose rock mining – добыча сыпучих пород

- solid rock mining – добыча твердых пород
- flat or tabular in nature mineral streams – плоские и пластинчатые минеральные потоки
- drag lines – перетаскивающие конвейеры, линии
- quarrying – разработка карьеров, карьерные разработки
- high degree of consolidation and density – высокая степень слияния и плотности
- are crushed and broken – раздавлены и разбиты
- are combined with other chemicals – соединяются с другими химическими веществами
- close proximity to the site of material use – близость к месту использования материалов
- flagstone – плитка
- limestone – известняк
- marble – мрамор
- slate – шифер
- quarried materials – добытые материалы

Read and translate the texts

Strip Mining

Strip mining is the process of removing a thin strip of overburden, (earth or soil) above a desired deposit, dumping the removed overburden behind the deposit, creating the second parallel strip in the same manner, and depositing the waste materials from that second (new) strip onto the first strip. And so on. Strip mining is used a lot for coal, phosphates, clay, and tar mining [12].

Mountaintop Removal

This is an alternative and more recent version of strip mining. Mountaintop removal mining involves removing the top of steep mountains to expose desired deposits below. The extracted overburden from the mountaintop is deposited in nearby low valley areas known as "valley fills" [13].

Mining Development

The economic goal in surface mining is to remove the least amount of material while to gaining the greatest return on investment by processing the most marketable mineral product.

As many ore deposits are not uniform shape, the mine plan is preceded by extensive exploratory drilling to profile the geology and position of the ore body. The size of mineral deposit dictates the size and layout of the mine. The layout of a surface mine is dictated by mineralogy and geology of the area. The shape of most open-pit mines is a cone but always reflects the shape of the mineral deposit being developed.

Open-pit mines are constructed of a series of concentric ledges or benches. Mines must have an access and haulage roads [12].

Stripping Overburden

Overburden is waste rock consisting of consolidated and unconsolidated material. That material must be removed to expose the underlying ore body. It is desirable to remove as little overburden as possible in order to access the ore of interest. But a larger volume of waste rock is excavated when the mineral deposit is deep. Most removal techniques are cyclical that involves extraction and removal phases. Extraction includes drilling, blasting, and loading. Removal involves haulage.

An exception to this cyclical effect are dredges used in hydraulic surface mining and some types of loose material mining with bucket wheel excavators [13].

Mining Equipment Selection

The selection of mining equipment includes the topography of the pit and surrounding area, the amount of ore to be mined and distance the ore must be transported for processing. Most contemporary surface mining operations rely on mobile drill rigs, hydraulic shovels, front-end loaders, scrapers and haul trucks to extract ore and process it [12].

Conventional Methods of Surface Mining

Open-pit and strip mining are two major categories of surface mining which account for more than 90 % worldwide surface mining production. The main differences between them are the location of the ore body and the mode of mechanical extraction. For loose rock mining the process is continuous with extraction and haulage steps running in series. Solid rock mining requires a discontinuous process of drilling and blasting and then loading and haulage stages.

Strip mining techniques relate to the extraction of ore bodies that are near the surface and relatively flat or tabular in nature mineral streams. It uses different types of equipment including shovels, trucks, drag lines, bucket wheel excavators and scrapers. Most strip mines process non-hard rock deposits. They mine coal that is strip mined from surface streams.

In contrast, open-pit mining is employed to remove hard rock ore that is located in deep streams and is limited to excavation by shovel and truck equipment. Many metals are mined by the open-pit techniques: gold, silver, copper.

Quarrying is a term used to describe a specialized open-pit mining technique. Solid rock with high degree of consolidation and density is extracted from localized deposits. Quarried materials are either crushed and broken to produce aggregate or building stone, such as dolomite and limestone, or combined with other chemicals to produce cement and lime. Construction materials are produced from quarries located in close proximity to the site of material use to reduce transportation costs.

Dimension stone such as flagstone, granite, limestone, marble, sandstone and slate represent the second class of quarried materials [14].

Tasks

Exercise 1

Read the sentences and decide if they are true or false ones. Correct the false statements:

1. Strip mining is the process of digging big holes to find a desired deposit.
2. Strip mining is used for diamonds, iron and silver.
3. Mountaintop removal mining involves removing the top of steep mountain to expose desired deposits below.
4. The economic goal in surface mining is to remove the least amount of material while to gaining the greatest return on investment by processing the most marketable mineral product.
5. The size of mineral deposit dictates the access to haulage roads.
6. The shape of most open-pit mines is rectangular.
7. Overburden is a waste rock consisting of consolidated and unconsolidated material.

8. It is desirable to remove as much overburden as possible in order to transport and process it.
9. Most removal techniques are cyclical that involves extraction and removal phases.
10. Extraction includes drilling, blasting, and loading.
11. The selection of mining equipment includes the proximity to factories.
12. Most contemporary surface mining operations rely on mobile drill rigs, hydraulic shovels, front-end loaders, scrapers and haul trucks to extract ore and process it.
13. For loose rock mining the process is continuous with extraction and haulage steps running in series.
14. Solid rock mining requires digging and processing.
15. Most strip mines process non-hard rock deposits.
16. Quarried materials are either crushed and broken to produce aggregate or building stone, or combined with other chemicals.

Exercise 2

Match columns A and B:

A	B
strip mining	драга
steep mountain	добыча твердых пород
ore deposits	удаление вскрышной породы
a series of concentric ledges	включать фазы извлечения и удаления
dump the removal overburden behind the deposit	традиционные методы
stripping overburden	серия концентрических выступов
loading	сбрасывать удаленную пустую породу за месторождением
haulage	добыча пластами
involve extraction and removal phases	погрузка
conventional methods	добыча сыпучих пород
loose rock mining	залежи руды
solid rock mining	перевозка
dredge	отвесная гора

Exercise 3

Complete the sentences with suitable words:

1. The economic goal in surface mining is ..... the least amount of material while to gaining the greatest return on investment by processing the most ..... mineral product.
2. The .... of mineral deposit dictates the size and layout of the mine.
3. The shape of most open-pit mines is .... but always ..... the shape of the mineral deposit being developed.
4. Open pit mines are constructed of series of ... .
5. Overburden is .... consisting of consolidated and unconsolidated material.
6. Overburden must be removed to expose the underlying ....
7. Most removal techniques are cyclical that involves ..... and ....
8. Extraction includes drilling, ... and loading.
9. Removal includes .... .
10. The selection of mining equipment includes .... of the pit and surrounding area, the amount of ore to be mined and .... the ore must be transported for processing.
11. The main difference between open-pit and strip mining are the .... of the ore body and the ....
12. For loose rock mining the process is ..... with extraction and haulage steps running in .... .
13. .... mining requires a discontinuous process of drilling and blasting and then loading and haulage stages.
14. Strip mining techniques .... to the extraction of ore body that are near the surface.
15. Most strip mines .... non-hard rock deposits.
16. Open-pit mining is employed to remove hard rock ore that ... . in deep streams and ... . to excavation by shovel and truck equipment.

Exercise 4

Answer the questions:

1. What kind of a process is strip mining?
2. What stages does mountaintop removal involve?

3. What is the economic goal in surface mining?
4. What do the size and layout of a mine depend on?
5. What is an overburden?
6. What steps do extraction and removal include?
7. What equipment is used in most contemporary surface mines?
8. What is the difference between open-pit and strip mining?
9. How are loose and hard rocks mined?
10. What techniques and equipment are used in strip mining?
11. What is quarrying?

Individual Task

Make projects and Power Point Presentations on the following topics:

1. The most conventional techniques to remove stripping overburden in the world.
2. The most conventional techniques to remove stripping overburden in Russia.
3. The main ore deposits in the world.
4. The main ore deposits in Russia.
5. The main ore deposits in Karelia.
6. Coal deposits in Russia.
7. Equipment used at strip mines.
8. Quarrying in Russia.

UNIT 3

Production and Equipment. Processing

Vocabulary

Read and learn the words and word combinations:

- production – производство
- equipment – оборудование
- mechanical drilling – механическое бурение
- hard rock overburden – вскрыша твердых пород
- mechanical devices – механические устройства
- capable – способный (сделать что-то), пригодный
- loosening hard rock – ослабить твердую породу
- ammonium nitrate – аммиачная селитра
- on the basis of the nature of the ore – исходя из природы руды
- the speed and depth – скорость и глубина
- to fracture – ломать, надломить
- a specified tonnage – указанный тоннаж
- current muck face – поверхность недавно отбитой, неубранной породы
- bench – выступ, рудный ствол
- loading – погрузка
- is conducted – производится
- utilize – использовать
- table shovels – лопаты
- hydraulic shovels – гидравлические экскаваторы
- has resulted production advantages and cost saving over traditional vehicle haulage – привело к преимуществам производства и к экономии стоимости по сравнению с традиционной перевозкой тягачами
- in three to five cycles or passes of shovel – от трех до пяти циклов или проходов ковша
- tracked shovels – гусеничные экскаваторы

- rubber-tyred loaders – погрузчики с резиновыми шинами
- cable shovels – тросовые экскаваторы
- payloads – полезная нагрузка
- haul trucks – тягачи
- diesel engines – дизельные двигатели
- electrical drives – электрические приводы
- ton capacity trucks – грузовые автомобили с грузоподъемностью
- single/dual direction traffic – одностороннее/двухстороннее движение
- left or right lane configuration – конфигурация левой или правой стороны
- visibility of tyre position – видимость положения шин
- left hand traffic – левостороннее движение
- driver-side collision – столкновение со стороны водителя
- gradients – уклоны, наклоны, градиенты
- sustained hauls – продолжительные перевозки
- safety and water drainage – безопасность и отвод воды
- road berms – дорожные насыпи, бермы
- degree of reliability – степень надежности
- adjacent excavations – смежные, соседние раскопки
- features – черты, особенности
- switch-back grades – подъездные дороги в обратном направлении
- long steep grades – длинные крутые уклоны
- ore handling – переработка руды
- conveyance – перевозка, транспортировка
- semi-mobile crusher – полумобильная дробилка
- a modular form – модульная форма
- steeper grades – более крутые уклоны
- mineral processing – обработка, переработка минералов
- art of treating crude ores – искусство очистки неочищенной руды
- to undergo – подвергаться
- comminution – дробление
- must be liberated – нужно освободить

- interlocked state – заблокированное состояние
- grind into powder – измельчать в порошок
- mills – мельницы
- discrete mineral particles – разрозненные частицы
- gravel beds – пласты гравия
- recoverable – извлечены
- in log washers – в бревнах, в деревянных лотках
- mill feed – сырье
- jaw crushers – щековые дробилки
- cone crushers – конусные дробилки
- cylinder mill – цилиндрическая мельница
- be disintegrated – измельченный
- varying length-to-diameter ratios – переменное отношение длины к диаметру
- to remove low-grade overburden material – удалять низкосортную пустую породу
- crude ores – неочищенная руда
- mounted with axis – установлены на осях
- autogenous mill – автогенная мельница
- semi-autogenous mill – полуавтогенная мельница
- roll crusher – валковая дробилка
- shafts – валы
- soluble rock – растворимая порода
- leaching – выщелачивание
- pyrometallurgical – пирометаллургический
- refining – очищение
- low-grade copper oxide ore – руды с низким содержанием оксида меди
- so that comminution takes place in the material bed between them – таким образом, измельчение происходит в слое материала между ними
- the coarser part – более грубая часть
- to revolve – вращать(ся)

Read and translate texts

Drilling and blasting

Mechanical drilling and blasting are the first steps in extracting ore from most open-pit mines and the most common method used to remove hard rock overburden. While there are many mechanical devices capable of loosening hard rock, explosives are preferred method. A commonly used hard rock explosive is ammonium nitrate.

Drilling equipment is selected on the basis of the nature of the ore and the speed and depth of holes necessary to fracture a specified tonnage of ore per day. For example, in mining a 15-m bench of ore, 60 or more holes will generally be drilled 15 m back from the current muck face depending on length of the bench to be mined [11].

Loading

Surface mining is now conducted utilizing table shovels, front-end loaders or hydraulic shovels. In open-pit mining loading equipment matches with haul trucks that can be loaded in three to five cycles or passes of shovel. With sharp rock hard digging and wet climates, tracked shovels are preferable. Rubber-tired loaders are preferred for loading material that is low volume and easy to dig. Loaders are very mobile and well-suited for mining scenarios requiring rapid movements from one area to another. Hydraulic shovels and cable shovels have similar advantages and limitations.

Hydraulic shovels are not preferred for digging hard rock. Large cable shovels with payloads of about 50 cubic meters are preferred at mines where production exceeds 200 000 tons per day.

Hydraulic shovels allow greater operator control to selectively load from either the bottom or top half of mine face [11].

Haulage

Haulage in open-pit and strip mines is accompanied by haul trucks. Technical development in haul trucks such as diesel engines and electrical drives have led to much larger capacity of vehicles.

Several manufactures currently produce 240 tons capacity trucks with exception for greater than 300 tons capacity trucks in the near future. Haul road systems may use single or dual direction traffic. Traffic may be either left or right lane configuration. Left lane traffic is frequently preferred to improve operator visibility of tyre position on very large

trucks. Safety is improved with left hand traffic by reducing the potential for driver-side collision in the center of the road.

Haul road gradients are typically limited to between 8 and 5 % for sustained hauls and optimally are about 7 to 8 %. Safety and water drainage require long gradients to include at least 45-m sections.

Road berms (elevated dirt boarders) located between roads and adjacent excavations are standard safety features of surface mines. They may also be placed in the middle of the road to separate opposing traffic. Where switch-back haul roads exist, increasing elevation escape lanes may be installed at the end of long steep grades. Road edge barriers such as berms are standard and should be located between all roads and adjacent excavations.

Rail haulage is superior to other methods for transport ore over long distances outside the mine.

Rail haulage is no longer widely used in open-pit mining since the advent of electrical and diesel-powered trucks [11].

Ore handling (Conveyance)

Location of a semi-mobile crusher in mine pit with subsequent transport out of the pit by a conveyor system has resulted production advantages and cost savings over traditional vehicle haulage. Crushers are constructed in a modular form to allow some portability within the mine.

Conveyors' advantages include automatic and continuous operation, a high degree of reliability with up to 90 to 95 % availability. Using steeper grades lowers the need to remove low-grade overburden material and may reduce the need to establish high-cost haulage roads [11].

Processing

Mineral processing, art of treating crude ores and mineral products, in order to separate the valuable minerals from the waste rock, is the first process that most ores undergo after mining.

Comminution

The minerals must be liberated from their interlocked state physically by comminution.

As a rule, comminution begins by crushing the ore to a certain size and finishes by grinding into powder. These processes are carried out in mechanized crushers and mills. Whereas crushing is done mostly under dry conditions, grinding mills can be operated both dry and wet, with wet grinding being predominant [14].

Crushing

Some ores occur in nature as mixtures of discrete mineral particles, such as gold in gravel beds and streams and diamond in mines. These mixtures require little or no crushing, since the valuables are recoverable using other techniques (breaking up placer material in log washers).

Most ores are made up of hard, tough rock masses that must be crushed before the valuable minerals can be released.

In order to produce a crushed material suitable for use as mill feed crushing is done in stages.

In the first stage, the devices used are mostly jaw crushers with openings as wide as two meters. These crush the ore less than 150 millimeters, which is suitable size to serve as feed for the secondary stage.

In this stage, the ore is crushed in cone crushers to less than 10 to 15 millimeters. This material is the feed for grinding mill [14].

Grinding

In this process stage, the crushed material can be disintegrated in a cylinder mill, which is cylinder built to varying length-to-diameter ratios. It is mounted with the axis horizontally and partially filled with grinding bodies that are caused to tumble under the influence of gravity by revolving the container. A special device is the autogenous or semi autogenous mill. Autogenous mill operates without grinding bodied, instead, the coarser part of the ore simply grinds itself. To semi autogenous mills 5 to 10 % grinding bodies are added. There is another development, combining crushing and grinding, it is the roll crusher. This consists of 2 cylinders that are mounted on horizontal shafts and driven in opposite directions. The cylinders are pressed together under high pressure, so that comminution takes place in the material bed between them [14].

Solution Mining Methods

Solution mining is employed to extract soluble ore where conventional mining methods are less efficient and/or less economical. Also known as leaching or surface leaching.

This technique can be a mining method or it can be used in pyrometallurgical steps of smelting and refining.

Gold, silver and low-grade copper oxide ores are processed by leaching [14].

Tasks

Exercise 1

Read the words and word combinations in English and match them with their Russian equivalents:

1) mechanical drilling	a) гидравлический экскаватор
2) loosening hard rock	b) полумобильная дробилка
3) hard rock overburden	c) переработка руды
4) on the basis of the nature of ore	d) искусство очистки неочищенных руд
5) a specified tonnage	e) дробление
6) current muck face	f) тягачи
7) hydraulic shovels	g) ослабить твердые породы
8) in three to five cycles or passes of shovel	h) погрузчики с резиновыми шинами
9) tracked shovels	i) грузовые автомобили с грузоподъемностью
10) rubber tyred loaders	j) пустые породы твердых пород
11) payloads	k) измельчение, шлифовка
12) haul trucks	l) сырье
13) ton capacity trucks	m) гусеничные экскаваторы
14) ore handling	n) производить, выполнять
15) semi-mobile crusher	o) исходя из природы руды
16) art of treating crude ores	p) поверхность недавно отбитой, неубранной породы
17) comminution	q) от трех до пяти циклов или проходов ковша
18) to carry out	r) указанный тоннаж
19) mill feed	s) полезная нагрузка
20) grinding	t) механическое бурение

Exercise 2

Group the words from the list and put them in the table. Use the captions (headings) as characteristics and marks of words being selected:

Comminution, jaw crushers, autogenous mills, semi-autogenous mills, conveyance, cylinder mills, cone crushers, electrical and diesel-powered trucks, rubber tyred loaders, grinding mills, haul trucks, drilling, grinding, hydraulic shovels, front-end loaders, table shovels, crushing, blasting, cable shovels, loading, haulage, silver, leaching, gold, low-grade copper oxide ore, tracked shovels.

Techniques and methods used in production and processing of rocks, mineral and ores	Haulage vehicles	Types of shovels/ excavators	Types of mills	Types of crushers	Names of minerals, rocks
blasting					

Exercise 3

Choose the suitable answer to each question:

1. Which steps are the first ones in extracting ore from most open-pit mines and the most common method used to remove hard rock overburden?

a) digging and excavating
b) mountaintop removal and dredging
c) mechanical drilling and blasting

2. What is the preferred method capable of loosening hard rock?

a) leaching
b) using explosives
c) heating

3. What equipment is used in conducting surface mining now?

a) hydraulic shovels
b) table shovels, front-end loaders and hydraulic shovels
c) floating equipment

4. What does loading equipment match with in open-pit mining?
   a) with haul trucks that can be loaded in three to five cycles or passes of shovel
   b) with front-end loaders that can be loaded in two to four cycles or passes of shovel
   c) with haul trucks that can be loaded in five to seven cycles or passes of shovel

5. What kind of trucks is haulage in open-pit and strip mines accompanied by?
   a) by rubber-tyred trucks
   b) by carts pulled by horses
   c) by haul trucks

6. What for are crushers constructed in a modular form?
   a) to beautify the process of ore handling
   b) to enable the process of ore handling
   c) to allow some portability within the mine

7. What equipment is used for the process of comminution?
   a) scrapers
   b) crushers and mills
   c) drill rigs

8. What does comminution begin and finish by?
   a) begins by crushing the ore to a certain size and finishes by grinding it into powder
   b) begins by excavating ores and finishes by loading them
   c) begins by crushing the ore to a certain size and finishes by loading it

9. What are the stages of producing a crushed material suitable for use as mill feed?
   a) a crushed material is produced in two stages: in the first stage jaw crushers are used and in the second stage cone crushers are utilized
   b) a crushed material is produced in three stages by using cylinder mills
   c) a crushed material is produced in two stages by using grinding mills

Exercise 4

Match the words and their definitions:

1) equipment	a) a cargo, weight placed on something
2) to fracture	b) a substance formed naturally in the ground and from which metal can be obtained
3) muck	c) an excavating machine
4) loading	d) a narrow shelf, path, or ledge typically at the top of a slope, the shoulder of a road
5) payloads	e) to clean up; to move or load rubbish; material removed in the process of excavating or mining
6) engine	f) the load expressed in tons of cargo or equipment which the vehicle is designed to transport under specified conditions of operation in addition to its unladen weight
7) gradient	g) to cause a crack; to damage or destroy as if by rupturing
8) berms	h) the necessary items for a particular purpose
9) ore	i) a machine with moving parts that converts power into motion
10) conveyance	j) an inclined part of a road or railway, a slope
11) undergo	k) breaking into pieces; crumbling, pulverizing the process of breaking up of a material to form smaller particles
12) grinding	l) move in a circle on a central axis; go around
13) comminution	m) to experience something that is unpleasant or has a strong effect
14) to revolve	n) the process of turning solid particles into a granular form
15) shovel	o) the process of transporting something from one place to another; vehicle or method of transport

Individual Task

Make the projects and Power Point Presentation on the following topics:

1. The process of drilling.
2. Drilling equipment.
3. The process of blasting.
4. Blasting equipment.

5. Loading equipment in open-pit mining.
6. Haulage equipment.
7. Comminution.
8. Crushing.
9. Griding.
10. Solution mining methods.
11. Haulage in open-pit and strip mining.

Test (units 1–3)

Task 1

Choose the best answer:

1. Surface mining is
   a) the process of digging big holes
   b) a form of mining in which the soil and rock covering mineral deposits are removed
   c) a form on underwater mining

2. Open-pit mining is
   a) exactly what the name implies: a big hole (or pit) in the ground
   b) the method of processing ores
   c) the process of excavating hard rocks

3. High wall mining is
   a) the process of excavating overburden
   b) the process of extracting diamonds
   c) combination of surface mining techniques and sub-mining techniques

4. Dredging is
   a) the method of mining copper
   b) the process of mining materials from the bottom of a body of water
   c) the technique of mining silver

5. Strip mining is
   a) the process of removing a thin strip of overburden above a desired deposit dumping the removed overburden behind the deposit, creating the second parallel strip in the same manner
   b) the process of digging shafts and tunnels
   c) the process of extracting placer deposits

6. Mountaintop removal mining involves
   a) removing overburden lying above the desired deposits

b) removing the top of steep mountains to expose desired deposits below
c) removing snow layers to expose desired deposits below

7. Economic goal in surface mining is
   a) to produce as much as possible of marketable products
   b) to reduce employees' salaries
   c) to remove the least amount of material while to gaining the greatest return on investment by processing the most marketable mineral product

8. Overburden is
   a) hard rock overlying ore body
   b) waste rock consisting of consolidated and unconsolidated material that must be removed to expose the underlying ore body
   c) loose material overlying ore body

9. The differences between open-pit and strip mining are
   a) methods of extracting ores
   b) methods of selecting equipment
   c) the location of the ore body and the mode of mechanical extraction

10. Quarrying is
   a) a term used to describe a specialized open-pit mining technique
   b) the method of processing ore
   c) mining loose rocks

Task 2

Match words to form appropriate word combinations:

1) open	a) mining production
2) conventional	b) rigs
3) worldwide surface	c) methods
4) drill	d) shovels
5) hydraulic	e) pit mining

6) front-end	f) direction traffic
7) haul	g) loaders
8) desired	h) removal
9) mountaintop	i) mountain
10) steep	j) deposit
11) rubber	k) tyred loaders
12) tone	l) capacity trucks
13) single/dual	m) crushers
14) jaw	n) grade
15) autogenous	o) trucks
16) low	p) mill

Task 3

Choose the best answer, use words and phrases from the list:

a) hydro-jet assistance and hydro jet
b) the hopper
c) mechanical drilling and blasting
d) the clam shell
e) mineral processing
f) solution mining methods
g) comminution
h) explosives
i) jaw crushers
j) cone crushers

What do we call:

1. The first steps in extracting ore from most open-pit mines and the most common method used to remove hard rock overburden.
2. The most preferable method of loosening hard rock.
3. The container into which the filled buckets dump their load.
4. The dredge that is characterized by a large single bucket operating at the end of cables.
5. The devices that are best suited to digging relatively small-sized loose materials such as sand, gravel, marine shell deposits and unconsolidated overburden.

6. The first process that most ores undergo after mining

7. The process that begins crushing the ore to a certain size and finishes by grinding it into powder.

8. The devices used in the first stage of crushing ores.

9. The devices used in the second stage of crushing ores.

10. Mining methods employed to extract soluble ores.

Task 4

Sort these words out under the headings:

1. Techniques used in production and processing rocks	2. Devices, equipment used in the process of dredging	3. Equipment used in the processes of comminution, crushing and grinding

1) clam shell dredge
2) crushing
3) loading
4) conveyance
5) bucket-line dredge
6) grinding
7) mineral processing
8) haulage
9) autogenous and semi-autogenous mill
10) cone crushers
11) drive sprocket
12) treatment plant
13) drilling
14) jaw crushers
15) blasting
16) roller
17) idler sprocket
18) cylinder mill

19) grinding mill
20) dredge
21) hopper
22) bucket ladder

Task 5

Choose the best answer to each question:

1. What kind of mining is surface mining?
   a) a form of underwater mining
   b) the other way of underground mining in which the overlying rock is left behind and the required mineral deposits are removed through shafts and tunnels
   c) a combination of digging, blasting and excavation

2. How is the pit in an open-pit mine created?
   a) by digging
   b) by removing overburden
   c) by blasting with explosives and drilling

3. How is high wall mining conducted?
   a) you start with an open-pit mine and then drill into those walls to extract more resources
   b) you blast walls and then extract resources
   c) you dig huge holes to extract resources

4. What excavation equipment is used in the process of dredging?
   a) underwater shovels
   b) an endless chain of open buckets that travel around a truss or a ladder
   c) hoppers and sprockets

5. How is the process of loose rock mining conducted?
   a) it is a continuous process with extraction and haulage running in series
   b) it requires blasting and drilling stages
   c) it requires continuous blasting and loading

6. How is the process of solid rock mining conducted?

a) it requires digging and loading
b) it requires blasting overburden
c) it requires a discontinuous process of drilling and blasting and then loading and haulage stages

7. What equipment do strip mining techniques include?

a) dredges and drill rigs
b) shovels, trucks, drag lines, bucket wheel excavators and scrapers
c) crushers and mills

8. What is the first process that most ores undergo after mining?

a) haulage
b) loading
c) mineral processing

Task 6

Choose the correct word from the choices offered:

1. Drilling equipment is selected on the basis of ***the nature / structure / shape*** of the ore and the speed and depth of holes necessary to fracture a specified tonnage of ore per day.

2. Mechanical drilling and blasting are the first steps in extracting ore from most open-pit mines and the most common method used to remove ***loose minerals / solid rocks / hard rock overburden***.

3. While there are many mechanical devices capable loosening hard rock ***drilling / explosives / digging*** are preferred method.

4. In open-pit mining loading equipment matches with ***haul trucks / rubber-tyred trucks / front-end loaders*** that can be loaded in three to five cycles or passes of shovel.

5. ***Hydraulic shovels / cable shovels / table shovels*** are not preferred for digging hard rock.

6. ***Large table shovels / cable shovels / hydraulic shovels*** with payloads of about 50 cubic meters are preferred at mines where production exceeds 200 000 tons per day.

7. Haulage in open-pit and strip mines is accompanied by ***front-end loaders / haul trucks / rubber-tyred loaders***.

8. ***Left Lane traffic / right lane traffic / single direction traffic*** is frequently preferred to improve operator visibility of tyre position on very large trucks.

9. Crushers are conducted in a modular form ***to support / to allow / to enable*** some portability within a mine.

10. Comminution begins by crushing the ore to a certain size and finishes by grinding into ***small particles / powder / a crushed material***.

11. In order to produce a crushed material for use as ***crushed stones / mill feed / flagstone*** crushing is done in stages.

12. In the first stage, the devices used are mostly *cone* ***crushers / cylinder mills / jaw crushers*** with opening as wide as two meters.

13. ***Cylinder mill / autogenous mill / semi-autogenous mill*** operates without grinding bodied, instead, the coarser part of the ore simply grinds itself.

14. There is another development, combining crushing and grinding, it is ***jaw mill / the cylinder mill / the roll crusher***.

Task 7

Complete the sentences with words and phrases from the list:

1. Strip mining is the process of removing ..... above a desired deposit.
2. ..... is an alternative and more recent version of strip mining.
3. Mountain removal mining involves removing ..... to expose desired deposits below.
4. Overburden is ..... of consolidated and unconsolidated material.
5. Most removal techniques are cyclical and involves ..... .
6. The selection of mining equipment includes ..... of the pit and surrounding area, the amount of ore must be mined and ..... the ore must be transported for processing.
7. Most strip mines process ..... .
8. Quarried materials are either ..... to produce building stone or combined with other chemicals to produce cement and lime.
9. Mineral processing, art of treating crude ore and mineral products in order to separate ..... from the waste rock, is the first process that most ores undergo after mining.

a) the top of steep mountains
b) extraction and removal phases
c) mountain removal
d) topography
e) valuable minerals
f) crushed and broken
g) a thin strip of overburden
h) distance
i) non-hard rock deposits
j) waste rock

Task 8

Match the words and their definitions:

1. Methods of extracting minerals near the surface of Earth	a) copper
2. Naturally occurring accumulations or concentrations of minerals	b) aluminum
3. Rock or soil overlying a mineral deposit	c) surface mining
4. Get, acquire	d) phosphate
5. A red-brown metal	e) overburden
6. A chemical compound that contains phosphorus	f) obtain
7. A long, narrow, typically vertical hole that gives access to a mine	g) mineral deposit
8. A light silvery-grey metal	h) shaft
9. A series of buckets that move in a continuous chain, used to dredge riverbeds, ponds to excavate land	i) placer deposit
10. A method of mining, in which the waste and ore are completely removed from the sides and bottom of a pit which gradually becomes enormous canyon-like hole	j) to blast
11. A wheel with teeth around the outer edge that fit into the holes in a chain	k) bucket-ladder

12. To blow up or break apart something solid with explosives	l) open pit mining
13. An accumulation of valuable minerals formed by gravity separation from a specific source rock during sedimentary processes	m) to extract
14. To take something out or put it out	n) a sprocket
15. Dredging is the process of	o) a big-hole (or a pit) in the ground
16. High wall mining is	p) mining materials from the bottom of water, including rivers, lakes and oceans
17. Dredging systems are classified as	q) created by blasting with explosives and drilling
18. The bucket ladder consists of	r) mechanical or hydraulic depending on the method of material transport
19. Open pit mining is	s) single hull supporting an excavating and lifting mechanism
20. The excavation equipment consists of	t) a combination of surface mining techniques and sub-surface techniques
21. The chain of buckets passes	u) an endless chain of open buckets that travel around a truss or a ladder
22. The filled buckets supported by rollers are pulled up	v) either pure suction with hydro-jet assistance or entirely hydro-jet
23. The pit in an open-pit mine is	w) the upper end of ladder at a drive sprocket and loops downward to an idler sprocket at the bottom
24. In pure hydraulic dredging systems the digging and lifting force is	x) the ladder and dump their load into the hopper

UNIT 4

Hydrocarbons. Crude Oil

Vocabulary

Read and learn words and word combinations:

- hydrocarbons – углеводороды
- crude oil and natural gas – сырая/неочищенная нефть и природный газ
- naturally occurring substances – встречающиеся в природе вещества
- rock – горная порода
- earth's crust – земная кора
- organic raw materials – органическое сырье
- compression of the remains of plants and animals – сжатие останков растений и животных
- sedimentary rock – осадочная порода
- sandstone – песчаник
- limestone – известняк
- shale – сланец
- deposits in ancient oceans – залежи в древних океанах
- bodies of water – водоемы
- layers of sediment – слои осадочных пород
- to be deposited – залегать
- decaying remains of plants and animals – разлагающиеся останки растений и животных
- to be integrated into – быть интегрированным / встроенным в
- forming rock – формирующая порода
- eventually – в конечном счете
- transform into – превратиться в
- be exposed – быть открытым, выставленным на показ
- after being exposed to specific temperature and pressure ranges deep within the earth's crust – после воздействия определенных температур и колебаний давления глубоко в земной коре

- less dense – менее плотный
- migrate through porous sedimentary rock – проникать через пористые осадочные породы
- be trapped beneath – находиться в ловушке внизу/снизу
- cap rock – покровная порода / покрывающая порода
- oil and gas reservoir – резервуар/залежи нефти и газа
- crude oil – неочищенная нефть
- petroleum product – нефтепродукты
- fossil fuel – ископаемое топливо
- is refined to – очищен до
- usable products – полезные продукты
- gasoline – бензин, газолин
- diesel – дизельное топливо
- petrochemicals – нефтехимикаты
- nonrenewable resources – невозобновляемые ресурсы
- to consume – потреблять
- drilling – бурение
- saline water – соленая вода
- composition – состав, структура
- widely demanded commodity – широко востребованный товар
- spark unrest – изобиловать волнениями, беспорядками
- supply and demand – спрос и предложение
- profitability – рентабельность
- the Organization of the Petroleum Exporting Countries (OPEC) – Организация стран – экспортеров нефти
- considerable leverage – важный рычаг
- hydro fracturing – гидроразрыв пласта
- energy boom – энергетический бум
- dump – сбросить
- oil spills – разлив нефти
- ocean acidification – закисление океана
- to extract – извлекать
- jet fuel – реактивное топливо
- global commodity – глобальный товар

- spot oil – нефть из скважины
- derivatives contracts – контракты на производные продукты
- primary source – первоисточник
- is obtain through drilling – полученный путем бурения
- found alongside other resources – находят вместе с другими ресурсами
- which is lighter and therefore sits above crude oil – который легче и, следовательно, находится под сырой нефтью
- is denser and sinks below – плотнее и опускается ниже
- extraction – извлечение
- is refined and processed – очищено и обработано
- asphalt – битум
- to vary in color – имеет разные цвета
- viscosity – вязкость
- distillation – перегонка, дистилляция
- was first discovered and developed – впервые был открыт и разрабатывался
- revolutionize – производить революцию
- newly invented machines – только что изобретенное оборудование
- widely demanded commodity – широко востребованный товар
- to spark unrest – разжечь волнения
- supply and demand heavily affect prices and profitability – спрос и предложение серьезно влияют на цены и рентабельность
- downside of oil reliance – обратная сторона зависимости от нефти
- considerable leverage of determine oil producers – значимые рычаги влияния на производителей нефти
- wind turbines – ветряные турбины

Read the texts and do the tasks

About Hydrocarbons

Hydrocarbons make up crude oil and natural gas, which are naturally occurring substances found in rock in the earth's crust. These organic raw materials are created by the compression of the remains of plants

and animals in sedimentary rock such as sandstone, limestone and shale. The sedimentary rock itself is a product of deposits in ancient oceans and other bodies of water. As layers of sediment were deposited on the ocean floor, the decaying remains of plants and animals were integrated into the forming rock. The organic material eventually transforms into oil and gas after being exposed to specific temperatures and pressure ranges deep within the earth's crust. Oil and gas are less dense than water, so they migrate through porous sedimentary rock toward the earth's surface. When the hydrocarbons are trapped beneath less-porous cap rock, oil and gas reservoir is formed. These reservoirs of oil and gas represent our sources of crude oil and gas [9].

What is Crude Oil?

Crude oil is naturally occurring petroleum product composed of hydrocarbon deposits and other organic materials. A type of fossil fuel, crude oil is refined to produce usable products including gasoline, diesel, and various other forms of petrochemicals. It is a nonrenewable resource, which means that it can't be replaced naturally at the rate we consume it and is, therefore, a limited resource.

Crude oil is the raw natural resource that is extracted from the earth and refined into products such as gasoline, jet fuel, and other petroleum products.

Crude oil is a global commodity that trades in market around the world, both as spot oil and via derivatives contracts.

Many economics view crude oil as the single most important commodity in the world as it currently the primary source of energy production. Crude oil is typically obtained through drilling, where it is usually found alongside other resources, such as natural gas (which is lighter and sits above the crude oil) and saline water (which is denser and sinks below).

After its extraction, crude oil refined and processed into a variety of forms, such as gasoline, kerosine, and asphalt, for sale to consumers. Although it is often called "black gold", crude oil has a range of viscosity and can vary in color from black to yellow depending on its hydrocarbon composition. Distillation, the process by which oil is heated and separated into different components, is the first stage in refining [9].

History of Crude Oil Usage

Although fossil fuels like coal have been harvested for centuries, crude oil was first discovered and developed during the Industrial Revolution, and its industrial uses were developed in 19th century. Newly invented machines revolutionized the way we do work, and they depended on these resources to run. Crude oil remains widely demanded commodity but often sparks unrest because a small number of countries controls the largest reservoirs. Like any industry, supply and demand heavily affect the prices and profitability of crude oil. The USA, Saudi Arabia and Russia are the leading producers of oil in the world. In the late 19th and early 20th century, the United States was one of the world's leading oil producer. US companies developed the technology to make oil into useful products like gasoline. The Organization of the Petroleum Exporting Countries (OPEC) founded in 1960, which consists of the world's largest holders of crude oil and natural gas reserves. It used to have considerable leverage of determine oil producers. In the early 21st century Hydro Fracturing created a second US energy boom which reduced OPEC's influence [9].

The Downsides of Oil Reliance

Heavy reliance on fossil fuels is considered as one of the main causes of global warming. Risks surrounding oil drilling include oil spills and ocean acidification which damage ecosystems. In the 21st century, many manufacturers have begun creating products that rely on alternative sources of energy, such as cars run by electricity, homes powered by solar panels, and communities powered by wind turbines [9].

Tasks

Exercise 1

Match columns A and B:

A	B
1. A product of deposits in ancient oceans	a) неочищенная нефть обычно добывается путем бурения
2. These organic raw materials are created by compression of remains	b) останки растений и животных включены в формирующую породу

3. Remains of plants and animals were integrated into the forming rock	c) продукт из залежей в древним океане
4. Oil and gas are less dense than water	d) встречающиеся в природе нефтепродукты
5. Naturally occurring petroleum product	e) это органическое сырье создается путем сжатия останков
6. Which means that it can't be replaced naturally at the rate we consume it	f) удаляется из земли и очищается до продуктов
7. Is extracted from the earth and refined into products	g) нефть и газ не такие плотные, как вода
8. A global commodity that trades in market around the world	h) он является сейчас первоисточником производства энергии
9. It is currently the primary source of energy production	i) глобальный продукт, который продается во всем мире
10. Crude oil typically obtained through drilling	j) это значит, что он не может быть заменен естественным путем в том объеме, в котором мы его используем

Exercise 2

Listen to audio file and answer the questions [9] (www.investopedia.com/terms/c/crude-oil.asp):

1. Is crude oil a renewable resource? Why?
2. How is crude oil found?
3. What does the color of crude oil depend on?
4. What countries are considered as top producers of crude oil?
5. Which technology made the USA the leading oil producer?
6. What alternative sources of energy are created now to reduce risks to the ecosystems?

Exercise 3

Complete the sentences with suitable words:

1. Hydrocarbons are created by ..... of the remains of plants and animals in sedimentary rocks such as sandstones, limestones and shale.

2. As layers of sediment were deposited on the ocean floor the .... were integrated into the forming rock.
3. When the hydrocarbons are trapped beneath ...., oil and gas reservoir is formed.
4. A type of fossil fuel, crude oil ..... to produce usable products including ....
5. It is a non-renewable resource, which means that it can't be .... naturally at the rate we .... it and is, therefore, a limited resource.
6. Crude oil is the .... that is extracted from the earth and refined into products such as gasoline, jet fuel and other petroleum products.
7. Crude oil is typically obtained through drilling, where it .... alongside other resources such as ....
8. Crude oil is a ..... that trades in market around the world.
9. After its extraction crude oil ..... into the variety of forms such as gasoline, kerosine, and asphalt for sale to consumers.
10. Although it is often called "black gold" crude oil has a range of ..... and can vary in color from black to yellow depending on its hydrocarbon composition.

Exercise 4

Match the words and their definitions:

1. A compound of hydrogen and carbon such as any of those which are the chief components of petroleum and natural gas	a) asphalt
2. Rock that formed through the deposition and solidification of sediment	b) shale
3. Soft finely stratified sedimentary rock that formed from consolidated mud or clay and can be split easily into fragile plates	c) hydrocarbons
4. Harder or more resistant rock type overlying a weaker or less resistant rock type	d) gasoline
5. A mixture of dark bituminous pitch with sand or gravel, used for surfacing roads, flooring, roofing	e) sedimentary rock
6. Water that contains a high concentration of dissolved salts	f) diesel

7. A natural fuel such as coal or gas, formed in the geological past form the remains of living organisms	g) saline water
8. A well stimulation technique involving the fracturing of bedrock formations by pressurized liquid	h) cap rock
9. A heavy petroleum fraction used as fuel in diesel engines	i) fossil fuel
10. A volatile flammable liquid hydrocarbon mixture used as a fuel especially for internal combustion engines and usually blended from several products of natural gas and petroleum	j) hydro fracturing

Exercise 5

Role play

Divide into groups and you are allotted individual roles, which are written out on cards.

You are participants/experts of a scientific conference "Crude oil is primary source of energy production: pros and cons. Express and prove your point of view.

Role Card A (group 1): You are sure that crude oil is the single source of energy production and there are no alternative sources of energy.

Role Card B (group 2): Crude oil is a non-renewable resource, and its amount is limited so we have to search for other sources of energy.

Role card C (group 3): Crude oil extraction can lead to risks to acidification. What should we do to avoid these risks and environmental problems?

Individual Task

Make the projects and Power Point Presentations on the following topics:

1. Hydrocarbons.
2. What is crude oil?
3. The largest crude oil deposits in the world.
4. The largest crude oil deposits in Russia.
5. The largest natural gas deposits in the world.

6. The largest natural gas deposits in Russia.
7. Downsides of oil reliance.
8. Alternative sources of energy.
9. Fossil fuel and global warming.
10. The useful products made of oil.

Test

Hydrocarbons. Crude Oil

Task 1

True/False statements:

1. Hydrocarbons make up oil and natural gas, which are naturally occurring substances found in rock in the earth's crust.
2. These organic raw materials are created due to volcanic eruptions.
3. As layers of sediment were deposited on the ocean floor, the decaying remains of sludge or mud were integrated into the forming rock.
4. The organic material eventually transforms into oil and gas often being exposed to specific temperatures and pressure ranges deep within earth's crust.
5. Oil and gas are less dense than water, so they migrate through porous sedimentary rock toward the earth's surface.
6. Crude oil is a naturally occurring porous substance composed of hydrocarbon deposits.
7. Crude oil is typically obtained through drilling, where it is usually found alongside other resources, such as natural gas saline water.
8. After its extraction, crude oil is sorted, drained and processed.
9. In the 19th early 20th century, the Saudi Arabia was one of the world's leading oil producer.
10. In the early 21st century Hydro Fracturing created a second US energy boom which reduced OPEC's influence.
11. Heavy reliance on natural gas is considered as one of the main causes of global warming.
12. Risks surrounding oil drilling include oil spills and ocean acidification which damage ecosystems.

Task 2

Choose the best answer to the questions:

1. How are hydrocarbons formed?
   a. They are created by subsiding of igneous rocks in caves.
   b. They are created by subsiding of sedimentary rocks at the bottom of oceans.
   c. They are created by compression of the remains of plants and animals in sedimentary rock such as sandstone, limestone and shale.

2. What is crude oil?
   a. Crude oil is an igneous substance composed of organic material.
   b. Crude oil is a naturally occurring petroleum product composed of hydrocarbon deposits and other organic material.
   c. Crude oil is biochemical substance composed of ores.

3. How is crude oil obtained?
   a. It is obtained through drilling.
   b. It is obtained through pumping.
   c. It is obtained through blowing it out.

4. What is a distillation?
   a. Distillation is the process of evaporation of water.
   b. Distillation, the process by which oil is heated and separated into different components, is the first stage in refining.
   c. Distillation is chemical processing of oil.

5. What affects prices and profitability of crude oil?
   a. Supply and demand heavily affect the prices and profitability of crude oil.
   b. Amount and colour affect prices and profitability of crude oil.
   c. Weight affects prices and profitability of crude oil.

6. What created the second US energy boom?
   a. New drilling tools created the second US energy boom.
   b. New drilling rigs created the second US energy boom.
   c. Hydro fracturing created the second US energy boom.

7. What is considered as one of the main causes of global warming?
   a. Burning coal is one of the main causes of global warming.
   b. Heavy reliance on fossil fuels is considered as one of the main causes of global warming.
   c. Cutting woods is one of causes of global warming.

8. What alternative sources of energy are used nowadays?
   a. Ballet dancers' spinning in dance may be used as alternative source of energy.
   b. Volcano eruption and force of the tides of seas are used as alternative sources of energy.
   c. Cars run by electricity, homes powered by solar panels and communities powered by wind turbines are alternative sources of energy.

Task 3

Match the words and their definitions:

A	B
1. Non-renewable resource	a) the action of purifying a liquid by the process of heating and cooling
2. Fossil fuels	b) the negative aspect of something otherwise regarded as good or desirable
3. Obtain	c) informally referred to as "fracking", is oil and gas well development process that typically involves injecting water, sand and chemicals under high pressure into a bedrock formation via the well
4. Viscosities	d) get, acquire or secure something
5. Distillations	e) a natural substance that is not replenished with the speed at which it is consumed; it is a finite
6. Commodities	f) a gradual increase in the overall temperature of the earth's atmosphere generally attributed to the greenhouse effect caused by increased level of carbon dioxide and other pollutants
7. Global warming	g) a natural fuel such as coal formed in the geological past from the remains of living organisms
8. Hydro-fracturing	h) a raw material or primary agricultural product that can be bought and sold, such as cooper or coffee
9. Downsides	i) the state of being thick, sticky and semi-fluid in consistency, due to internal friction

UNIT 5

Exploration and Production

Vocabulary

Read and learn the words and word combinations:

- accumulation of oil and natural gas – залежи нефти и природного газа
- the process of recovering hidden resources – процесс извлечения скрытых ресурсов
- processing, marketing and use – обработка, маркетинг и использование
- source rocks – материнская порода
- to squeeze – выдавливать
- reservoir rock – коллекторские породы
- to feature – быть характерной чертой, показывать
- a surface seep – поверхностное просачивание
- an underground pocket – подземный карман
- drilling a well – бурение скважины
- to gather above-ground clues – собирать надземные улики
- satellites – спутники
- ocean floor – дно океана
- seismic surveys – сейсморазведка
- high-energy sound waves – звуковые волны высокой энергии
- how long they take to reflect back to the surface – сколько времени им понадобится, чтобы отразиться на поверхности
- well path to the reservoir – путь скважины к залежам
- surveys – разведка, обследование
- exploration wells – разведочные скважины
- data – информация
- a likely site for oil and gas reserves – вероятное место запасов нефти и газа
- rock samples – образцы пород

- well logs measure properties of the rocks – разрезы буровых скважин измеряют качество пород
- gravity and geomagnetic surveys – гравиметрические и магнитные исследования
- bearing – несущий, опора
- sedimentary basing – осадочные бассейны
- high-resolution aero magnetic surveys – аэромагнитная съемка с высоким разрешением
- show fault traces – показывать следы разломов (неисправностей)
- differentiate between – различать
- impact to the environment – влияние, воздействие на окружающую среду
- secure permission – безопасное разрешение
- assume all the costs and risks – взять на себя все расходы и риски
- the share of the production – доля производства
- royalty payment – отчисления владельцу
- drilling derrick – буровая вышка
- drill string – бурильная колонна
- drill rigs – буровые установки
- to supply power to turn the bit and raise and lower drill pipe and casing – для подачи питания на вращение долота, подъем и опускание бурильной трубы и обсадной колонны
- conical shaped cutting surfaces to grind rock rice-sized particles – коническая режущая поверхность для шлифования
- lengths of pipe fastened to each other – отрезки труб, скрепленные друг с другом
- The mud is circulated to bring cuttings to surface – Ил/глина циркулирует, чтобы вывести шлам на поверхность
- counteract the pressure of any gas or fluids encounted along the way – противодействуют давлению любого газа или жидкостей, встречающихся на пути
- blow out – задуть
- the aquifer – водоносный слой
- contamination – загрязнение, заражение
- to reduce waste – уменьшать количество отходов

- a sieve – сито
- holding areas are carefully sited, lined and often covered with nets to protect local wildlife – места, где обнаружены месторождения, тщательно выстланы и покрыты сетками для защиты окружающей природы
- land based drilling rigs – наземная буровая установка
- slim hole drilling rig – буровая установка для тонких скважин
- conventional drill bore – обычное сверло
- technically feasible – технически осуществимо
- coiled tubing drill rig – буровая установка для коллтюбинга
- rigid pipe to form the drill string – жесткая труба для формирования бурильной колонны
- a continuous length of pipe stored on a large – непрерывная длина трубы
- jack up drill rigs – самоподъемные буровые установки
- a floating barge – плавучая баржа
- drilling structure that is outfitted with long support legs that can be raised or lowered independently of each other – буровая конструкция с длинными опорными стойками (ногами), которые можно поднимать и опускать независимо друг от друга
- slowly lifts the entire barge and drilling structure to a predetermined height above the water – медленно поднимает всю баржу и буровую конструкцию на заданную высоту над водой
- a floating barge containing the drilling structure that is outfitted with long support legs that can be raised or lowered independently of each other – плавучая баржа, содержащая буровую конструкцию, оборудованную длинными опорными стойками, которые можно поднимать или опускать независимо друг от друга
- is towed onto location with its legs up and the barge section floating on the water – буксируется на место с поднятыми ногами, а часть баржи плавает в воде
- the legs are jacked down onto the sea floor – ноги опущены на дно
- all three legs jacked further down – все три ноги подняты ниже

- continued jacking down of the legs raises the jacking mechanism attached to the barge and drilling package – система опускания опор поднимает домкрат, прикрепленный к барже и к буровому комплексу
- pontoon-like structures – понтонная конструкция
- are submerged below the sea surface – погружены ниже поверхности моря
- operating decks are elevated as much as 100 or more feet – рабочие палубы подняты более чем на 100 футов
- this design has the advantage of submerging most of the area of components in contact with the sea – эта конструкция имеет преимущество погружения большей части компонентов, контактирующих с морем
- submersibles can operate in a wide range of water depths – подводные аппараты могут работать в широком диапазоне глубин
- strong chains and wire cables – прочные цепи и тросы
- may utilize dynamic positioning to remain stationary during drilling without anchors – можно использовать динамическое положение, чтобы оставаться неподвижным во время бурения без якорей
- for exploration targets farther offshore – для геологоразведочных целей дальше от берега
- specially designed rigs mounted on ships – специально разработанные буровые установки, размещенные на судах
- can be attached to the ocean bottom using traditional mooring and anchoring systems – может быть прикреплен ко дну океана с помощью традиционных систем швартовки и якоря
- to withstand ocean storms and high waves – противостоять штормам и огромным волнам в океане
- shift out – сдвинуть
- semi-submersible rigs – полупогруженные буровые установки
- floating vessels – плавучие суда
- are submerged below the sea surface – погружены ниже поверхности моря
- minimize loading – уменьшить нагрузку
- mooring and anchoring systems – системы швартовки и якоря

Read texts and do the tasks:

Exploration and Production

Exploration is the process of trying to find accumulation of oil and natural gas trapped under the Earth's surface. Production is the process of recovering those hidden resources for processing, marketing and use. To understand the challenges the oil and natural gas industry faces in exploration and production, it helps to understand how oil and gas accumulations (often called "reservoirs") develop in the first place. Oil and natural gas are formed when decaying plants and micro-organisms are trapped in layers of sediment rocks. Over the course of millions of years, they become buried deep within the earth, where underground heat and pressure turn them into useful hydrocarbons, such as oil and natural gas. The layers of rock in which hydrocarbons are formed, are called source rocks. High pressures underground tend to squeeze hydrocarbons out of source rocks into what are called reservoir rocks. These are rocks such as sandstone, which feature pores large enough to permit fluids like oil, natural gas, and water to pass through them. Since oil and gas are less dense than water, they will float upward to the surface. If nothing stops this migration, the oil and natural gas may reach a surface.

More often however, hydrocarbons path upward is blocked by a layer of such rocks as shale or by some other geologic formation. These trap the oil and gas, either in an underground pocket or in a layer of reservoir rock, so that it may be recovered only by drilling a well. There isn't any way to be absolutely sure where new oil and gas reserves are located.

Advanced technology has revolutionized the exploration process for oil and gas. This results with fewer wells and lowered exploration costs. Engineers can gather above-ground clues using airplanes and satellites to map the surface and look for gas and oil seeps. Ships can do the same for ocean floor.

Engineers use a number of strategies including: seismic surveys, exploration well, gravity and geomagnetic surveys, creating a drill site, drilling rigs, slim hole drilling rig jack up drill rigs, semi-submersible rigs, drill ships [9].

Seismic surveys are done by sending high-energy waves into the ground and measuring how long they take to reflect back to the surface. Since sound travels at different speeds as it passes through different materials, computers can use seismic data to create 3D map of what lies

below the surface. Geologists and geophysicists- known as "explorationists"-use these 3D seismic images to look for accumulations of oil and natural gas. Engineers then use the data to plan the safest, most cost-effective well path to the reservoir. While seismic data are extremely useful to geologists, these surveys are also very expensive [9].

Exploration Wells

When the data indicate a likely site for oil and gas reserves, an exploration well is often drilled. Rock samples from the well are brought to the surface and analyzed.

Well logs measure the electrical, magnetic and radioactive properties of the rocks [9].

Gravity and Geomagnetic Surveys

These relatively inexpensive techniques can identify potential oil and natural gas bearing sedimentary basins and structures. High-resolution aero-magnetic surveys done by special aircraft also show fault traces and differentiate between different rock types near the surface [9].

Creating a Drill Site

1. Drilling for oil and natural gas is a complex process, but advanced technology has made the job more efficient and productive while providing less impact on the environment.

Some people believe that oil and gas companies can explore for oil wherever they want. This is not true. Companies must secure permission from the owner of the mineral rights, whether the owner is a private citizen or the government. Many mineral owners and the government allow oi and gas companies compete to drill on their land. The companies assume all the costs and risks of drilling, and in return, pay the mineral owners a portion of what they find and a signing bonus to secure the drilling rights. The share of production paid by the company is called a royalty payment.

2. The drilling derrick is used to position and support the drill string. Modern drilling equipment comes in a wide range of sizes. Many wells can be drilled with equipment that requires for less space than in the past.

3. Drill rigs now run-on electricity to supply power to turn the bit and raise and lower drill pipe and casing. Since most drilling occurs in remote areas, the electricity is supplied by electric power generators that run on diesel fuel.

4. The drill bit uses three conical shaped cutting surfaces to grind rock rice-sized particles. The drill string consists of lengths of pipe fastened to each other and to the drill bit. The drill string transmits power from the top drive, to the drill bit.

5. As the drill cuts into the rock, drilling mud is added to the hole. This helps cool the drill bit and the mud is circulated to bring, cuttings to the surface. The weight of the drilling mud keeps the hole open. It also helps counteract the pressure of any gas or fluids encounted along the way, in this way preventing a well from loss of control or "blow out".

6. Protecting the aquifer from contamination is a major concern of the oil and gas industry casing made of steel or high-tech alloys is lowered into the hole and cemented into place to protect fresh water aquifers. The casing also keeps the hole open so that oil and natural gas can be brought to the surface.

7. To reduce waste, the drilling mud is passed through a sieve where the ground rock particles or cuttings can be removed. Then the mud is recycled back into the hole.

8. Dirt and rock cuttings are removed from the hole and temporarily stored nearby. Holding areas are carefully sited, lined and often covered with nets to protect local wild life.

9. All aspects of the drilling operations are closely monitored to ensure efficient drilling and safety. Electronic sensors measure drilling rates, vibration, pressure, rock type, mud properties and many other drilling parameters. Computers monitor operations and collect data from inside the well. With advanced communications technology, drilling personnel can share and review this data with engineers and geologists located thousand miles away. If a problem is detected, the rig can be safety and quickly shut down [5].

Drilling Rigs

There are different types of drilling rigs. Which rig selected depends on the specific requirements of each drill site.

Land Based Drilling Rigs

Land Based Drilling Rig is the most common type used for exploration. This site is using a conventional land-based drilling rig that is smaller and more efficient than those used in the past.

Slim Hole Drilling Rig – A conventional drill bore might be 18 inched in diameter, a slim hole bore can be as little as 6 inches. A slim hole well drilled to 14.760 feet may produce one-third the amount of rock cuttings

generated by a standard well. However, slim hole drilling is not technically feasible in all environments.

Coiled Tubing Drill Rig – Conventional wells are drilled using sections of rigid pipe to form the drill string. In some cases, coiled tubing technology can replace the typical drill string with a continuous length of pipe stored on a large spool. The approach has many benefits, including reduced drilling waste and minimized equipment footprints, so its especially useful in environmentally sensitive to re-entering existing wells, and when multiple casing wells are unnecessary [5].

Jack up drill rigs

These rigs may be used in relatively shallow water less than 300 feet deep. A jack up rig is a floating barge containing the drilling structure that is outfitted with long support legs that can be raised or lowered independently of each other. The jack up, as it is known informally, is towed onto location with its legs up and barge section floating on the water. Once at the drilling location, the legs are jacked down onto the sea floor, and then all three legs jacked further down. Since the legs will not penetrate the sea floor, continued jacking down of the legs raises the jacking mechanisms attached to the barge and drilling package, and slowly lifts the entire barge and drilling structure to a predetermined height above the water. These rigs are extremely strong, since they have to withstand ocean storms and high waves. These rigs are moved by simply moving the legs up and down, which makes them cost-effective and easily shifted out of harm's way during storms [5].

Semi-Submersible Rigs

Drilling in water deeper than 300 feet demands some kind of floating vessels supported on large pontoon-like structures that are submerged bellow the sea surface. As with jack up rigs the operating decks are elevated as much as 100 or more feet above the pontoons on large steel columns. This design has the advantage of submerging most of the area of components in contract with the sea and minimizing loading from waves and wind. Semisubmersibles can operate in a wide range of water depths, including deep water. Semi-submersibles can either be attached to the ocean bottom using strong chains and wire cables or may utilize dynamic positioning to remain stationary during drilling without anchors [5].

Drill Ship

For exploration targets farther offshore, specially designed rigs mounted on ships can drill a well in water depths up to 10 000 feet. These rigs float and can be attached to the ocean bottom using traditional mooring and anchoring systems, or utilize dynamic positioning to remain stationary during drilling without anchors [5].

Tasks

Exercise 1

Read the texts "Exploration and Production. Seismic surveys" and decide which sentences are true and which ones are false. Correct the false statements:

1. Exploration is the process of trying to dig huge holes to extract reserves.
2. Production is the process of recovering those hidden resources for processing, marketing and use.
3. Oil and natural gas are formed when igneous rocks are trapped in layers of sediment rocks.
4. Over the course of millions of years, they become buried deep within the earth, where underground water turns them into useful hydrocarbons.
5. The layers of rock in which hydrocarbons are formed and they are called source rocks.
6. High pressures underground tend to break hydrocarbons out of source rocks into what are called forming rocks.
7. Since oil and natural gas are less dense than water, they float upward to the surface.
8. There are several ways to be absolutely sure where new oil and gas reserves are located.
9. Advanced technology has revolutionized the exploration process for oil and gas.
10. Seismic surveys are done by using satellite to map location of reserves.

11. Geologists and geophysicists use 3D seismic images to look for accumulations of oil and natural gas.
12. Engineers then use the data to plan the safest, most cost-effective well path to the reservoir.

Exercise 2

Read the texts "Exploration Wells. Gravity and Geomagnetic surveys. Creating a drill site" and complete the sentences with suitable words, and word combinations:

1. Rock samples from the well .... to the surface and analyzed.
2. Well logs measure the electrical, ... and radioactive properties of the rock.
3. High-resolution aero-magnetic surveys done by .... also show fault traces and differentiate between different rock types near the surface.
4. Drilling for oil and natural gas is a complex process, but .... has made the job more efficient and productive while providing less impact on the environment.
5. Many mineral owners and government allow oil and gas companies to .... to drill on their land.
6. The share of the production paid by the company is called ....
7. The drilling derrick is used to .... and the drill string.
8. Drill rigs now run on electricity to supply power to turn the bit and raise and lower .... and ..... .
9. The drill bit uses three .... cutting surfaces to grind rock rice-sized particles.
10. The drill string consists of lengths ..... of fastened to each other and to the drill bit.
11. As the drill cuts into the rocks, ... is added to the hole.
12. Protecting the aquifer from contamination is .... of the oil and gas industry casing made of steel on high-tech alloys is lowered into the hole and cemented into place to protect fresh water aquifers.
13. To reduce waste, ... Is passed through a sieve where the ground rock particles or cuttings can be removed.
14. Dirt and rock cuttings .... form the hole and temporarily stored nearby.

Exercise 3

Read the texts "Drilling rigs. Land rigs. Slim hole drilling rig. Coiled tubing drill rig. Jack up rigs. Semi-Submersible rigs. Drill ships." and match the beginnings and endings of sentences:

1. Which rig selected depends on	a) to the ocean bottom using strong chains and wire cables or may utilize dynamic positioning to remain stationary during drilling without anchors
2. Land based drilling rig is the most common type	b) a continuous length of pipe stored on a large spool
3. A slim hole well drilled to 14 760 feet way	c) less than 300 feet deep
4. In some cases, coiled tubing technology can replace the typical drill string with	d) the specific requirements of each drill site
5. Jack up drilling may be used in relatively shallow water	e) used for exploration
6. A jack up rig is a floating barge containing the drilling structure that	f) is outfitted with long support legs that can be raised or lowered independently of each other
7. Once at the drilling location	g) produce one-third the amount of rock cuttings generated by a standard well
8. Semi-submersible rigs are floating vessels supported on large pontoon-like structures that	h) specially designed rigs mounted on ships can drill a well in water depths up to 10 000 feet
9. Semi-submersibles can either be attached	i) are submerged below the sea surface
10. For exploration targets farther offshore	j) the legs are jacked down onto the sea floor, and then all three legs jacked further down

Exercise 4

Group the words from the list and put them in the table. Use the captions (headings) as characteristics and marks of words being selected:

1. Organic material used to produce usable products and energy	2. Rocks that can be called waste rocks / materials which hide accumulations of hydrocarbons	3. Strategies that engineers use to look for accumulations of oil and gas	4. Techniques / processes used to create a drill site

Drilling derrick, seismic surveys, oil, natural gas, drilling rigs, exploration wells, a drill bit, hydrocarbons, sediment rocks, slim hole drilling rigs, reservoir rocks, gravity and geomagnetic surveys, jack up rigs, land-based rigs, source rocks, semi-submersible rigs, coiled tubing drilling, drill ship.

Exercise 5

Answer the questions:

1. What is the exploration of oil and natural gas?
2. What is the production of oil and natural gas?
3. How are oil and gas formed?
4. How are the layers of rocks in which hydrocarbons are formed called?
5. How do engineers gather above-ground clues to map the locations of gas and oil reserves?
6. What strategies do engineers/surveyors use to search for oil and gas accumulations?
7. How does drilling equipment work?
8. What technologies, equipment, tools are used to drill for gas and oil?
9. What types of drilling rigs can you name?
10. Which type of rigs are used for exploration?
11. What is the diameter of a conventional drill bore?
12. What type of rigs and the approach reduces equipment foot prints?
13. How do jack up rigs work?
14. How can semi-submersibles be attached to the ocean bottom?
15. What type of drilling equipment is used for exploration targets farther offshore?

Exercise 6

There are several technologies to search for oil and gas. Also, engineers use advanced strategies to organize the exploration process for oil and gas. Express your opinion about the technologies and prove your point of view.

What technologies of looking for reserves do you consider:

1) the most efficient
2) the most advanced
3) the most precise
4) as the technology which produce less impact on the environment

What strategies/equipment do you consider:

1) the most efficient to extract oil and gas
2) the most advanced
3) the most expensive and the cheapest

Individual Task

Make the projects and Power Point Presentations on the following topics:

1. The most efficient strategies and equipment of looking for reserves of oil and gas.
2. Technologies of looking for reserves that produce less impact on the environment.
3. The advanced technologies used for exploration process of oil and gas.
4. How are seismic surveying organized?
5. The advanced technologies used to drill for oil and gas.
6. Land based rigs.
7. Jack up drilling rigs.
8. Semi-submersible rigs.
9. Drill ships.

Test

Exploration and Production

Task 1

True/False statements:

1. Exploration is the process of trying to find accumulations of oil and natural gas trapped underneath the Earth's surface.
2. Production is the process of recovering those hidden resources for processing, marketing and use.
3. Oil and natural gas are formed when decaying plants and micro-organisms are dissolved in underground waters.
4. The layers of rock in which hydrocarbons are formed, are called sedimentary rocks.
5. High pressures underground tend to squeeze hydrocarbons out of source rocks into what are called reservoir rocks.
6. Seismic surveys are done by drilling holes.
7. Geologists and geophysicists-known as explorationists-use 3D images to look for accumulations of oil and gas.
8. When the data indicate a likely site for oil and gas reserves, an exploration well is often drilled.
9. 3D seismic images can identify potential oil and natural gas bearing sedimentary basins and structures.
10. The drilling derrick is used to position and support the drill string.
11. The drill bit uses three conical shaped cutting surfaces to grind rock rice-sized particles.
12. The drill string consists of 3 cylinders.
13. As the drill cuts into the rock, drilling mud is recycled.
14. The casing also keeps the hole open so that oil and natural gas can be brought to the surface.

Task 2

Choose the best answers to the questions:

1. What is the exploration?
    a. Exploration is the process of digging huge holes in the earth's surface.

b. Exploration is the process of producing fuel.
c. Exploration is the process of trying to find accumulations of oil and gas trapped under the Earth's surface.

2. What is the production of oil and gas?

a. Production is the process of recovering those hidden resources for processing, marketing and use.
b. Production is the process of searching for mineral deposits.
c. Production is the process of making maps of mineral deposits' locations.

3. How are oil and natural gas formed?

a. Oil and gas are formed when volcanoes spewing lava.
b. Oil and gas are formed when decaying plants and micro-organisms are trapped in layers of sediment rocks.
c. Oil and gas are formed when volcanic rocks settle at the bottom of the seas.

4. How do engineers gather above-ground clues to map the locations of gas and oil reserves?

a. Engineers use ships and offshore platforms.
b. Engineers use drilling rigs to map the surface and look for gas and oil.
c. Engineers can gather above-ground clues using airplanes and satellites to map the surface and look gas and oil seeps.

5. What strategies do engineers/surveyors use to search for oil and gas?

a. They use high-energy sound waves, 3D seismic images.
b. They use draglines.
c. They use supersonic aircrafts.

6. How does drilling equipment work?

a. The drilling equipment digs wells.
b. The drilling bit uses 3 conical shaped cutting surface to grind rock rice-shaped particles. As the drill cuts into the rock, drilling mud is added to the hole.
c. The drilling equipment grinds rocks.

7. What type of rigs are used for exploration?

a. Casing.
b. Land based drilling rig is the most common type used for exploration.
c. Coiled tubing drill rigs.

8. What type of rigs and approach reduce drilling waste and minimize equipment footprints?

a. Coiled tubing drill rig reduces drilling waste and minimizes equipment footprints.
b. Land based drilling rigs reduce waste and minimize equipment footprints.
c. Slim hole drilling rigs reduce waste and minimize equipment footprints.

Task 3

Match the words and their definitions:

A	B
1. Exploration	a) a large structure with equipment for drilling an oil well
2. Satellite	b) the action of exploring an unfamiliar area through examination of a subject
3. Surveying	c) a place where a boat or ship is moored; ropes, chains or anchors by or to which a boat, ship or buoy is moored
4. Drilling derricks	d) a self-elevating unit of mobile platform that consists of a buoyant hull fitted with a number of movable legs, capable of raising its hull over the surface of the sea
5. Drilling rigs	e) a celestial body orbiting the earth or another planet; an artificial body in orbit round the earth or moon or another planet
6. Aquifers	f) the technology that takes well-established concept of CT and combines it with directional drilling using a mud to create a system for drilling reservoir
7. Coiled tubing drilling (CTD)	g) the profession or work of examining and recording the area and features of a piece of land so as to construct a map, plan or detailed description of it

8. Jack up drill rigs	h) a specialized marine vessel used in offshore drilling rigs, safety vessels, oil production platforms and heavy lift cranes
9. Semi-submersible rigs	i) an elevated structure over a well for lowering and raising drilling tools, face motors, casing pipes and other equipment
10. Mooring	j) a body of permeable rock which can contain or transmit ground water

UNIT 6

Advanced Drilling Techniques

Vocabulary

Read and learn words and word combinations:

- range from ... to – варьироваться от ... до ...
- reduce environment impact – уменьшить воздействие на окружающую среду
- footprint of drilling operations – след буровых работ
- waste – отходы, потери, пустая порода
- avoid sensitive ecosystems – избегать уязвимых экосистем
- horizontal drilling – горизонтальное бурение
- to expose more open hole – обнажить больше открытого ствола
- exposure length – длина экспозиции
- to drain – осушать
- to flow – течь, литься, струиться
- surface disturbance – поверхностное возмущение, повреждение поверхности
- employ in certain locations – использовать на определенных территориях
- multilateral drilling – многоствольное бурение
- extended reach drills allow producers to reach deposits that are great distance away from the drilling rig – буровые установки с увеличенным вылетом позволяют добывать из месторождений на большом расстоянии от буровой установки
- onshore dozens of wells can be drilled from a single location – на суше можно пробурить десятки скважин с одного места
- pulverized rock – измельченная порода
- microscopic analysis to determine the type rock being drilled – микроскопический анализ для определения типа пробуриваемой породы
- wells are completed for production if the value of the recoverable oil and gas is greater than the cost of drilling and producing them – скважины завершены для добычи, если ценность извлекаемых нефти и газа больше, чем стоимость бурения и их добычи

- a device that is placed on the well at the surface – устройство, которое устанавливается в скважину на поверхности
- to regulate the optimum field production or to shut down a producing well if petroleum is detected – для регулирования оптимальной добычи на месторождении или для закрытия добывающей скважины в случае обнаруженной нефти
- tap oil and natural gas deposits – вскрывать месторождения нефти и природного газа
- under surface area – под поверхностью
- offshore platforms – морские платформы
- complex path drilling – бурение сложной траектории
- have multiple twists – иметь несколько поворотов
- to hit multiple accumulations from a single well location – выбить несколько залежей из одной скважины
- well evaluation – оценка скважины
- rock and fluid properties – свойства пород и жидкости
- determine – определять
- to evaluate – оценивать
- economically feasible – экономически целесообразно
- to initiate recovery operations – инициировать восстановительные операции
- drill cuttings – буровой шлам
- core samples – образцы сердцевины, стержня
- it is run through a sieve to remove the drill cuttings – его пропускают через сито для удаления бурового шлама
- trace amounts of oil or gas are present – присутствуют следовые количества нефти или газа
- rock cuttings – обрезки горных пород
- well logging – каротаж
- exact porosity and permeability – точная пористость и проницаемость
- determine – определить
- the value – значение
- to deliver – доставлять

- is plugged in accordance with industry standards – закрыт в соответствии с промышленными стандартами
- site is restored – площадка/место добычи восстановлено
- completion – завершение
- casing – кожух
- drilled hole – просверленное отверстие
- cement is then pumped through the bottom of the casing so that it fills the area between the casing and side of the well – цемент затем закачивается со дна кожуха, так чтобы он заполнил площадь между кожухом скважиной
- to prevent – предотвращать
- deep brines – глубинный рассол/соленая вода
- to contaminate aquifers – загрязнять водоносный слой
- this string of pipe is called "tubing" – эта колонна труб называется «трубопровод»
- double – hulled tanker – танкер с двойным корпусом
- extra layer of protection – дополнительный слой защиты
- ground water supplies – запасы грунтовых вод
- tubing is pulled out the hole – трубка вытаскивается из отверстия
- must be perforated – должен быть перфорирован
- explosive charges – заряды взрывчатки
- precise depth – точная глубина
- detonating the charges – детонация зарядов
- facilities for processing and sale – объекты по переработке и продаже
- a series of valves – серия клапанов
- a petroleum is detected – нефть обнаружена

Read the texts and do the tasks

Advanced Drilling Techniques

Oil and natural gas wells have traditionally been drilled vertically, at depths ranging from a few thousand feet to as deep as five miles. Today, advance in drilling technology allow oil and gas companies to reach more reserves while reducing environmental impact by:

1) reducing the surface "footprint" of drilling operations

2) drilling smaller holes and generating less waste
3) creating less noise
4) avoiding sensitive ecosystems
5) completing operations more quickly [5]

Here are some technologies used:

Horizontal Drilling starts with vertical well that turns horizontal within the reservoir rock in order to expose more open hole to the oil. These horizontal "legs" can be over a mile long, the longer the exposure length, the more oil and gas is drained and the faster it can flow. More oil and natural gas can be produced with fewer wells and less surface disturbance. However, the technology only can be employed in certain locations [5].

Multilateral Drilling-Extended Reach Drilling

Extended reach drills allow producers to reach deposits that are great distances away from the drilling rig. This can help producers tap oil and natural gas deposits under surface areas where a vertical well cannot be drilled, such as under developed or environmentally sensitive areas. Wells can now reach out over 5 miles from the surface location. Offshore, the use of extended reach drilling allows producers to reach accumulations far from offshore platforms, minimizing the number of platforms needed to produce all the oil and gas. Onshore, dozens of wells can be drilled from a single location, reducing surface impacts [5].

Complex Path Drilling

Complex well paths can have multiple twists and turns to try to hit multiple accumulations from a single well location. Using this technology can be more cost effective and produce less waste and surface impacts than drilling multiple wells [5].

Well Evaluation

Rock and fluid properties will determine how much oil and natural gas can be recovered from a reservoir. After an exploratory well has been drilled, it is evaluated to determine if there is enough oil and gas in the reservoir to make it economically feasible to initiate recovery operations [5].

Drill Cuttings and Core Samples

As the drilling mud is brought to the surface, it is run through a sieve to remove the drill cuttings (pulverized rock) before the mud is recycled down into the well. Small pieces of rock are selected for microscopic analysis to determine the type of rock being drilled, how porous it is, and whether oil is present. The drilling mud also is analyzed with sensors to see if trace amounts of oil or gas are present an indication of a possible accumulation at depth. In the past, the principal source of well information [5].

Well Logging

A special bit can be used to cut a cylindrical piece of rock that can be brought to the surface for analysis. The core is sent to a laboratory where the exact porosity and permeability can be determined. This gives a good indication of how well oil and natural gas would flow through the rock. Fluid samples can be taken and analyzed to determine the amount and type of hydrocarbon present in the rock. Wells are completed for production if the value of the recoverable oil and/or gas is greater than the cost of drilling and producing them and delivering them to market. If not, the well is plugged in accordance with industry standards and federal or state requirements (depending on the location) and the site is restored [5].

Completion

Preparing a well for production is a complex process:

Step 1

A pipe, called the casing, is lowered down the drilled hole. Sections of casing fit together just like the drill pipe. Cement is then pumped through the bottom of the casing so that it fills the area between the casing and side of the well. The casing prevents oil, gas and deep brines (underground salt water) from entering and contaminating aquifers (underground fresh water).

Step 2

Because the casing and the liner must remain in a well for a long time and their repair or replacement would be costly, another string of pipe is placed in the well through which oil or gas is usually produced. This string of pipe is called “tubing”. This is like a double-hulled tanker in

that it provides an extra layer of protection for groundwater supplies. Tubing is pulled out the hole on occasion and inspected to see if it needs to be repaired (casing is cemented in and can be repaired, but not as easily as the tubing).

Step 3

Operators do not want anything but oil and natural gas to enter the well. To allow underground fluids to enter the pipe and flow to the surface, the tubing and casing must be perforated. Explosive charges are lowered to the precise depth of the oil reservoir. Detonating the charges forces holes in the casing. Fluids can then flow into the casing and up the tubing towards the surface.

Step 4

"A Christmas Tree" is a device that is placed on the well at the surface. It regulates the flow from the well into the pipelines that take the oil and natural gas to facilities for processing and sale. It consists of a series of valves that are opened and closed to regulate flow for optimum field production or to shut down a producing well if a petroleum is detected. Some Christmas Trees computer systems that allow them to be monitored, opened and closed [5].

Tasks

Exercise 1

Match columns A and B:

A	B
1. Oil and natural gas wells	a) начинается с вертикальной скважины, которая превращается в горизонтальную
2. Reduce environmental impact	b) уменьшение/сокращение следа буровых работ
3. Completing operations more quickly	c) может применяться на определенных территориях
4. Drilling smaller holes and generating less waste	d) скважины с газом и нефтью

5. Reducing the surface “footprint” of drilling operations	e) бурение небольших скважин и уменьшение отходов
6. Creating less noise	f) бурение сложной траектории может иметь ряд разворотов и поворотов, чтобы выбить несколько залежей из одной скважины на территории
7. Avoiding sensitive ecosystems	g) с меньшим количеством скважин и меньшим ущербом для земли
8. Starts with vertical well that turns horizontal	h) уменьшить воздействие на окружающую среду
9. With fewer wells and less surface disturbance	i) большие расстояния от буровой установки
10. Can be employed in certain location	j) уменьшение шума
11. Great distances away from the drilling rigs	k) завершить операции быстрее
12. Where a vertical well cannot be drilled	l) уменьшить количество платформ, необходимых для производства всего газа и нефти
13. Minimizing the number of platforms needed to produce all the oil and gas	m) где вертикальная скважина не может быть просверлена
14. Complex well paths can have multiple twists and turns to try to hit multiple accumulations from a single well location	n) не затрагивать уязвимые экосистемы

Exercise 2

Match the beginnings and endings of the sentences:

1. Oil and gas wells have traditionally been drilled vertically	a) it is evaluated to determine if there is enough oil and gas in reservoir to make it economically feasible to initiate recovery operations
2. Horizontal drilling starts with vertical well that	b) greater that the cost of drilling and producing them and delivering them to market

3. These horizontal "legs" can be over a mile long, the longer the exposure length	c) the drill cuttings before the mud is recycled down into the well
4. Extended reach drills allow producers to reach deposits that	d) are great distances away from the drilling rig.
5. This can help producers tap oil and natural gas deposits under surface areas where	e) at depths ranging from a few thousand feet to as deep as five miles
6. Offshore, the use of extended reach drilling allows producers	f) the more oil and gas is drained and the faster it can flow
7. Complex well paths can have multiple twists and turns	g) turns horizontal within the reservoir rock in order to expose more open hole to the oil
8. After an exploratory well has been drilled	h) can be brought to the surface for analysis
9. As the drilling mud is brought to surface, it is run through a sieve to remove	i) to reach accumulations far from offshore platforms, minimizing the number of platforms needed to produce all the oil and gas
10. A special bit can be used to cut a cylindrical piece of rock that	j) a vertical well cannot be drilled, such as under developed or environmentally sensitive areas
11. Wells are completed for production if the value of the recoverable oil and/or gas is	k) is lowered down the drilled hole
12. A pipe, called the casing	l) to try to hit accumulations from a single well location
13. Cement is then pumped through the bottom of the casing so that	m) would be costly; another string of pipe is placed in the well through which oil or gas is usually produced
14. Because the casing and the liner must remain in a well for a long time and their repair or replacement	n) it fills the area between the casing and side of the well

Exercise 3

Complete the sentences with suitable words:

1. The casing prevents oil, gas and deep brines from entering and .... .
2. Tubing is pulled out the hole on occasion and inspected to see if it needs .... .

3. Operators do not want anything but oil and natural gas to .... .
4. To allow underground fluids to enter the pipe and flow to the surface, the tubing and casing ... .
5. Explosive charges are lowered to the precise depth of ....
6. Detonating the charges forces holes ... .
7. Fluids can then flow into the casing and up the tubing ... .
8. It regulates the flow from the well at .... .
9. It regulates the flow from .... That take the oil and natural gas to facilities for ... and ... .
10. A pipe, called the casing, is lowered down ....
11. Cement is then pumped through the bottom of the casing so that it fills the area between the casing and .... .
12. The casing prevents oil, gas and underground salt water from entering and .... .

Exercise 4

Answer the questions:

1. How can oil and gas companies reduce environmental impact?
2. What does the length of horizontal "legs" affect/influence at?
3. What technology allows producers to reach deposits that are great distances away from the drilling rig?
4. What are the main advantages of multilateral drilling?
5. Which technology can try to hit multiple accumulations from a single well location?
6. What determines how much oil and gas can be recovered from a reservoir?
7. What for is the drilling mud analyzed?
8. When are wells completed for production?
9. How many steps does the process of preparing a well for production have?
10. Where is a pipe lowered down?
11. Which structure is the cement pumped through? Why?
12. What does the casing prevent oil, gas and underground salt water from?
13. What is another string of pipe placed in the well?

14. In which occasion is tubing pulled out the hole?
15. What for must the tubing and casing be perforated?

Individual Task

Make the projects and power Point presentation on the following topics:

1. Horizontal drilling.
2. Multilateral Drilling.
3. Complex path drilling.
4. Well logging.
5. Preparing a well for production.
6. How are wells prepared for production in Russia.
7. How are wells prepared for production in Karelia.
8. “A Christmas Tree” is not an attribute of Christmas but a device that is placed on the well.
9. What is an aquifer?

Test

Advanced Drilling Techniques

Task 1

True/False statements:

1. Advance in drilling technology allow oil and gas companies to reach more reserves while reducing environmental impact by using explosives.
2. Horizontal drilling starts with vertical well that turns horizontal within the reservoir rock in order to expose more open hole to the oil.
3. Extended reach drills allow producers to reach deposits that are few miles from the drilling rig.
4. Extended reach drilling can help producers tap oil and gas deposits under surface areas where a vertical well cannot be drilled.
5. Complex path drilling can be more cost effective and produce more waste and surface impacts than drilling multiple wells.
6. Rock and fluid properties will determine how much oil and gas can be recovered from a reservoir.
7. The drilling mud also is measured to see if trace amounts of oil or gas are present.
8. A special bit can be used to cut a cylindrical piece of rock that can be brought to the surface for analysis.
9. Wells are completed for production if the amount of recoverable oil and gas is fewer than the cost of drilling and producing them and delivering them to market.
10. Preparing a well for production is a complex process.
11. A pipe, called the casing, is lowered down the drilled hole.
12. The casing prevents oil, gas and deep brines from lifting up.

Task 2

Choose the best answer to the questions:

1. How can oil and gas companies reduce environmental impact?
   a) by reducing the cost of drilling holes
   b) by generating less waste; creating less noise; avoiding sensitive ecosystems
   c) by using advanced technologies

2. What does the length of horizontal “legs” affect?
   a) The length of horizontal “legs” affects the amount of oil and gas and their speed of flowing.
   b) The length of horizontal “legs” affects the cost of oil and gas.
   c) The length of horizontal “legs” affects the speed of producing wells.

3. What are the main advantages of multilateral drilling?
   a) Multilateral drilling helps to find large oil and gas deposits onshore.
   b) Multilateral drilling allows producers o reach deposits that are great distances away from drilling rigs; it can help producers tap oil and gas deposits under surface areas where a vertical well cannot be drilled.
   c) It helps to avoid environmental problems.

4. Which technologies can try to hit multiple accumulation from a single location?
   a) horizontal drilling
   b) well logging
   c) complex path drilling

5. What for is the drilling mud analyzed?
   a) It is done to determine the type of rock being drilled, how porous it is and whether oil is present.
   b) to protect underground waters
   c) to determine the amount of oil and gas in the deposit

6. How many steps does the process of preparing a well for production have?
   a) it has 2 steps
   b) it has 4 steps
   c) it has 3 steps

7. Where is a pipe lowered down?
   a) a pipe is lowered down a cemented well
   b) a pipe is lowered down a shaft

c) a pipe is lowered down a drilling hole

8. What does the casing prevent oil, gas and underground salt waters from?
   a) It prevents oil, gas and underground salt waters from entering and contaminating aquifers.
   b) It prevents oil, gas and underground salt water from polluting environment.
   c) It prevents oil, gas and underground salt water from flooding surroundings.

9. In which occasion is tubing pulled out the hole?
   a) to determine the amount of oil in the hole
   b) to see if it needs to be repaired
   c) to examine the process of production

10. What for is a device called "a Christmas Tree" used?
    a) to produce as much oil and gas as possible
    b) to make wells more efficient
    c) it regulates the flow from the well into the pipelines that take oil and gas to facilities for processing and sale

Task 3

Match the words and their definitions:

A	B
1. Environmental impact	a. This technology creates well paths with multiple twists and turns to try to hit multiple accumulations from a single well location
2. Multilateral drilling	b. Underground salt water
3. Accumulations	c. Environmental effect, damage
4. Complex path drilling	d. The acquisition or gradual gathering of something; a mass or quantity of something that has gradually gathered or been acquired
5. Drill cuttings	e. A cover or shell that protects or encloses something; the frame round a door or window

6. Casing	f. A new technology developed after directional drilling, sidetrack and horizontal drilling; technology can reduce reservoir development cost through drilling several lateral wells in one borehole
7. Aquifers	g. A body of permeable rock which can contain or transmit groundwater
8. Tubing	h. A length or lengths of metal, plastic, glass, etc in tubular form
9. Petroleum	i. Broken bits of solid material removed from a borehole drilled by rotary, percussion or auger methods
10. Deep brines	j. A naturally occurring liquid beneath the earth's surface that can be refined into a fuel

UNIT 7

Extracting Oil and Natural Gas

Vocabulary

Read and learn the words and word combinations:

- extracting oil and natural gas – добыча нефти и природного газа
- drilling and completing a well – бурение и обустройство скважины
- the porosity – пористость
- the viscosity – вязкость
- impede the free flow of product into the well – препятствовать свободному поступлению продуктов в скважину
- to recover – извлекать
- primary recovery – первичная добыча
- rely on underground pressure to drive fluids to the surface – полагаться на подземное давление жидкостей на поверхность
- artificial lift technology – технология искусственного подъема
- when the pressure falls, artificial lift technologies, such as pumps, are used help to bring more fluids to the surface – когда давление падает, технологии искусственного подъема в виде насосов помогают поднять больше жидкости на поверхность
- pumps – насосы
- is pumped back down the well underneath the oil – закачивается обратно в скважину под нефть
- to expand – расширять
- the gas expands, pushing oil to the surface – газ расширяется, выталкивая нефть на поверхность
- offshore facilities – морские объекты
- secondary recovery – вторичное извлечение
- is applied – применяется
- enhanced recovery technique – улучшенная методика восстановления

- initial phase – начальная стадия
- water that is produced and separated from oil in the initial phase of drilling is injected back into the oil-bearing formation to bring more oil to the surface – вода, которая добывается и отделяется от нефти на начальном этапе бурения, закачивается обратно в нефтеносный пласт, чтобы вывести больше нефти на поверхность
- is injected back into the oil-bearing formation – закачивается обратно в нефтяной пласт
- boosting oil recovery – ускорение добычи/извлечения
- to dispose of the waste water – утилизировать сточные воды
- it is also disposing of the wastewater, putting it back where it came from – он также утилизирует сточные воды, возвращая их туда, откуда они пришли
- to mobilize the remaining oil – использовать оставшуюся нефть
- thermal recovery – термическая добыча/извлечение
- thermal recovery entails injecting steam into the formation – термическое извлечение влечет закачку пара в пласт
- gas injection – закачка газа
- chemical flooding – химическое заводнение
- to entail steam into the formation – уводить пар в пласт
- miscible or immiscible gases – смешивающиеся и несмешивающиеся газы
- miscible gases dissolve CO_2 propane, methane or other gases in the oil to lower its viscosity and increase flow – смешивающиеся газы растворяют CO_2 пропана, метана или других газов в нефти, чтобы снизить его вязкость и усилить поток
- dissolve – растворяться
- CO_2 propane – пропан CO_2
- methane – метан
- well bore – скважина
- water-soluble polymers – водорастворимые полимеры
- water vapor – водяной пар
- pipeline quality oil – качество нефти в трубопроводе
- heater/treater unit – блок нагревателя/очистителя

- treatment – обработка, очистка
- well head – источник
- refined products – очищенные продукты
- carbon steel – углеводородная сталь
- market specifications – характеристики рынка
- interstate pipeline system – межгосударственная трубопроводная система
- clean-burning methane – чистый горящий метан
- hydrocarbon – углеводород
- contaminants – загрязняющие вещества
- sulfur – сера
- ethane – этан
- propane – пропан
- butane – бутан
- gathering pipeline – сборный трубопровод
- processing plants – перерабатывающие предприятия
- accomplished using hydrocarbons – осуществляется с использованием углеродов
- to spin – вращать, крутить
- acceleration – ускорение
- water is forced to the outside of the hydrocyclone – вода вытесняется за пределы гидроциклона
- it is removed – удаляется
- chains of carbon and hydrogen atoms – цепочки атомов углерода и водорода
- cleaning or desalting the crude oil – очистка и обессоливание сырой нефти
- waxy residual hydrocarbons – парафинистые остаточные углероды
- a distilling column – дистилляционная колонна
- to revert – вернуться
- stacks of trays – стопки желобов, поддонов
- distinct streams – отдельные потоки
- bubble caps – пузырчатые колпачки

- raised perforations – выпуклые перфорации
- the easiest way to tell one kind of hydrocarbon from another is by its boiling point – самый простой способ отличить один вид углеводорода от другого – по его температуре кипения
- each collection tray has a network of raised perforations that allow vapor to rise through the tray but prevent the collected liquid from pouring down the tray below – каждый поддон для сбора имеет сеть выступающих перфораций, которые позволяют пару подниматься через желоб, но не позволяют собранной жидкости стекать вниз по желобу
- a bubble cap fits loosely over each perforation forcing the vapor to pass through the hydrocarbon liquid before it continues its upward journey – пузырчатый колпачок свободно надевается на каждое перфорированное отверстие, заставляя пар проходить через углеводородную жидкость, прежде чем он проходит свой путь наверх
- contact with the liquid cools the vapor so that the heavier hydrocarbons become liquid, too – контакт с жидкостью охлаждает пар, так что более тяжелые углеводороды тоже становятся жидкостями

Read the texts and do the tasks

Extracting oil and natural gas

Extracting oil and natural gas from deposits deep underground isn't as simple as just drilling and completing a well. Any number of factors in the underground environment including the porosity of the rock and the viscosity of the deposit can impede the free flow of product into the well. In the past, it was common to recover as little as 10 percent of the available oil in a reservoir, leaving the rest underground because the technology did not exist to bring the rest to surface. Today, advanced technology allows production of about 60 percent of the available resources from a formation [5].

Primary recovery first relies on underground pressure to drive fluids to the surface. When the pressure falls, artificial lift technologies, such as pumps, are used help to bring more fluids to the surface. In some situations, natural gas is pumped back down the well underneath the oil.

The gas expands, pushing the oil to the surface. Gas lift technology is often used in offshore facilities. Primary recovery often taps only 10 percent of the oil in a deposit [5].

Secondary recovery is the most widely applied enhanced recovery technique. Water that is produced and separated from the oil in the initial phase of drilling is injected back into the oil-bearing formation to bring more oil to the surface. In addition to boosting oil recovery, it also disposes of the waste water, putting it back where it came from. This can bring additional 20 percent of oil in place to the surface [5].

Enhanced recovery techniques are used to mobilize the remaining oil. There are three common approaches: thermal recovery, gas injection or chemical flooding.

Thermal recovery entails injecting steam into the formation. The heat from the steam makes the oil flow more easily, and the increased pressure forced it to the surface [5].

Gas injection uses either miscible or immiscible gases. Miscible gases dissolve CO_2 propane, methane or other gases in the oil to lower its viscosity and increase flow. Immiscible gases do not mix with the oil, but increase pressure in the "gas cap" in a reservoir to drive additional oil to the well bore.

Chemical flooding involves mixing dense, water-soluble polymers with water and injecting the mixture into the field. The water pushes the oil out of formation and into the well bore [5].

Separating oil, natural gas and water

Oil generally comes out of the well with water and, often, small amounts of natural gas. Similarly, natural gas often comes out of the ground mixed with water vapor and other gases. These various components must be separated before "pipeline quality" oil and/or natural gas can be sent to market. To remove water and gas from oil, the mixture is passed through a device that removes the gas and sends it into a separate line. The remaining oil, gas and water mixture goes into a heater/treater unit. Heating helps to break up mixture so that oil separates from water, which is denser. Any remaining natural gas, which is less dense than oil, rises to the top. The gas is removed for either processing or burning, water is removed and store for further treatment. Although natural gas and crude oil can be found in the same location, they take completely different

routes, from the well head to you, the consumer. While crude oil and refined products can travel through a chain of pipelines, tanker ships, trucks and the like, 99 percent of natural gas makes the journey through pipelines made of durable carbon steel. This makes it important to bring recovered natural gas into line with market specifications before it enters the main interstate pipeline system. The natural gas used to cook our food and/or heat and cool our homes is 90 percent clean-burning methane, the simplest form of hydrocarbon. But that's not the case for natural gas as it comes out of the ground. Depending on the location of the well and the geologic conditions that created the gas in the first place, contaminants such as water, sulfur and gas liquids (including ethane, propane and butane) may be present. So-called "gathering pipelines" collect natural gas from wells in a given region and deliver it to local processing plants.

Additional separation of oil from waste water is accomplished using hydro cyclones. Hydro cyclones spin the oil water mixture, and use acceleration to separate oil from water. Water is forced to the outside of the hydro cyclone, where it is removed. Because most waste water is very salty, it cannot be used as a water resource. Instead, it is injected back deep into the subsurface, usually into the same formation where oil and water came from, helping force more oil out of the reservoir [5].

Refining oil

Hydrocarbons are basically chains of carbon and hydrogen atoms. The number of carbon atoms in the chain and way that chain is arranged will determine the properties of the hydrocarbon. The easiest way to tell one kind of hydrocarbon from another is by its boiling point. Just as water goes down from liquid to vapor at about 212°Fahenheit, each type of hydrocarbon changes from liquid to vapor within a specific temperature range. In general, the more carbons in a molecule, the higher the boiling point. The refining process therefore begins by cleaning or desalting the crude oil and then heating it until only waxy residual hydrocarbons remain in liquid form. The mixed hydrocarbon vapor rises through a distilling column, getting cooler as it goes up. When a hydrocarbon cools below its boiling point, it reverts to liquid form. Stacks of trays collect the liquid hydrocarbons, which have now been sorted into several distinct

streams. Surprisingly simple devices called bubble caps are the keys how a distilling column works. Each collection tray has a network of raised perforations that allow vapor to rise through the tray but prevent the collected liquid from pouring down the tray below. A bubble cap fits loosely over each perforation forcing the vapor to pass through the hydrocarbon liquid before it continues its upward journey. Contact with the liquid cools the vapor so that the heavier hydrocarbons become liquid, too [5].

Tasks

Exercise 1

Read the texts and decide if the statements are true or false once. Correct the false statements:

1. Primary recovery first relies on underground pressure to drive fluids to the surface.
2. When the pressure falls, drilling technologies, are help to bring more fluids to the surface.
3. Natural gas is lifted from the well.
4. The gas expands, pushing the oil to the surface.
5. Gas lift technology is often used in onshore facilities.
6. Secondary recovery is the most widely applied enhanced recovery technique.
7. Water that is produced and separated from oil in the initial phase of drilling is pumped into the oil-bearing formation.
8. In addition to boosting oil recovery, it also disposes of the wastewater, putting it back where it came from.
9. Enhanced recovery techniques are used to mobilize the remaining oil.
10. Thermal recovery helps to reduce injecting steam.
11. The heat from the steam makes the oil flow more easily, and the increased pressure forced it to the surface.
12. Chemical flooding involves mixing dense, water-soluble polymers with water and extracting the mixture into the field.
13. The water pushes the oil out of formation and into the well bore.
14. Oil generally comes out of the well with water and, often, small amounts of natural gas.

Exercise 2

Match columns A and B:

A	B
1. Natural gas often comes out of	a) tanker ships, trucks and the loke, 99 percent of natural gas makes the journey through pipelines made of durable carbon steel
2. These various components must be separated before "pipeline quality" oil and	b) rises to the top
3. To remove water and natural gas from oil	c) the simplest form of hydrocarbon
4. The remaining oil, gas and water mixture	d) natural gas can be sent to market
5. Any remaining natural gas, which is less dense than oil,	e) is removed and stored for further treatment
6. The gas is removed for either processing or burning water	f) the ground mixed with water vapor and other gases
7. While crude oil and refined products can travel through a drain of pipelines	g) goes into a heater/treater unit
8. The natural gas used to cook our food and/or heat and cool our homes is 90 percent clean-burning methane	h) the mixture is passed through a device that removes the gas and sends it into a separate line

Exercise 3

Answer the questions:

1. Why was it common to recover as little as 10 percent of the available oil in a reservoir leaving the rest underground?
2. How is water and natural gas removed from oil?
3. How is water and gas removed from oil?
4. What routes form the well head can gas and crude oil take the consumers?
5. What for are bubble caps used?

Exercise 4

Express your opinion about the following statements:

1. Extracting oil and natural gas from deposits deep underground isn't as simple as just drilling and completing a well.
2. Artificial lift technologies can be considered as very advanced technologies.
3. Extracting oil and gas from deposits can be performed without enhanced recovery technique.
4. Such devices as bubble caps should be improved and modernized.

Individual Task

Make the projects and Power Point Presentations on the following topics:

1. Primary recovery.
2. Secondary recovery.
3. Thermal recovery.
4. Gas injection.
5. Separating oil, natural gas and water.
6. Refining oil.
7. Chemical flooding.
8. Differences and similarities of the process of separating oil, gas and water in the world and in Russia.
9. Separation of oil from waste water.
10. The main oil refineries in the world.
11. The largest oil refineries in Russia.

Test

Extracting Oil and Natural Gas

Task 1

True/False statements:

1. Primary recovery first relies on underground pressure to drive fluids to the surface.
2. When the pressure falls, artificial lift technologies, such as complex path drilling, are used to help to bring more fluids to the surface.
3. In some situations, natural gas is pumped back down the well underneath the oil.
4. The gas expands pushing the oil to the surface.
5. Gas lift technology is often used to extract 80 % of crude oil from the deposit.
6. Secondary recovery is the most widely applied enhanced recovery technique.
7. Water that is produced and separated from the oil in the initial phase of drilling is pumped down the oil-bearing formation.
8. Enhanced recovery techniques are used to mobilize the remaining oil.
9. Thermal recovery entails injecting steam into the formation.
10. Immiscible gases mix with oil and water.
11. Gas injection uses either miscible or immiscible gases.
12. Chemical flooding involves mixing dense water-soluble polymers with water and injecting the mixture into the field.
13. Natural gas comes out of the well with water.
14. To remove water and natural gas from oil, the mixture is passed through a device that removes the gas and sends it into separate line.
15. The remaining oil, gas and water mixture goes into the pipelines.
16. Heating helps to break up mixture so that oil separates from water, which is more dense.

Task 2

Choose the best answer to the questions:

1. What technologies are used to bring more fluids to the surface on the stage of primary recovery?
   a. So called “a Christmas Tree” devices.

b. Gas injection.
c. Lift technologies, such as pumps.

2. Which technique is applied on the stage of secondary recovery?
   a. Enhanced recovery technique.
   b. Chemical flooding.
   c. Thermal recovery

3. What for are enhanced techniques used?
   a. Enhanced techniques are used to determine the type of oil and gas being recoverable
   b. Enhanced techniques are used to mobilize the remaining oil
   c. Enhanced techniques are used to pump down chemical substances to the well

4. How does thermal recovery work?
   a. It entails injecting steam into the formation.
   b. It dissolves unwanted gases.
   c. It lowers oil's viscosity.

5. How does gas injection work?
   a. Gas injection helps to drill wells.
   b. Gas injection uses either miscible or immiscible gases. Miscible gases dissolve CO2 propane, methane in oil to lower its viscosity and increase flow.
   c. Gas injection pushes the crude oil to the surface.

6. In what form does natural gas come out of ground?
   a. It comes out of the ground as a mixture of gases and oil.
   b. It comes out of the ground mixed with rock debris and oil.
   c. It comes out of ground mixed with water vapour and other gases.

7. How is water and natural gas removed from oil?
   a. To remove water and natural gas from oil, the mixture is passed through a device that removes the gas and sends it into a separate line.
   b. The mixture is passed through a unit/device filled with salt water.
   c. The mixture is passed through a system of pipes.

8. What helps to break up mixture so that oil separates from water?
    a. Drilling and basting help.
    b. Lifting technologies help.
    c. Heating helps.

Exercise 3

Match the words and their definitions:

A	B
1. Hydro cyclones	a) a general term for injection process that introduce heat into a reservoir
2. Subsurface	b) a hole made by boring or piercing; a small hole or row of small holes punched in a sheet of paper
3. Molecules	c) a group of atoms bonded together representing the smallest fundamental unit of chemical compound that can take part in a chemical reaction
4. Residual hydrocarbons	d) gas repressurization into an underground reservoir, typically one already containing both gas and crude oil in order to increase the pressure within the reservoir
5. Stacks of trays	e) the stratum or strata below the earth's surface
6. Perforations	f) an open shelf system, somewhat like a flat file system, each of which is especially suited for the storage of large, flat objects
7. Gas injection	g) liquid or semi-liquid products obtained as residues from the distillation
8. Thermal recovery	h) a density-based separation device that uses fluid pressure to generate centrifugal forces and a fluid pattern; it is used to separate solid particles from a liquid or mixture medium

UNIT 8

Careers in Mining

Vocabulary

Read and learn words and word combinations:

- mining technicians – горные технологи
- provide technical assistance to professional engineers – оказывать техническую помощь инженерам
- coal and metal mining – добыча угля и металла
- work in exploration and development, in production and preparation – работа в разведке и разработке, в добыче и подготовке
- beneficiation – обогащение
- desired ore – желаемая руда
- unwanted material – нежелательный материал
- perform chemical and physical tests – проводить химическое и физическое исследование
- observe mining operations – наблюдать за горными работами
- assist in surveying and drafting – помогать в составлении чертежей геодезии
- in planning solutions – в планировании решений
- technical sales support – техническая поддержка продаж
- metallurgists – металлурги
- chemists – химики
- test samples – испытания образцов
- evaluate the quality – оценивать качество
- design and install ventilation – проектировать и устанавливать систему вентиляции
- mine shafts – шахты
- an underground chamber – подземная камера
- evidence of poisonous gas – присутствие ядовитого газа
- mine's production supervisors – начальник производства шахты
- shift boss – начальник смены
- to supervise – контролировать

- to increase the efficiency of a mining technician surveys – повысить эффективность исследований технолога
- a strip mine – открытая добыча/шахта
- stopwatches – секундомеры
- mining crews – бригады горняков
- education and training requirements – требования к образованию и обучению
- an associate degree in mining technology – степень младшего специалиста по горным технологиям
- rotating shifts – чередующиеся смены
- oversee the construction – наблюдать за строительством
- mining engineer – горный инженер
- exploration and discovery – разведка и открытие
- feasibility studies – экономическое обоснование
- scheduling – планирование
- processing – обработка
- mine closure stages – этапы закрытия шахты
- restoration – восстановление
- rehabilitation – реабилитация
- investigate deposits – исследовать месторождения
- can be mined profitably – можно добывать с прибылью
- work out the most suitable mining – разработать самый подходящий метод добычи
- carry out the mine design – проектировать шахту
- relevant mine planning – соответствующее планирование горных работ
- state-of-the art mine planning – современное горное планирование
- visualization software – программное обеспечение визуализации
- coordinate the employment of mining staff – координировать трудоустройство горнодобывающего персонала
- selection of equipment – выбор оборудования

- with regard of efficiency, safety and environmental conditions – с точки зрения эффективности, безопасности и условий окружающей среды
- provision of equipment, facilities for mining – предоставление оборудования, помещений для горных работ
- access roads, water and power supplies – подъездные пути, вода и электроснабжение
- in conjunction with mine management – в сочетании с планами шахты
- implementation of mine plans – реализация планов горных работ
- take on responsibility for – взять на себя ответственность
- conduct ongoing research – проводить текущие исследования
- aimed at improving – направленный на улучшение
- petroleum engineers – инженер-нефтяник
- to implement – реализовать
- make estimations – делать оценки
- to locate the dig site – найти место раскопок
- to keep costs low – держать расходы на низком уровне
- are highly sought – очень востребованы
- fuel source – источник топлива
- hydrocarbons – углеводороды
- to determine the most efficient drilling method – определить наиболее эффективные методы бурения
- develop tools – разработать инструменты
- operate software used to control and run the machines – работать с программным обеспечением, используемым для управления машин
- oversee teams employed on a job site – наблюдать за бригадами, работающими на местах
- drillers and blasters – бурильщики и взрывники
- mobile drilling machines – мобильные буровые машины
- to bore blast holes in open-pit mines and quarries – пробурить взрывные скважины в открытых шахтах и карьерах
- for building foundation at construction sites – для строительства фундамента на стройплощадках

- fill blast holes with explosives – заполнять взрывные скважины взрывчаткой
- detonate explosives to demolish structures – взрывать взрывчатку, чтобы снести конструкции
- they are employed by mining, quarrying and construction companies – они работают в горнодобывающих карьерах и строительных компаниях
- drilling and blasting contractors – подрядчики по буро-взрывным работам
- drive and operate tracked or truck mounted rotary drilling – управление роторным бурением на гусеничном ходу или на грузовике
- air-track machine – машины на воздушных гусеницах
- to specified depths at staked positions – на заданную глубину в разбитых позициях
- with auger or other attachment – со шнеком или другим приспособлением
- pilings – сваи
- measure location – измерить местоположение
- stake out pattern of holes to be drilled – разбивка просверливаемых отверстий
- load blast holes with explosives – заряжать взрывные скважины взрывчаткой
- to dislodge coal, ore – выбивать уголь, руду
- lay out drill pattern – разложить схему сверления
- conduct field tests – проводить полевые испытания
- determine type and quantity of explosives required – определить тип и количество требующейся взрывчатки
- assemble or direct other works – собрать или направить другие работы
- assemble primer charges – собрать заряды праймера
- fuses – предохранители
- detonating cords – детонирующие шнуры
- load explosives by hand – заряжать взрывчатку вручную
- direct movement of bulk explosives trucks – управлять движением грузовиков с сыпучими веществами
- connect electrical wires into series – соединять электрические провода последовательно

- press handle or button – нажать ручку или кнопку
- handle, store and transport explosives and accessories – для обращения, хранения и транспортировки взрывчатых веществ и принадлежностей
- in accordance with regulations – в соответствии с правилами
- ensure that safety procedures are observed – убедиться, что правила безопасности соблюдены
- down-the-hole drilling – скважинный буровой станок
- a mining machine operator – оператор горных машин
- to maintain and to repair – поддерживать и ремонтировать
- back holes – экскаваторы
- dozers – бульдозеры
- scrapers – шаберы, скребки
- hauls – погрузчики
- graders – грейдер, сортировщик
- front-end loaders – фронтальные погрузчики
- draglines – скребковый экскаватор
- hydraulic or cable shovels – гидравлические или кабельные экскаваторы
- packers – упаковщики
- mine dewatering – высушивание шахты
- air exhauler – вытяжной вентилятор
- conveyor belts – конвейерные ленты
- boom bolters – болтеры стрелы
- gease guns – шприцы для смазки
- hammers – молотки
- jacks – домкраты
- tape measures – рулетка
- gauges – датчики
- dials – циферблаты
- indicators – индикаторы
- to identify solutions – определить состав
- to ascertain advantages and disadvantages – удостовериться в плюсах и минусах
- subordinates – подчиненные

- peers – равные по рангу/статусу
- supervisors – руководители
- must be communicated with – должны общаться
- in a team environment – в командной среде
- a cramped space – теснота
- awkward position – неудобное положение
- loads as heavy as 44 pounds will have been lifted – придется поднимать грузы до 44 фунтов
- hard-hat – каска
- life jacket – спасательный жилет
- hearing protection – защита слуха
- gloves – перчатки
- glasses – очки
- safety shoes – специальная обувь
- lightning might be extremely bright – слишком яркое освещение
- noise levels can be uncomfortable – уровень шума может быть высоким
- at considerable height – на значительной высоте
- extended period – длительный период
- might be exposed to contaminants or hazardous equipment – может подвергаться воздействию загрязняющих веществ или опасного оборудования
- methane in coal seams can escape in tunnels – метан в угольных пластах может улетучиваться в туннелях
- injure – травмировать
- cave-ins – пещеры
- trap – ловушка
- bury – захоронить
- flooding – наводнение, затопление
- contend with – бороться с
- drafting technologist and technicians – технологи-чертежники и техники
- prepare engineering designs, drawing – подготовить инженерные проекты, чертежи

- related technical information – соответствующая техническая информация
- utility, resource and manufacturing companies – коммунальные, ресурсные и производственные компании
- establishments – учреждения
- surveyors – геодезисты
- surveying – геодезия
- geometric constraints – геометрические ограничения
- terrestrial laser scanning – наземное лазерное сканирование
- airborne laser scanning – воздушное лазерное сканирование
- airborne photogrammetry – аэрофотограмметрия
- unmanned aerial systems – беспилотный авиационный комплекс
- satellite imagery – спутниковые снимки
- essential – существенный, необходимый
- captured data needs to be processed – полученные данные необходимо обработать
- theodolites – теодолиты
- the state-to-the art instrument – современный инструмент
- laser sighting – лазерное прицеливание
- electronic data storage-coupled with a global navigation satellite system – электронное хранение данных в сочетании с глобальной навигацией
- carry out special and geometric measurements in bowels of earth – проводить пространственные и геометрические измерения на планах и картах
- display measurements on plans and maps – отображать измерения на планах и картах
- subsequent geometric constructions of the structure – последующие геометрические построения конструкции
- enclosing rocks – вмещающие породы
- reflection of the dynamics of the production process – отражение динамики производственного процесса
- prospector artels – старательские артели
- ditches – канавы
- surface-open pits – открытый карьер

- open-pit mines – открытые шахты
- adjusting the process – корректировка процесса
- knowledge, skills and abilities – знания, умения, способности
- balanced character – уравновешенный характер
- infinitely pedantic – бесконечно педантичный
- accurate and precise in performance of his duties – аккуратный и точный в исполнении своих обязанностей
- know safety precaution – знать меры предосторожности
- errors – ошибки
- can lead to colossal losses, accidents with massive loss of life – может привести к колоссальным потерям и авариям с большой потерей людей
- rock displacement on the sides of the quarry – смещение горных пород по бокам карьера
- waste dumps – свалки
- prevent – предотвращать
- a related profession in land construction – родственные профессии в строительстве
- surveyor engineer – инженер-геодезист

Read the texts and do the tasks

Mining technicians

Definition and Nature of the Work

Mining technicians provide technical assistance to professional engineers in coal and metal mining. Mining technicians work in exploration and development, in production, and in preparation. During preparation, sometimes called beneficiation, the technicians separate the desired ore from rock and other unwanted materials. Mining technicians gather information by performing chemical and physical tests and observing mining operations. They assist in surveying and drafting and in planning solutions to engineering problems. They may also work in technical sales support.

Mining technicians also assist chemists and metallurgists. They usually work in laboratories where they test samples of rock and ore. The results of these tests help scientists evaluate the quality of the metals or minerals found.

Many mining technicians work in the engineering offices of mining operations. For example, some help to design and install ventilation systems that force fresh air into mine shafts. These technicians calculate the volume of air in an underground chamber so that mining engineers can decide what kind of ventilation system to use. Sometimes these technicians go into mine shafts and take samples of air. Then they test these samples in the mine's laboratory for evidence of poisonous gas.

Some technicians assist the mine's production supervisors. These technicians may be shift bosses and may supervise thirty to fifty miners. They train new miners and make sure that safety rules are strictly followed. The most experienced technicians may become production supervisors who supervise shift bosses. Other technicians assist managers who try to increase the efficiency of a mining technician surveys at a strip mine. Sometimes these technicians use stopwatches to measure how long it takes crews to do certain kinds of work. These time studies help managers decide whether methods need to be changed [10].

Education and Training Requirements

At least two years of college training is needed to be a mining technician. Some colleges and technical institutes offer programs leading to an associate degree in mining technology. This degree will qualify candidates for most beginning positions as a mining technician. For attendees of a four-year college that offers a degree in mining engineering, a counselor can be helpful in designing a program that will prepare candidates to become a mining technician. This program may take two to three years to complete. Most technicians take courses in technical writing, mathematics, chemistry, geology, physics, and metallurgy. Technicians who want jobs in management or production supervision usually take courses in business administration [10].

Getting the Job

For students attending a school that offers an associate degree in mining technology, instructors and the school's placement office may be helpful in locating a job as a mining technicians. Candidates can also get help from counselors at state employment offices in states where mining is an important industry. Prospective mining technicians should also apply directly to mining companies. A summer job with one of these firms can lead to a full-time job after graduation [10].

Working Conditions

Underground mining is dangerous work. Technicians who work underground with engineering and geological crews share this danger. Technicians usually spend part of their working day in offices and laboratories. They generally work in crews with other technicians, engineers, and workers. Technicians who become shift bosses usually spend all of their working day in mines. They may work rotating shifts. Technicians usually work forty hours a week [10].

Petroleum Engineers

Petroleum Engineers are employed by oil or gas companies to design, test and implement efficient methods to extract petroleum products from the earth and sea floor. They spend most of their time making estimations because they can never see what is actually going on thousands of meters below the ground. They work closely with other professionals, such as geologists, to locate the dig site, design and build the machines that extract as much oil and gas as possible, and oversee the removal and processing of the petroleum itself. All this, while working to keep costs low.

To help with the company's decision making, a Petroleum Engineer may research and present the findings to a company's management. Petroleum Engineers need to determine whether the cost to remove the 'crude materials' from the ground is low enough compared to the money earned from selling the refined products. Petroleum Engineers are highly sought after because the world has such a high need for hydrocarbons as a fuel source. Many petroleum engineers work for some of the biggest companies in the world and, in most cases, are the best paid compared to other engineering disciplines [10].

What do Petroleum Engineers do?

1) study geological and geophysical information to determine the most efficient drilling method and equipment to use;
2) develop tools, machines, and equipment used to extract petroleum products;
3) operate software used to control and run the machines;
4) oversee teams employed on a job site;
5) manage a job site's overall production;
6) supervise the safe removal of drilling equipment once the site is exhausted [10].

Mining engineers

A mining engineer evaluates, plans, and oversees the construction of a mine. A mining engineer will be involved in a project through all phases of mining operations – from exploration and discovery of mineral resource, through feasibility studies, mine design, development of plans and production scheduling, operations, processing and even marketing.

They are still involved at mine closure stages including final and land restoration and rehabilitation.

1. Investigate mineral deposits and work with geologists, other earth scientists and economists to evaluate them and determine whether they can be mined profitably.
2. Look at depth and characteristics of mineral deposit and its surrounding to work out the most suitable mining method.
3. Carry out the mine design including all the relevant mine planning and scheduling using state-of-the art mine planning and visualization software.
4. Plan and coordinate the employment of mining staff and selection of equipment with regard to efficiency, safety, and environmental conditions.
5. Talk to geologists and other engineers about the design, selection and provision of equipment, facilities and systems for mining, as well as infrastructure such as access roads, water and power supplies.
6. Oversee the mine construction and implementation of mine plans.
7. Take on responsibility and leadership for production crews and operational mine performance.
8. Conduct ongoing research aimed at improving efficiency and safety in mines [10].

Drillers and blasters

Drillers operate module drilling machines to bore blast holes in open-pit mines and quarries and to bore holes for building foundation at construction sites. Blasters in this unit group fill blast holes with explosives and detonate explosives to demolish structures.

They are employed by mining, quarrying and construction companies and by drilling and blasting constructors.

Main duties

Drillers perform some or all of the following duties:

1) drive and operate tracked or truck-mounted rotary drilling, air-track or other drilling machines to bore large blast holes to specified depths at stacked positions in open-pit mine or quarry;

2) operate drilling machines to drill blast holes in rock at road on other construction sites;
3) read instruction or diagrams, lay out drill pattern and determine depth and diameter of blast holes and conduct field tests to determine type and quantity of explosives required;
4) assemble or direct other workers to assemble primer charges using selected detonators, fuses, detonating cords and other materials;
5) load explosives in blast holes by hands or direct movement of bulk explosives trucks to load holes;
6) connect electrical wires, detonating cords or fuses into series and connect series to blasting machines, press handle or button to detonate charges;
7) handle, store and transport explosives and accessories in accordance with regulations and ensure that safety procedures are observed;
8) may operate air-track, rotary, down-the hole or other drilling machines to drill blast holes or may direct drilling of blast holes [10].

A mining machine operator

A mining machine operator must know not only how to use a variety of machines but also be able to maintain and repair them. Mining machine operators use backhoes, dozers, scrapers, haul or other tracks, graders, front- end loaders, draglines, hydraulic or cable shovels, packers, mine dewatering equipment, equipment transporters, air haulers, conveyor belts, boom bolters, grease guns, hammers, jacks and tape measures. While controlling the operations of mining machines, the operator will watch gauges, dials, and other indicators, determine the cause of problems and identify solutions and use logic and reasoning to ascertain advantages and disadvantages of different approaches to sometimes complex problems. Subordinates, peers, and supervisors must be communicated with, and the operator could be responsible for the health and safety of others.

A mining machine operator must be able to work both independently and in a team environment. It may be necessary to work in a cramped space or awkward position or at considerable height for an extended period. Loads as heavy as 44 pounds will have to be lifted. Lighting might be extremely bright, and noise levels can be uncomfortable. A hard-hat,

life jacket, hearing protection, gloves, glasses, and safety shoes will often be necessary. In remote locations, mining machine operators may be away from home for several weeks at a time. A mining machine operator might be exposed to contaminants or hazardous equipment. Methane in coal seams can escape into tunnels, and miners sometimes hear it hissing. Explosions can injure workers who are many yards away, and cave – ins can trap or bury workers. Flooding is another problem mining machine operator must sometimes contend with [10].

Drafting technologists and technicians

They prepare engineering designs, drawing and related technical information.

They work with:

1) consulting and construction companies;
2) utility, resource and manufacturing companies;
3) all level of government;
4) a wide range of other establishments.

Drafting technologists and technicians work within multidisciplinary teams or in support of engineers, architects or industrial designers, or they may work independently [10].

Surveyors. Surveying in the Mining Sector

Mining surveying can be summarized as "the digging of mine shafts and galleries and calculation of volume of rock", although it entails much more than this in practice. Geometric constraints – vertical shafts and narrow passages – demand the use of specific survey techniques.

While the basic principles of surveying may have remained largely unchanged throughout the ages, the instruments use have not. Common technologies in mine surveying today include terrestrial laser scanning, airborne laser scanning, airborne photogrammetry, unmanned aerial systems (UASs), satellite imagery.

Besides this, software forms an essential part of mining surveying profession nowadays. After all, the captured data needs to be processed in order for it to be of any use.

Today, mining surveying is an exact science. Modern theodolites (which in fact are incorporated in total stations, the state-of-the art

surveying instrument that intergrades an electronic theodolite with electronic distance meter) – using laser sighting and electronic data storage-coupled with a global navigation satellite system (GNSS) offer an accuracy that is probably beyond the wildest dreams of the early surveyor armed only with his simple dial and measuring chain [10].

Marks cheider – a mining engineer or technician, a specialist in carrying out a spatial and geometric measurements in the bowels of the earth and on corresponding sections of its surface, followed by displaying the measurement results on plans, maps and sections in mountain and geological exploration works.

Mine surveying – the branch of mining science and technology, the subject of which is the study on the basis of field measurements and subsequent geometric constructions of the structure of the deposit, the shape and size of bodies of the mineral in the bowels, the placement of useful and harmful components in them, the properties of the enclosing rocks, the spatial location of workings, the processes of deformation of rocks and the earth's surface in connection with mining operations, as well as a reflection of the dynamics of the production process of a mining enterprise.

The work is carried out using surveying instruments. The data is synthesized in mining graphic documentation, which is drawing obtained by the method of geometric protection.

Today, a mine surveyor is a specialist who plans and controls all stages of the construction of underground structures and the development of mine workings (surface-open pits, open-pit mines, prospector artels, ditches and underground mines, metro and wells), organizing work and adjusting the process in accordance with delivery plan of the object.

A mine surveyor is responsible for observing all the design parameters of the mining systems, all parameters and deformations of buildings and structures in mine and on the surface of the mining enterprise. In addition to certain knowledge, skills and abilities, he must have a very balanced character, be infinitely pedantic, accurate and precise in performance of his duties, and know safety precautions. Errors in its work can lead to colossal losses, accidents with massive loss of life. The mine surveyor is engaged in accounting for the movement and state of mineral reserves (discovered, prepared and ready for excavation reserves), taking into account the loss and dilution of the mineral. The mine surveying service at mining enterprise also monitors the process of rock displacement on

the sides of the quarry, waste dumps, and, if necessary, takes measures to prevent rock displacement; or to prevent further mining operations. A related profession in land construction is a surveyor engineer [10].

Tasks

Exercise 1

Match columns A and B:

A	B
1. Mining technicians work in exploration and development in production, and in preparation	a. Некоторые помогают создавать и устанавливать вентиляционные системы, которые подают свежий воздух в шахты
2. Mining technicians gather information by performing chemical and physical tests and observing mining operations	b. Горные технологи работают в разведке и разработке, в добыче и переработке пород
3. Some help to design and install ventilation systems that force fresh air into mine shafts	c. Инженеры-нефтяники нанимаются нефтегазовыми компаниями, чтобы спроектировать, апробировать и реализовать эффективные методы извлечения нефтепродуктов из недр земли и со дна морского
4. A mining engineer evaluates plans, and oversees the construction of a mine	d. Горный инженер вовлечен в проект, во все фазы горных работ и обнаружение залежей минералов, в создание шахты, производственное планирование, горные разработки и маркетинг
5. Mining engineer will be involved in a project through all phases of mining operation and discovery of mineral resources, through feasibility studies, mine design, development of plans and production scheduling, operations, processing and even marketing	e. Горные технологи собирают информацию, проводя химические и физические тесты, и наблюдают за горными работами

6. Drilling operate module drilling machines to bore blast holes in open-pit mines and quarries	f. Горный инженер оценивает, планирует и наблюдает за строительством шахты
7. Petroleum engineers are employed by oil and gas companies to design, test and implement efficient methods to extract petroleum products from the earth and sea floor	g. Инженеры-нефтяники очень востребованы, т. к. мир остро нуждается в углеводородах как источнике топлива
8. Petroleum engineers are highly sought after because the world has such a high need for hydrocarbons as a fuel source	h. Бурильщики работают с мобильными буровыми машинами, чтобы создать отверстия для взрывчатки на открытых шахтах и карьерах

Exercise 2

Match the words and their definitions:

1. Exploration	a) form an idea of the amount, number or value of; to assess
2. Carry out	b) a substance which can be made to explode, especially any of those used in bombs or shells
3. Surveying	c) a person/a professional who locates reservoir of natural gas and crude oil beneath the earth's surface and then determines if the effort of extracting the product is worth the time and money for company, he works for
4. Evaluate	d) the action of studying or researching an unfamiliar area
5. Shafts	e) the profession or work of examining and recording the area and features of a piece of land so, as to construct a map, plan, or detailed description of it
6. Petroleum engineers	f) a person who has acquired enough knowledge and skill to operate and assume the responsibility of operating drilling machine
7. Drillers	g) perform a task; put a threat, promise or order into action
8. Blasters	h) a machine that provides a wide range of drilling and bolting solutions for secondary bolting in difficult conditions
9. Explosives	i) a wheeled machine for levelling the ground, especially in making roads
10. Draglines	j) a person or thing that emits or uses blasts

11. Graders	k) a long narrow typically vertical hole that gives access to a mine, accommodates a lift in a building or provides a ventilation
12. Boom bolters	l) a large excavator with a bucket pulled in by a wire cable

Exercise 3

Express your opinions about the following statements:

1. The job of mining machine operators is the most dangerous in the sector of mining industry
2. The career of marks cheider is the most challenging, exciting and very costly in terms of knowledge, responsibility, special abilities
3. The career of petroleum engineers is highly sought

What career would you choose in mining industry? Why?

Individual task

Make the projects and Power Point Presentations on the following topics:

1. The main responsibilities of surveyors.
2. What is surveying?
3. Definition and nature of the work of mining technicians.
4. Education and Training requirements for the profession of mining technicians in the world and in Russia.
5. Education and Training requirements for the profession of mining engineers in the world and in Russia.
6. What do petroleum engineers do?
7. What are the duties of mining engineers?
8. The career of drillers.
9. The career of blasters.
10. What does a mining machine operator do?
11. The main responsibilities of mark cheiders.

Test

Careers in mining

Task 1

True/false statements:

1. Mining technicians provide technical assistance to professional engineer in coal and metal mining.
2. Mining technicians work in galleries and museums where they study pieces of art and master pieces.
3. At least two years of college training is needed to be a mining technician.
4. Mining engineers investigate mineral deposits and work with geologists, other earth scientists and economists to evaluate them and determine whether they can be mined profitably.
5. Mining engineers carry out the design of well and caves.
6. Petroleum engineers spend most of their time making estimations because they can never see what is actually going on thousands of meters below the ground.
7. Petroleum engineers work for small companies and are low paid.
8. Drillers operate mobile drilling machines to bore holes in open-pit mines and quarries.
9. Drillers operate jets and supersonic aircraft.
10. Mining machine operators use backhoes, dozens, scrapers, haul or other tracks, graders, front-end loaders, draglines, hydraulic or cable shovels, packers etc.
11. A hard-hat, life-jacket, leather pajamas, slippers, sun glasses will often be necessary for mining machine operators.
12. Marks cheider – a mining technician, a specialist in carrying out a special and geometric measurements in the bowels of the earth.

Task 2

Choose the best answers to the questions:

1. What is mining surveying?
   a. It is the branch of geology that studies technologies of searching for deposits.

b. It is the branch of mining and technology, the subject of which is the study on the basis of field measurements and subsequent geometric construction of structures of the deposit.
c. It is the branch of mining that studies minerals, ores and other types of rocks.

2. What are the main duties of marks cheider?
   a. Marks cheider carries out a special and geometric measurements in the bowels of earth.
   b. Marks cheider works in laboratories and tests rock samples.
   c. They determine if the deposits are profitable enough.

3. What are the responsibilities of mining surveyors?
   a. Mine surveyors are responsible for observing all the design parameters of the mining systems, all parameters and deformations of buildings and structures in mine and on the surface of mining enterprises.
   b. Mine surveyors have to dig wells and shafts.
   c. Mine surveyors are engaged in supervising mines and mine crews.

4. What do drafting technologists and technicians work with?
   a. They work with landscape design agencies.
   b. They work with consulting and construction companies; utility; resource and manufacturing companies; all level of government.
   c. They work with agricultural companies.

5. What duties do drillers perform?
   a. Drillers take on responsibility and leadership for production crews.
   b. Drillers observe all the design parameters of the mining systems.
   c. Drillers operate drilling machines to drill blast holes in rock on other construction sites.

6. What are the difficulties and inconveniences of mining machine operator's job?
   a. It may be necessary to work in a cramped space or awkward position on at considerable height for an extended period.

b. Mining machine operators have to wear leather costumes and safety shoes.
c. Mining machine operators don't have an opportunity to have launch and dinner in restaurants for an extended period.

7. What are the most common technologies in mine surveying?
   a. They include graders, draglines, packers and boom bolters.
   b. They include terrestrial laser scanning, airborne laser scanning, airborne photogrammetry, unmanned aerial systems, satellite imaginary.
   c. They include jacks and tape measures, conveyor belts.

8. What are mining technicians involved in?
   a. They may work in cafes, restaurants and markets.
   b. They assist in construction industry.
   c. Mining technicians provide technical assistance to professional engineers in coal and metal mining.

Task 3

Match the words and their definitions:

A	B
1. Shift boss	a) a site for disposal of solid waste in which refuse is buried between layers of dirt
2. Strip mine	b) a ground-based version of the airborne used for terrain and landscape mapping
3. Mining crews	c) a continuous moving band of fabric, rubber or metal used for transporting objects from one place to another
4. Satellite imagery	d) a group of people who work in shafts, mines
5. Theodolites	e) a foreman in charge of the workers of a particular shift
6. Terrestrial laser scanning	f) a measurement system in which pulses of light are emitted from an instrument mounted in an aircraft and directed o the ground in a scanning pattern
7. Airborne laser scanning	g) a device attached or integral to a firearm to aid target acquisition; it projects a beam onto the target that provides a visual reference point

8. Laser sighting	h) a precision optical instrument for measuring angles between designated visible points in the horizontal and vertical planes
9. Waste dumps	i) removal of soil and rock (overburden) above a layer or seam, followed by the removal of the exposed mineral
10. Conveyor belt	j) images of Earth collected by imaging satellites operated by governments and business around the world

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