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Part II

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МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ
Федеральное государственное автономное образовательное учреждение высшего образования
**«НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ
ТОМСКИЙ ПОЛИТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ»**

ПРОФЕССИОНАЛЬНЫЙ ИНОСТРАННЫЙ ЯЗЫК (АНГЛИЙСКИЙ)

Часть 2

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Редакционно-издательским советом
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Настоящее учебное пособие используется для самостоятельной работы студентов по закреплению и усвоению грамматического и лексического материала, состоящего из общетехнической, общенаучной и профессиональной лексики; развития умений профессионально ориентированной письменной речи; для обучения основным видам чтения, а также для контроля понимания прочитанного и умения переводить профессионально ориентированные тексты. Кроме того, данный УМК включает рекомендации по овладению произносительной стороной речи и выполнению упражнений, вызывающих затруднения. В приложениях рассматриваются особенности употребления основных языковых явлений.

Пособие является второй частью учебно-методического комплекса для студентов заочного отделения специальностей 21.03.01 «Нефтегазовое дело», 21.05.02 «Прикладная геология», 21.05.03 «Технологии геологической разведки» ИШПР НИ ТПУ.

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INTRODUCTION

The modern community requires the graduate of an educational institution to be successful in his professional activity and could make a career independently, work in competitive environment at national and international levels, thereby, contributing to prosperous well-being of the society.

The modern conditions of professional activity which are the result of rapid development of global business determine an increasingly growing interest to learning foreign languages and, especially, English as a means of international communication. The success of cross-cultural relationships depends on the ability of people to adequately understand each other, interact and cooperate.

ESP Correspondence Course is organized around a subject–matter core and is appropriate to the needs of specific groups of students. The main purpose is language proficiency development for 3d–4th year correspondent students majoring in petroleum engineering.

The manual develops the necessary practical skills to support communication in both oral and written forms of the language required by the conditions of professional interaction.

The course consists of two modules, four units, two self-study parts, two key to self-study sections and a variety of supplementary material. The course may require classroom work or can be partially or entirely worked through at home by individual students.

The modules correspond to the basic fields of professional expertise in petroleum engineering and are developed to train the skills relevant for the successful accomplishment of the Progress Test tasks.

Each module focuses on a core of useful language related to the topics of professional interest with which the students need to be familiar. The suggested succession of modules is predetermined by the nature of language mastering ability. It provides gradual increase in complexity and difficulty of studied material. In accordance with this pedagogical principle, profound knowledge of basic language units (vocabulary) and their combinability (grammar) makes it possible to recognize them in a natural written speech (reading). Subsequently, speaking and writing skills can be further developed as productive aspects of language usage.

The units follow the same basic structure which includes **Lead-in sections**, briefly introducing the basic subject-matter, and **Practice sections**, consisting of a set of exercises to train and develop the necessary skills and language aspect usage. The phonetic, vocabulary, grammar, reading and writing practice is provided. **Assessment sections**, reinforcing students' knowledge of the topics, vocabulary and structures presented in the previous units or the entire module, include Progress Tests which are aimed at getting feedback and assessing students' progress throughout the course.

The course is accompanied by easy to comprehend and operate **Appendixes** which can be used as Vocabulary, Grammar and Writing reference materials.

Course Outline

Содержание программы и цели обучения Профессиональному иностранному языку (английскому)

Целью дисциплины «Профессиональный иностранный язык (английский)» является совершенствование иноязычной коммуникативной компетенции студентов, необходимой для осуществления профессиональной деятельности и позволяющей им использовать иностранный язык в профессиональной сфере.

В результате освоения дисциплины «Профессиональный иностранный язык (английский)» студенты должны уметь:

В области говорения:

- строить небольшие монологические всказывания по профессиональной тематике в пределах изученных тем с опорой на картинки, схемы или оригинальные тексты.

В области чтения:

- понимать короткие адаптированные тексты, отражающие ситуации связанные с профессиональной деятельностью;
- извлекать необходимую информацию из аутентичных текстов общетехнической и профессиональной направленности;

В области письма:

- писать короткое сообщение по вопросам, связанным с описанием отдельных фактов, событий;
- составить аннотацию текста по профессиональной тематике;

Наряду с практической целью обучения, данный курс имеет образовательные и воспитательные цели. Достижение образовательных целей осуществляется в аспекте гуманизации технического образования и означает расширение кругозора студентов, повышение уровня общей культуры мышления, общения и речи.

Реализация воспитательного потенциала курса проявляется в готовности специалистов содействовать налаживанию межкультурных и научных связей, представлять свою страну на международных конференциях и симпозиумах, относиться с уважением к духовным ценностям других стран и представителей иной языковой культуры.

При обучении студентов английскому языку ставятся следующие **задачи**:

- формирование лексико-грамматических навыков и развитие умений в опосредованных видах речевой деятельности (далее ВРД);
- планомерное и целенаправленное развитие умений использования стратегий автономной учебно-познавательной деятельности;

- формирование позитивного отношения и интереса к культуре страны изучаемого языка;
- стимулирование познавательной активности студентов и мотивации к изучению аспектов использования иностранного языка в профессиональном общении.

Цели и задачи дисциплины достигаются на практических занятиях, в процессе самостоятельной работы студентов и консультаций, в форме электронного обучения и он-лайн. При обучении используются как традиционные, так и современные методы и приемы обучения.

Содержание обучения определяется спецификой курса и включает определенный набор лексических единиц, грамматических тем социолингвистических и стратегических навыков и умений в опосредованных видах речевой деятельности, по тематике в сфере повседневно-бытового и профессионального общения.

ФОНЕТИЧЕСКИЙ МИНИМУМ. Звуковой строй английского языка; особенности произношения английских гласных и согласных, ударение, особенности интонации английского предложения на материале изучаемых лексических ядиниц и грамматических явлений, встречающихся в рассматриваемых текстах.

ЛЕКСИЧЕСКИЙ МИНИМУМ. За полный курс обучения студент приобретает словарный запас в 1000-1500 лексических единиц (слов и словосочетаний).

Данный объем лексических единиц является основой для расширения потенциального словарного запаса студентов, и поэтому программа предусматривает усвоение наиболее употребительных словообразовательных средств английского языка: префиксов, основных суффиксов имен существительных, прилагательных, наречий, глаголов. В словарный запас включаются также фразеологические сочетания, наиболее употребительные синонимы, антонимы, встречающиеся в английских научных и технических текстах.

ГРАММАТИЧЕСКИЙ МИНИМУМ. В процессе обучения студент усваивает сложные грамматические формы и структуры английского языка, характерные для профессиональной сферы общения и технических текстов.

Неличные формы глагола. Причастие и причастные обороты. Способы перевода. Особенности употребления**.** Функции и формы инфинитива. Способы перевода на русский язык. Особенности употребления. Конструкции сложного дополнения. Конструкции сложного подлежащего. Функции, перевод и особенности употребления. Функции и формы герундия. Способы перевода на русский язык. Герундиальные обороты. Перевод, функции и употребление.

Формирование вышеперечисленных навыков является необходимой основой развития целого ряда умений, определяющих уровень иноязычной компетенции, достаточной для опосредованного общения.

УМЕНИЯ ГОВОРЕНИЯ

- вести устный обмен информацией на английском языке в повседневных ситуациях на элементарном уровне;
- отвечать на вопросы, обмениваться мнениями и информацией в пределах изученных тем профессиональной направленности: Oil And Gas Industry, Hydrocarbon Exploration, Oil Extraction Methods, Drilling, Oil And Gas Transport and Storage, Underground Pipeline Construction Stages.

УМЕНИЯ ЧТЕНИЯ

- понимать короткие адаптированные тексты, имеющие профессиональную тематику;
- извлекать необходимую информацию из аутентичных текстов общетехнической и общенаучной направленности из учебника и специализированных изданий;
- понимать логическую структуру текста и последовательность событий, изложенных в них;
- выбирать вид чтения в соответствии с поставленной целью (ознакомительное, просмотровое, поисковое и др.) при работе с текстами.

УМЕНИЯ ПИСЬМЕННОЙ РЕЧИ

- писать короткое сообщение по ключевым словам слайда, связанным с описанием отдельных фактов, событий;
- писать грамматически и лексически правильное сообщение, содержащее ответ на поставленный вопрос;
- написать аннотацию текста по профессиональной тематике.

Course Structure and Progress Test Requirements

Структура курса

Структура курса «Профессиональный иностранный язык (английский)» разрабатывается с учетом дистанционного и проблемно-ориентированных методов и принципа модульной организации процесса обучения и представляет собой логически взаимосвязанные модули. Каждый из модулей имеет единую структуру и состоит из уроков, заданий для самостоятельного выполнения и проверки, а также тестовых контрольных работ.

В соответствии с действующими учебными планами на полный курс обучения «Профессиональному иностранному языку (английскому)» для заочных отделений вузов неязыковых специальностей отво-

дится не менее 24 часов обязательных аудиторных занятий, 264 часа самостоятельной работы и консультации из расчета один час на каждого студента. За курс обучения студент выполняет четыре контрольные работы, сдает четыре зачета.

Распределение учебных часов.

3 курс: 12 часов аудиторных занятий, 132 часа самостоятельной работы. Студент выполняет две контрольные работы и сдает зачет в конце пятого и шестого семестров.

4 курс: 12 часов аудиторных занятий, 132 часа самостоятельной работы. Студент выполняет четыре контрольные работы, сдает зачеты по окончании седьмого и восьмого семестров обучения.

Требования на зачете

Программа данного курса предусматривает проведение рубежного контроля знаний, навыков и умений. Целью контроля является оценка качества языковой подготовки студентов по изучаемой учебной дисциплине.

Рубежный контроль (зачет) позволяет определить качество усвоения студентами учебного материала по разделам (подтемам) модуля. Проводится в V, VI,VII и VIII семестрах.

Зачет. К зачету допускаются студенты, представившие контрольную работу, включающую задания по чтению, лексике и грамматике, выполняемые в письменной форме.

Для получения зачета студент должен уметь:

а) прочитать со словарем текст на английском языке, содержащий изученный грамматический материал. Форма проверки – письменный или устный перевод. Норма перевода – 600-800 печатных знаков в час письменно или 1000-1200 печатных знаков в час устно;

б) беседа по одной из пройденных за семестр разговорных тем.

Выполнение и оформление контрольных работ

Количество контрольных заданий, выполняемых на каждом курсе, устанавливается учебным планом университета.

Каждая контрольная работа включает 5 вариантов. Студент должен выполнить один из 5 вариантов в соответствии с последними цифрами номера зачётной книжки:

1,2 – вариант № 1;
3,4 – вариант № 2;
5,6 – вариант № 3;
7,8 – вариант № 4;
9,0 – вариант № 5.

Контрольная работа должна быть выполнена на листах формата А–4 печатным способом, 14 шрифтом, Times New Roman, 1,5 интервал, параметры страницы должны соответствовать ГОСТу Р 6.30-2003 (верхнее, нижнее, левое поле 20 мм, правое – 10 мм). Титульный лист должен содержать: полное наименование образовательного учреждения, вид работы, название дисциплины, фамилию, имя, отчество студента, курс, номер группы, номер зачётной книжки, номер контрольной работы.

Студенты заочного отделения изучают «Профессиональный иностранный язык (английский)» 2 года на третьем и четвертом курсе, т. е. 4 семестра. Итогом обучения является зачет на 4-м курсе (8 семестр).

Зачет на четвертом курсе предполагает выполнение контрольных работ № 3–4 (7 семестр – контрольная работа № 3 (TEST 3); 8 семестр – контрольная работа № 4 (TEST 4).

UNIT 5

OIL AND GAS INDUSTRY

LEAD-IN

Match the words in bold with the pictures a–d.

Oil and gas industry has two sectors: the upstream sector and the downstream sector. Workers in the **upstream sector** find and produce crude oil and gas. Workers in the **downstream sector** produce useful things from **crude oil**, like **fuel** for car and planes.

a

b

c

d

I. Read and remember the list of words associated with Petroleum Engineering.

1)	engineering	– технология, техника; инженерно-техническая деятельность, инженерно-технические работы
2)	petroleum engineering	– нефтегазовое дело
3)	branch	– отрасль, раздел (науки)
4)	to develop	– разрабатывать, развивать
	development	– разработка, развитие
5)	exploitation	– эксплуатация, разработка месторождения
6)	to forecast	– прогнозировать
7)	to produce	– добывать
	production	– добыча

8) mining engineering – горная техника, горное дело
9) deposit – залежь, месторождение
10) production engineer – инженер–эксплутационник, инженер по добыче нефти и газа
11) reservoir engineer – инженер–разработчик
12) civil engineering – гражданское строительство
13) to process – обрабатывать
14) to design – проектировать
15) technique – техника (методика), метод; оборудование
16) to drill – бурить, разбуривать
17) to select – отбирать
selection – отбор
18) casing – обсадка, колонна обсадных труб
19) safety equipment – оборудование, обеспечивающее безопасность работ
20) supervision – технический контроль
21) negotiation skill – навыки ведения переговоров
22) well completion – заканчивание скважины
23) producing intervals – продуктивный, нефтеносный интервал
24) to measure – мерить; мера
25) to deliver – доставлять, поставлять
26) raw (products) – сырье
27) pipeline – трубопровод
28) to collaborate – сотрудничать
29) distribution – распределение
30) reservoir performance – поведение, отдача, производительность пласта
31) to introduce – вводить, представлять
32) formation-evaluation – оценка параметров продуктивности пласта
33) to determine – определять, устанавливать
34) take sample – брать образцы
35) responsibility – обязанность
36) approach – подход
37) complex reservoir – пласт сложной структуры

II. Read the following words and remember their pronunciation.

[ʃ] exploitation, negotiation, production, evaluation, formation, selection
[ʒ] measure, supervision
[ɔ:] performance, forecast, raw, formation
[a:] sample, forecast, reservoir, branch
[ai] mining, pipeline, design

[ou] approach, process, petroleum
[ju:] supervision, producing, evaluation, introduce, distribution

III. Pay attention to the stress in the following words.

de'velopment	'process	ˌengi'neering
'forecast	de'termine	eˌvalu'ation
de'posit	'product	reˌsponsi'bility
reser'voir	tech'nique	ˌdistri'bution

READING

IV. Read the text and write whether the following statements are true (T) or false (F).

Statement	True/False (T/F)	
1. Petroleum engineering originated from geology.		
2. Geoscience is a branch of petroleum engineering.		
3. The role of petroleum engineer is to drill into the underground reservoirs.		
4. The work of a drilling engineer involves protection of local residents.		
5. Production engineers measure the recovered fluids.		
6. Reservoir engineers deal with the analysis of rock-fluid system.		

PETROLEUM ENGINEERING

Petroleum engineering is the **branch** of engineering that focuses on the **development** and **exploitation** of crude oil and natural gas fields as well as **forecasting** of their future **production**. Petroleum engineering evolved from **mining engineering** and geology, and it is closely linked to geoscience, which helps engineers understand the geological structures and conditions favorable for petroleum **deposits**.

During the evolution of petroleum engineering, several areas of specialization developed: drilling engineering, **production engineering**, **reservoir engineering**, and petrophysical engineering. Within these four areas there are close links to **civil**, geological, geophysical, and chemical specializations of engineering. The unique role of the petroleum engineer is to integrate all the specializations into an efficient system of oil and gas drilling, production, and **processing**.

The drilling engineer is responsible for the **design of the techniques** available to **drill** into and control the underground reservoirs, the selection of **casing** and **safety equipment**, and management of the operations. Because drilling involves coordinating many service companies, equipment, working

with local governments, and providing the safety of workers and the local residents, the engineer must develop the skills of **supervision**, management, and **negotiation**.

The work of production engineers begins after **completion of the well.** It includes the selection of producing intervals, controlling and meas**uring** the produced fluids (oil, gas, and water), and **delivering** the **raw** products (gas and oil) to **pipeline** companies. As in all branches of petroleum engineering, production engineers cannot solve problems in isolation but must **collaborate** with both the drilling and reservoir engineers.

Reservoir engineers are concerned with the physics of oil and gas **distribution** and their flow through porous rocks. They are responsible for analyzing the rock-fluid system, forecasting the **performance** of the oil-gas reservoir, and **introducing** methods for maximum efficient production.

To understand the reservoir rock-fluid system, the drilling, production, and reservoir engineers are helped by the petrophysical, or **formation-evaluation, engineer**, who provides tools and analytical techniques for **determinin**g rock and fluid characteristics. The petrophysical engineer takes **samples** of the rocks and well fluids to determine porosity, permeability, and fluid content in the reservoir.

While each of these four specialty areas has individual engineering **responsibilities**, only an integrated **approach** of geoscience and petroleum engineering can help develop **complex** reservoirs at present.

Abridged from: McLeroy P.G., Honeycutt B.D. Petroleum-engineering, Encyclopeadia Britannica, 2018.

V. Hamdan Al Nuami comes from Abu Dhabi. He is a trainee instrument engineer. Complete the interview by matching 1–7 with A–G.

1. What are you doing at the moment?
2. Who are your colleagues?
3. How did you join the company?
4. What do you do when you're not at work?
5. What is the next step?
6. What do you like best about your job?
7. Why did you want to work in this field?

A. During the summer vacation, I joined our national oil company's training programme. I'm training to be a fully qualified instrument engineer. It takes two years. I work at the main refinery. Our refinery produces a wide range of petroleum products.

B. I am interested in computers and science. The job means I can use the theory in real-life situations.

C. Well, right now we are updating the control rooms for the refinery. You know, to make it more modern. It is a really interesting project. Safety is a major part of the instrumentation so you can learn about how the whole refinery works. I don't understand everything yet.

D. Well, I work with several other nationalities. We often spend time together after work. But I'm also proud to be part of a growing number of local students and trainees. I believe it is important to increase know-how in the country.

E. For me, the best thing is that I can learn about a lot of different things. I know something about instruments but there is also telecommunications, computer technology, and other engineering subjects. I want to learn more about administration, petroleum engineering in general, and the different cultures of the people I work with.

F. I like sport – I often play volleyball after work. I usually play twice a week, but this evening we are working late. My family owns a large house where I live with my parents and brothers and sisters, but this week I am staying in the company guest house.

G. I want to apply for a place on the company's graduate development programme, which means a placement at an overseas university. If you work hard, there is no limit to what you can achieve.

Abridged from: Naunton, J, Pohl, A. Oil and Gas 2, Oxford University Press, 2011.

VOCABULARY AND TERMINOLOGY

VI. Read the text Petroleum Engineering in detail and match the English word-combinations (1–10) with the Russian equivalents (a–j).

1)	focus on exploitation of oil fields	a)	быть тесно связанным с науками о земле
2)	evolve from mining engineering	b)	отвечать за проектирование методов
3)	be closely linked to geoscience	c)	возникнуть в ходе эволюции горного дела
4)	be responsible for the design of the techniques	d)	иметь дело (заниматься) с физическими процессами распределения нефти и газа в пласте
5)	involve working with local governments	e)	сосредоточить внимание на эксплуатации нефтяных месторождений
6)	develop the skills of supervision	f)	развивать навыки осуществления технического контроля
7)	be concerned with the physics of oil and gas distribution	g)	разрабатывать продуктивные пласты сложной структуры

8)	introduce methods for maximum efficient production	h)	включать работу с местными органами власти
9)	provide tools and analytical techniques	i)	вводить методы, обеспечивающие максимально эффективную добычу
10)	develop complex reservoirs	j)	предоставлять инструменты и аналитические методы

VII. Choose the correct variant a, b or c.

1. How many basic areas of PE specializations are there?
   a) 3
   b) 4
   c) 2
2. Which branch of engineering deals with design, construction of the physical and naturally built environment including works such as roads, bridges, canals, airports, pipelines, and railways.
   a) petroleum engineering
   b) mining engineering
   c) civil engineering
3. How do we call skills which help to come to an agreement between two or more parties in course of work?
   a) negotiation
   b) management
   c) supervision
4. Whose work begins after well completion?
   a) production engineer
   b) petroleum engineer
   c) drilling engineer
5. What is a specialist who selects casing and safety equipment?
   a) petrophysical engineer
   b) drilling engineer
   c) production engineer
6. Whose job responsibilities include determining porosity and permeability of reservoir?
   a) drilling engineer
   b) petrophysical engineer
   c) production engineer
7. Who is responsible for maximizing oil production?
   a) drilling engineer
   b) production engineer
   c) reservoir engineer

8. What is one of reservoir engineering tasks?
   a) selection of producing intervals
   b) forcasting reservoir performance
   c) determining rock and fluid characteristics

VIII. Compose the sentences of the given words.

1. Develops/ petroleum/ skills/ constantly/ engineer/ negotiation/ his.
2. For/ the engineers/ oil/ conditions/ favorable/ deposits/ determine.
3. Engineers/ rocks/ in/ study/ oil/ porous/ reservoir/ the distribution of.
4. Techniques/ petrophysical/ which/ engineer/ determine/ rock/ provides/ characteristics of.
5. Complex/ develop/ integrated/ helps/ approach/ engineers/ reservoirs.
6. Local/drilling/ in/ collaborate/ residents/ their/ engineers/ work/ with.

IX. Complete the following sentences with one of the words in bold in the text A WORLD OF OPPORTUNITIES.

1. I've been working as a technologist, but now I've finished my course at university and I hope to get ____soon.
2. We have to work 3 8 hours a week, but if we work longer we get paid ____.
3. Workers usually get paid ___ but professional people get paid a _____.
4. He doesn't work outside. He's got an _____.
5. You must do a health and safety course and get a ___before you can work in this area.
6. It takes three or four years of university to get a _____.

A WORLD OF OPPORTUNITIES

There are many different jobs within the oil and gas industry, each requiring different skills and qualifications and sometimes travel.

Working as a labourer is physically hard. You have to be strong and willing to work very hard. You work outdoors on site, perhaps for a drilling or pipeline company. You only need qualifications from school and, of course, health and safety qualifications. You get the chance to travel and often get paid **overtime** so you can earn good **wages**.

An apprentice begins work after leaving school, working together with a qualified person such as a technician, electrician, or welder to learn the job. At the same time, an apprentice spends time at college to get a recognized **certificate** or diploma. It can take three or four years but there is the chance to travel and get paid for overtime too.

Technologists usually study at college for two or three years and have a qualification before they begin work in specialized fields. Their job is to de-

cide which equipment to use on site, know how to install it, and use it. Some technologists have an **office job**, but some work in the field and have to travel.

Engineers have a university **degree** and are often expected to do more study while working. They earn a good **salary** but have a lot of responsibility and have to know and follow regulations. There are usually good chances of **promotion** and many engineers work their way up to jobs as managers. Engineers work in the office and also travel to work sites.

Of course not all the jobs in oil and gas are technical jobs. There are many people who work in transportation, health and safety, or customer relations. There are also people who have to negotiate with land owners and draw up contracts. It's an amazing industry! There are millions of people working in almost every country in the world so there are lots of opportunities.

Abridged from: Naunton, J, Pohl, A. Oil and Gas 2, Oxford University Press, 2011.

X. Read the sentences and match the words in bold (a–o) with definitions (1–15).

She went for three (a) **interviews** before they gave her the job.
I'm trying to find a (b) **placement** or (c) **internship** for the summer to get some (d)**experience**.
You don't need lots of (e) **qualifications** but you have to be tough and ready to work hard.
I think I'm going to (f) **apply for** a postgraduate course if there are still (g)**vacancies.**
Just send me a (h) **CV**, don't worry about a (i) **covering letter**.
There's an (j) **application form** on our website you can (k) **fill in**.
The company (l) **recruits** and (m) **trains** over a hundred school-leavers each year.
I'd like the names of two (n) **referees** as well.
More than ninety (o) **candidates** replied to the advertisement.

1. The letter you send with a CV that says why you want the job.
2. To add information to the gaps on a form.
3. The practical knowledge and know-how you get from doing something.
4. An official document that shows you have reached a required le.
5. A person who wants to be considered for a job.
6. A meeting where you are asked questions to see if you are suitable for a job.
7. A list of printed questions that you answer by filling the gaps.
8. (Br E) a job that is often a part of studies where you get experience of a particular kind of work. Usually unpaid.

9. (Am E) a job that is often a part of studies where you get experience of a particular kind of work. Usually unpaid.
10. Someone who knows you well who gives their opinion of you.
11. An available job.
12. To teach someone how to do a specific task.
13. To get someone to join a business or organization.
14. A document that gives details about your education and qualifications and the jobs you have done.
15. To formally request a job.

GRAMMAR

The -ing form (Present Participle/ Participle I)

Forms

	Active	**Passive**	**Typical Situation**
Non-Perfect	reading	being read	When two things happen at the same time or one action happens during another action
Perfect	having read	having been read	When one action happens before another action, we use **having V_3** for the first action

Uses

1. as a part of the Continuous Tenses.
Eg. *They are working in the laboratory.*

2. as an attribute which describes the noun it is associated with.
The **-ing form** takes the place of a longer phrase with *which*, *who* or *that*.
We can use the **-ng form** to replace *which* and the verb that follows it.
Participle I as an attribute can be placed before or after the associated noun.
Eg. *The car moved down the street at an* ***increasing*** *speed.*
Eg. *Processes* ***leading*** *to the formation of rocks are known*.

3. as an adverbial modifier.
a) The **–ing form** takes the place of a longer phrase with *when, while*, etc.
Eg. *When* ***designing*** *new machines, engineers pay attention to geological conditions.*
b) The **-ing form** takes the place of a longer phrase with because*, since,as* etc.
Eg. Feeling *tired, I went to bed early.*

(For more details you may see Grammar Reference p. 190).

XI. Match the uses of Participle I (A–C) with the sentences (1–8).

A. a part of the Continuous Tenses
B. an attribute which describes the noun it is associated with
C. an adverbial modifier
Example: *0. Plastic bags are already polluting oceans and killing wildlife. – Answer is 0.A (As* ***polluting*** *is a part of Present Continuous form)*

1. While being used the device showed poor characteristics.
2. The successful results of the experiments received at the laboratory are very important
3. Global warming is melting the ice so it is easier to reach the oil.
4. Having finished the first experiments they began to process the data.
5. I spent most of the time answering questions.
6. The scientists investigating the problem are known over the world.
7. Wild life is put in danger by companies searching for oil.
8. Eleven people were having a meeting in a trailer in the danger zone.

XII. Rewrite *which-, who-, that*-sentences and use Participle I.

Example: *A boy who is playing near the school is my brother. – A boy playing near the school is my brother.*

1. Do you know the engineer who is talking to Tom?
2. A group of workers who are waiting outside are from a different company.
3. Police who are investigating the crime are looking for three men.
4. The drillers who are staying in this hotel left for work.
5. The road which joins the site with the village is very narrow.
6. Life must be very unpleasant for people who live near busy airports.
7. Can you think of the name of a drilling device which begins with "R"?
8. They live in a pleasant room which overlloks the garden.

XIII. Make one sentence from two using Participle I.

Example:
0. *Jim was playing tennis. He hurt his arm.* ***– Jim hurt his arm playimg tennis.***

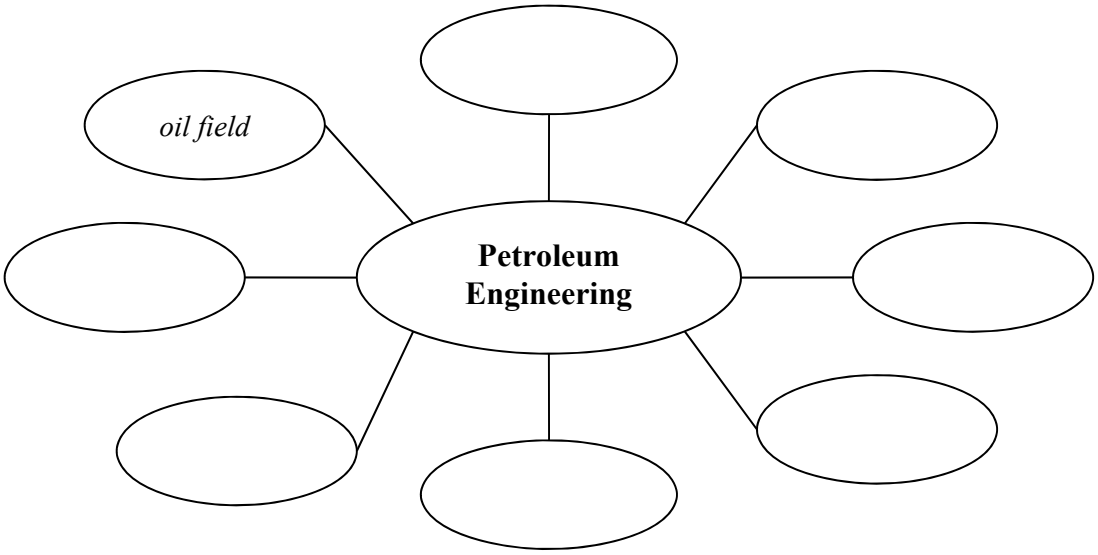
1. I was watching television. I fell asleep.
2. The man slipped. He was getting off the bus.
3. Margaret was driving to work yesterday. She had an accident.
4. I was walking home in the rain. I got wet.
5. She is a foreinger. So she needs a visa to stay in this country.
6. Carol was in the bar. She was having a drink.
7. Kate took a key out of her pocket. He opened the door.
8. Mike is unemployed. He has not got much money.

TRANSLATION

XIV. Find 8 sentences with Participle I in the texts of Unit 5. Write them down and translate into Russian.

SPEAKING

XV. Fill in the spidergram with the words associated with Petroleum Engineering and explain your associations.



Example: *Petroleum and reservoir engineers collaborate in development of oil field.*

XVI. Describe the picture in 10 sentences.

Example: *There are a lot of wells in the area.*

WRITING

XVII. Write an abstract (100–120 words) to the following article. (For more details you may see Writing Reference p. 202).

A GREAT LEADER

His Highness Zayed bin Sultan Al Nahyan was one of the founders of the United Arab Emirates and ruled Abu Dhabi for over thirty years. Abu Dhabi and the UAE have a tenth of the world s oil reserves (and almost five per cent of its natural gas). Sheikh Zayed was a wise man who used the money from petroleum to help his people. Under his leadership Abu Dhabi became a rich and stable country. He built universities, hospitals, and schools and paid for medical treatment abroad for those who needed it.

He also helped to turn the desert green. He was a respected local and international figure who preferred discussion and negotiation to war.

Despite being one of the world's richest men he lived a simple traditional life. He enjoyed riding and hunting with birds. Another love was for conservation and the environment. He helped to protect different kinds of wildlife in his region. He was awarded the World Wildlife Fund's 'Golden Panda for his work.

In memory of Sheikh Zayed, the Zayed Future Energy Prize is for people and organizations that introduce new ideas in renewable energy (for example solar and wind power). Masdar City in Abu Dhabi is designed to be the world's first eco-city. Researchers at Masdar City want to find solutions to climate change and energy security. Masdar City will only use solar energy and other renewable energy sources.

Abridged from: Naunton, J, Pohl, A. Oil and Gas 2, Oxford University Press, 2011.

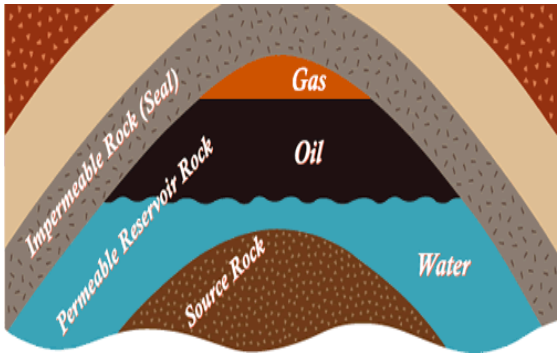
Unit 6

HYDROCARBON EXPLORATION

LEAD-IN

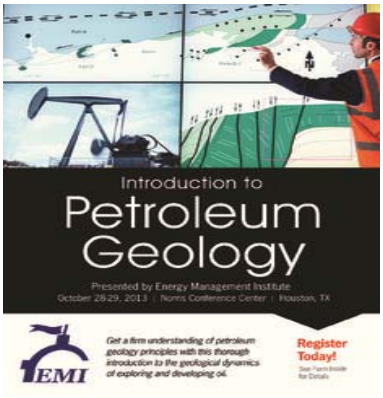
Match the words in bold with the pictures a-d.

Hydrocarbon exploration (or oil and gas exploration) is the search by **petroleum geologists** and **geophysicists** for **hydrocarbon deposits** beneath the Earth's surface, such as oil and natural gas. Oil and gas exploration are grouped under the science of **petroleum geology.**



a

b



c

d

I. Read and remember the list of words associated with Hydrocarbon Exploration.

1) to look for – искать
2) seep – высачивание (нефти), выход на поверхность
3) oil-gas pool – нефтегазовая залежь, месторождение
4) to examine – рассматривать, изучать, исследовать
5) to expose – выходить (на поверхность), обнажаться
6) surface – поверхность; поверхностный
7) outcrop – обнажение, выход (пород) на дневную поверхность

8) aerial – аэро, снятый с воздуха
9) satellite image – спутниковый снимок, космоснимок
10) access – доступ
11) seismic line – сейсмический профиль
12) interpret – интерпретировать; объяснять, толковать
interpretation – интерпретация; объяснение, толкование
13) shock wave – ударная волна
14) subsurface rock – горная порода
15) to reflect – отражать
16) to pound – сильно бить, колотить, ударять
17) vibrator truck – вибратор на шасси грузовика
18) to explode – взрывать
19) charge – заряд
20) shallow hole – неглубокая скважина
21) environmental restrictions – ограничения, налагаемые требованиями охраны окружающей среды
22) to detect – обнаруживать, улавливать
23) device – устройство
24) geophone – сейсмоприемник
25) to convert – преобразовывать
26) two-dimensional – двухмерный
27) display – изображение
28) cross-section – разрез
29) intersecting grid – сеть частично–перекрывающихся профилей
30) to refer – относиться, рассматриваться
31) 3D seismic volume – трехмерный массив данных
32) in this way – подобным образом
33) clue – ключ (подсказка), сведение
34) enticing – занимательный, привлекательный
35) well logs – каротаж скважины
36) to yield – давать, выдавать
37) to abandon – закрывать, консервировать, ликвидировать (скважину)
38) to locate – определять местонахождение, расположить в определенном месте

II. Read the following words and remember their pronunciation.

[ə:] surface, subsurface, convert, interpretation, refer
[æ] abandon, examine, satellite, access, shallow
[ɪ] restriction, image, examine, reflect, detect, device, environmental
[ou] expose, explode, shallow, geophone, locate

[ai] satellite, vibrator, device, dimensional, seismic, environmental, enticing
[ʃ] interpretation, restriction, cross-section, two-dimensional

III. Pay attention to the stress in the following words.

'surface	'yield	re'striction
'aerial	'access	en¸viron'mental
re'flect	e'xamine	¸inter'secting
re'fer	a'bandon	in¸terpre'tation

READING

IV. Read the text and write whether the following statements are true (T) or false (F).

Statement	True/False (T/F)	
1. The search for oil and gas was less complex in ancient times than today.		
2. To find oil and gas pools geologists need geophysical data.		
3. At present the schock waves are generated by exploding dynamite charges.		
4. Two-dimensional lines are created by laying the geophones out in single line.		
5. Geophysical data help learn if an oil or gas field really exists.		
6. Well logs can determine type of underground rocks.		

LOOKING FOR OIL AND GAS?

The ancient cultures found petroleum by simply **look**ing **for** oil **seep**s or gas seeps and hoping that an adequate source was nearby, but the search for oil and gas today is much more complicated. To find an underground geological structure necessary to form an oil or **gas pool** requires a combination of science and art.

To discover what structure and compositions the rocks might have deep underground, geologists **examine** the rocks where they are **expose**d in surface **outcrop**s, or they examine **aerial** photographs and **satellite image**s when surface **access** is limited. Geologists also work closely with geophysicists to integrate different types of geophysical data (for example, results of magnetic and gravity surveys) and **seismic line**s into their **interpretation**s.

The collection of seismic data involves sending **shock wave**s into the ground and measuring how long it takes for the **subsurface rock**s to **reflect** these waves back to the surface. The shock waves that are used today are usually generated by **pound**ing the earth with giant **vibrator truck**s, but in

the past gephysicists preferred to **explod**e small dynamite **charge**s in **shallow hole**s. However, environmental **restriction**s in most places today prevent using explosives to collect seismic data. The reflected waves at the surface are **detect**ed by listening **device**s called **geophone**s. Computers then process the geophone data and **convert** it into seismic lines, which are nothing more than **two-dimensional display**s that resemble **cross-section**s.

Seismic lines in the old days were just two-dimensional lines created by laying the geophones out in single line. But today, the data is commonly collected as an **intersecting grid** of seismic lines **refer**red to as **3-D seismic volume**. Data collected **in this way** may even be used to help create 3-D computer models of the underground geometries of the rocks.

Geologic and geophysical **clue**s are **enticing**, but drilling is the only way to learn if an oil or gas field really exists. Once a well is drilled, **well logs yield** data on the types of rock present and, most important, what fluids these rocks contain. The information interpreted from the logs is used to decide whether a well should be completed and used to produce oil and gas, or filled with cement and **abandon**ed. The logs are also used to update the geologic models originally used to **locate** the well.

Abridged from: The History of Oil Industry. Oil exploration. 2016. http://www.sjvgeology.com/oil/exploration.html

V. Read the text about Schlumberger brothers and match the headings (1–5) with the paragraphs (A–E).

1. Education and career ____
2. Famous and recognised over the world ____
3. Important achievement ____
4 Small steps towards huge success ____
5. Parents and early years ____

SCHLUMBERGERS' REVOLUTION

A. Conrad Schlumberger and Marcel Schlumberger, French brothers, geophysicists and petroleum engineers are noted for their invention of a method of continuous electric logging of boreholes in 1927. Their application of physics for use in geology brought major and universally adopted changes in mining and petroleum production. The company they founded in 1926, Schlumberger Ltd., is still one of the most important oil-field service companies in the world.

B. The Schlumbergers' father was a rich French-speaking textile manufacturer, and their mother was the granddaughter of a conservative minister at that time. The brothers were born during a period when their native Alsace was joined to Germany, and both left for France before the age of military service.

C. Both brothers received engineering education in Paris. Conrad taught physics at mining school, also in Paris, from 1907, interrupting his academic career during World War I (1914–18) to serve as an artillery officer in the French army. Marcel went to work for foreign mining interests owned by his wife's family; he too served in the army during the war.

D. Between 1911 and 1914 Conrad developed a method of detecting mineral deposits by passing an electric current through the ground and taking measurements at the surface of variations in resistivity caused by underground rock formations. In 1926 they founded the precursor of Schlumberger Ltd. During that period they also developed a technique for using a wire-drawn electrode to measure variations in electrical resistivity in a borehole drilled through rock formations. In 1927 a team led by Conrad's son-in-law, Henri-Georges Doll, conducted the first electric "well log," profiling an oil well drilled hundreds of metres into the rock.

E. The Schlumbergers' technique revolutionized oil exploration, offering a far cheaper and more reliable method of well logging than the traditional coring techniques. In 1935 they established an affiliated company in the United States. After Conrad's death while returning from a business trip to the Soviet Union, Marcel ran the company along with the family members, including Doll and Marcel's son, Pierre. Marcel died at the family estate in Normandy, near which the there is a small museum of innovations of the Schlumberger brothers at present.

Abridged from: Conrad Schlumberger and Marcel Schlumberger. German Geophysicists. Encyclopeadia Britannica, 2018.

VOCABULARY AND TERMINOLOGY

VI. Read the text LOOKING FOR OIL AND GAS? in detail and match the English word-combinations (1–10) with the Russian equivalents (a–j).

1)	be exposed in surface outcrops	a)	раскладывать сейсмоприемники в линию
2)	examine satellite images	b)	обнажаться в выходе на дневную поверхность
3)	send shock waves into the ground	c)	изучать изображения со спутников
4)	update the geologic models	d)	обрабатывать данные с сейсмоприемников
5)	fill with cement	e)	пропускать ударные волны через породы
6)	complete a well	f)	заполнять цементом
7)	resemble cross-sections	g)	закончить скважину (ввести в эксплуатацию)

8)	process the geophone data	h)	давать данные о типе присутствующих пород
9)	yield data on the types of rock present	i)	напоминать разрез
10)	lay the geophones out in single line	j)	усовершенствовать геологические модели

VII. Match the words in collum A with the words in column B to form word-combinations. Then give Russian equivalents to these word-groups.

A		B	
1)	exposed	a)	rocks
2)	satellite	b)	waves
3)	reflected	c)	images
4)	aerial	d)	lines
5)	seismic	e)	holes
6)	shallow	f)	photographs
7)	environmental	g)	displays
8)	giant	h)	charges
9)	two-dimensional	i)	restrictions
10)	dynamite	j)	vibrator trucks

VIII. Complete the sentences with one of the words in bold.

a)	**shock waves**	**c)**	**pool**	**e)**	**access**	**g)**	**interpret**
b)	**charges**	**d)**	**examine**	**f)**	**yield**	**h)**	**in this way**

1. The search for an oil-gas ____ requires a combination of science and art.
2. To discover underground rocks and structures, geologists _____ the rocks where they are exposed in surface outcrops.
3. Geologists also examine aerial photographs and satellite images when surface ____ is limited.
4. The collection of seismic data involves sending _____ into the ground.
5. In the past gephysicists exploded small dynamite _____ in shallow holes.
6. Data collected ___ may help create 3-D computer models of the underground rocks.
7. Well logs ___ data on fluids which the rocks contain.
8. Geologists and geophysicists ____ the information from the logs to decide on well completion.

IX. Choose the correct variant a, b or c and complete the sentences.

1. The ancient cultures did not find petroleum by _____.
   a) examining aerial photographs and satellite images
   b) search for oil seeps or gas seeps
   c) examining rocks in surface outcrops

2. Environmental restrictions in most places today _____.
   a) allow exploding small dynamite charges in shallow holes
   b) prevent using explosives to collect seismic data
   c) limit pounding the earth with giant vibrator trucks
3. The device which is used to detect reflected waves at the surface is called _____.
   a) geophone
   b) vibrator truck
   c) satellite
4. Two-dimensional displays that resemble cross-sections are called _____.
   a) seismic lines
   b) 3-d computer models
   c) intersecting grid
5. Well logs are used _____.
   a) to update the geologic models originally used to locate the well
   b) to fill the abandoned well with cement
   c) to create 3-d computer models of the underground rocks

X. Give the English equivalents of the given Russian sentences.

1. Геологи изучают изображения со спутников.
2. Вибратор на шасси грузовика создает колебания почвы и производит ударные волны.
3. Сейсмоприемники улавливают отраженные волны на поверхности.
4. Компьютеры преобразуют данные сейсмоприемников в сейсмические профили.
5. Сеть частично-перекрывающихся профилей выдает трехмерный массив данных.
6. Инженеры решили законсервировать скважину.

GRAMMAR

The V_3 (-ed) form (Past Participle/Participle II)

Uses

1. as a part of the Perfect Tenses and Passive forms. ***Eg.****The mine was* ***built*** *many years ago.*
2. as an attribute which describes the noun it is associated with. The V_3 form takes the place of a longer phrase with *which*, *who* or *that*. We can use the V_3 form to replace *which* and the verb that follows it. • In this case the V_3 form has a *passive* meaning. • Participle II as an attribute can be placed before or after the associated noun. ***Eg.****The* ***stolen*** *picture was very soon found.* ***Eg.*** *The engineers* ***invited*** *to the mine are good specialists*.

3. as an adverbial modifier.
a) The $\mathbf{V_3}$ form takes the place of a longer phrase with *when, while*, etc.
Eg. *<u>When</u>* ***burnt****, coal produced heat.*
b) The $\mathbf{V_3}$ form takes the place of a longer phrase with *if, unless,* etc.
Eg. *Metals do not melt <u>unless</u>* ***heated*** *to a definite temperature.*

(For more details you may see Grammar Reference p. 190).

XI. Match the uses of Participle II (A–C) with the sentences (1–8).

A. a part of the Perfect Tenses or Passive forms
B. an attribute which describes the noun it is associated with
C. an adverbial modifier
Example: *0. The task was set by the head of the department. – Answer is 0.A (As* ***set*** *is a part of Past Simple Passive form)*

1. The results obtained showed the stability of the system under reference conditions.
2. Masdar City in Abu Dhabi is designed to be the world's first eco-city.
3. Sheikh Zayed was a respected local and international figure.
4. Unless checked this technique is not applicable in the field.
5. The successful results of the hydrodynamic tests have been received in the research center.
6. Well done the tool will work in a good way.
7. After the machine had been repaired, it was put into operation.
8. The devices developed lately increased the efficiency of the whole construction.

XII. Rewrite *which-, who-, that*-sentences and use Participle II.

Example: *A boy <u>who was injured</u> in the accident was taken to hospital. – A boy <u>injured</u> in the accident was taken to hospital.*

1. A window which was broken in the storm last night has now been repaired.
2. A number of suggestions that were made at the meeting were not very practical.
3. Some paintings which were stolen from the museum have not been found yet.
4. What was the name of a man who was arrested by the police?
5. Some of the people who had been invited to the party can't come.
6. Most of the goods which are made in this factory are exported.
7. The police never found the money that was stolen in the robbery.

8. A chip which is used in everything from watches to computers can store more information than a disc.

Absolute Participle Construction

Noun/ I, you, she, he, it , they, we	+	Participle I/ Participle II

(For more details you may see Grammar Reference p. 193)

XIII. Paraphrase the sentnces using the Absolute Participle Construction.

Example: ***As the door was open****, she could see everything. –* ***The door being open,*** *she could see everything.*

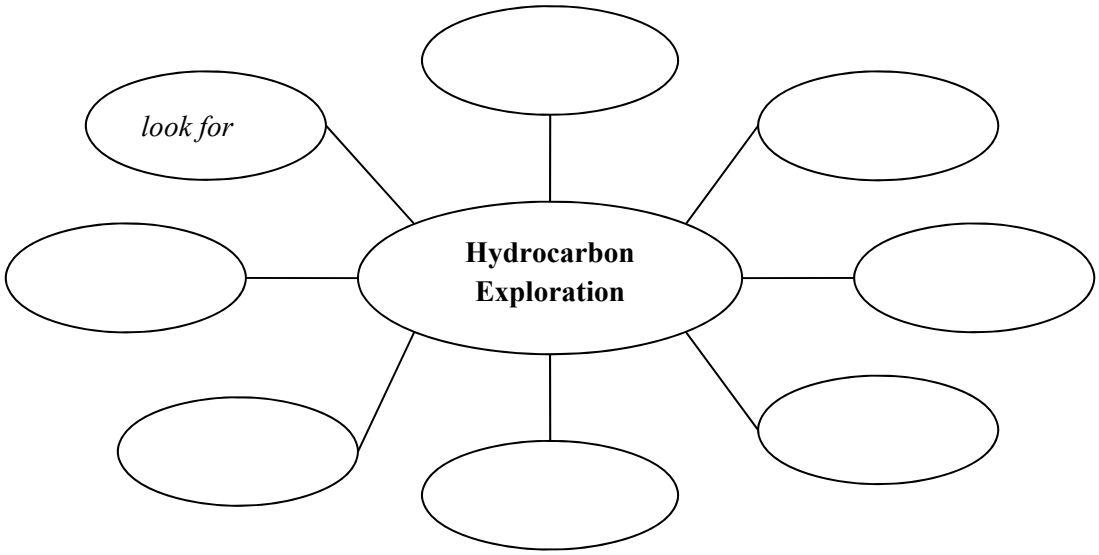
1. **After data have been input**, the processing hardware interprets them.
2. Computer system has a complicated structure **and people are the most important component of it**.
3. CPU reads and interprets software instructions **and the design of the microprocessor affects the processing power and speed of the computer.**
4. **After the first inventions have been made**, the science of magnetism began to develop at a high speed.
5. Hardware provides the operation of the computer system **and software controls the internal computer activities.**
6. **When the cursor reaches the desired location**, the reader usually pushes a button on the mouse.
7. Communication software transfers data from one computer into another **and these programs provide the user with data security and error checking.**
8. **As multiple analogies between electricity and magnetism existed**, the scientists thought that there must be connection between them.

TRANSLATION

XIV. Find 8 sentences with Participle II in the texts of Unit 6. Write them down and translate into Russian.

SPEAKING

XV. Fill in the spidergram with the words associated with "Hydrocarbon Exploration" and explain your associations.



Example: *In hydrocarbon exploration geologists look for clues to detect oil pools.*

XVI. Describe the picture in 8 sentences.

Example: *In the picture there are four boys having practical training.*

WRITING

XVII. Write an abstract (100–120 words) to the following article. (For more details you may see Writing Reference p. 202).

ARCTIC CIRCLE MAY HOLD KEY TO WORLD OIL SUPPLY

The United States Geological Survey (USGS) believes that the area north of the Arctic Circle holds an estimated 90 billion barrels of oil. This is enough to supply the world for almost three years at 86.4 million barrels a day. Russia, Canada, Denmark, Norway, and the USA have all claimed some of these resources. Global warming is melting the ice so it is easier to reach the oil. The USGS thinks the area north of the Arctic Circle could also contain 1,770 trillion cubic feet of natural gas. The Arctic holds about thirteen per cent of the world's undiscovered oil, 30 per cent of the undiscovered natural gas and twenty per cent of the undiscovered liquefied natural gas.

Mark Myers of the USGS thinks it is important to have the facts. Then we can decide how to protect endangered species, native communities, and the health of our planet. Frank O'Donnell of Clean Air Watch said polar bears and other wildlife within the Arctic Circle are losing their habitat due to global warming which is caused by burning fossil fuels, and would also be put in danger by companies searching for oil. An oil spill could cause enormous damage to the environment and habitats.

Abridged from: Naunton, J, Pohl, A. Oil and Gas 2, Oxford University Press, 2011.

SELF-STUDY

OIL EXTRACTION METHODS

LEAD-IN

Oil extraction (oil production) is a process of oil recovery from a well.

I. Read and remember the list of words associated with oil extraction.

1) to extract oil	– добывать нефть
2) to establish	– оценивать, устанавливать, создавать
3) refinery	– нефтеперерабатывающий завод
4) reserves	– запасы
5) to decrease	– уменьшать, убывать, понижаться
6) to increase	– увеличивать, повышать, усиливать
7) to discover	– обнаруживать, открывать
8) to recover	– получать (керн), добывать (нефть, газ)
9) to pump	– добывать нефть глубокими насосами, качать; нагнетать, закачивать в пласт
10) substance	– вещество, материя
11) composition	– состав, соединение
12) viable	–целесообразный, рентабельный
13) recovery factor	– коэффициент нефтеотдачи
14) to extract	– извлекать (нефть, газ или инструмент из скважины)
15) excess pressure	– избыточное давление
16) sluggish	– медленно текущий, вязкий
17) treacle	– вязкая жидкость, жидкая смола
18) formation	– проедуктивный пласт
19) large-scale	– широкий, масштабный; крупномасштабный
20) commercial production	– промышленная добыча
21) production facilities	– сооружения для ведения добычи
22) trap (pocket)	– ловушка
23) reservoir	– пласт–коллектор; пластовый резервуар (нефти, газа)
24) sufficient	– достаточный; обоснованный
25) to force	– оказывать давление, вытеснять
26) to inject	– нагнетать, закачивать
27) atmospheric temperature	– среднее значение температуры воздуха
28) flowing well	– фонтанная скважина

II. Pay attention to the pronunciation of the following terms.

[ai] refinery, viable, widely, pipeline
[e] excess, well, generally
[i:] treacle, seam, decrease, increase

III. Pay attention to the stress in the following words.

´viable	es´tablished	´excess
´terminal	´sluggish	dis´covered

READING

IV. Read the text and write whether the following statements are true (T) or false (F).

Statement	True/False (T/F)	
1. Crude oil is the only hydrocarbon found in a reservoir.		
2. A recovery factor of about 30 per cent indicates commercial production at present.		
3. Reservoir pressure causes problems.		
4. Crude oil is a natural substance whose composition is stable.		
5. The oil varies in colour.		
6. Most oil we use is produced at sea.		

OIL EXTRACTION

Discovering new **reserves** of oil is only the beginning of the story. It is then the job of a new team of economists, scientists and engineers to decide how to go into **large-scale commercial production.**

When oil or gas have been discovered, you have to be established how much oil is there, how much can be **recover**ed, what its quality is and how the oil and gas can be transported safely to a **refinery** or terminal. In other words, is the find economically **viable**? If so, further wells will have to be drilled and **production facilities** established.

The **recovery factor** – the amount of oil that can be economically **extracte**d compared with the total amount estimated to be in the ground – varies widely. Twenty years ago a recovery factor of about 30 per cent was normal. Today the average is about 45 per cent. Improved technology is likely to increase this further.

Crude oil is found in underground **pockets or traps**. Gas and water are generally found in the **reservoir** too – usually under pressure. This pressure

is sometimes **sufficient to force** the oil to the surface of the well and **excess pressure** may cause problems.

In the early stages of production an oilfield may have freely **flowing well**s, but as oil is extracted the pressure **decrease**s and **pump**ing may become necessary. Alternatively, it may be possible to **increase** the pressure by **inject**ing further gas or water into the edges of the reservoir.

Crude oil is a natural substance whose composition varies. Even in the same oilfield, where oil is obtained from different depths, it can vary greatly in composition and appearance. It may be an almost colorless liquid or a **sluggish**, black substance, so heavy that it cannot be pumped at **atmospheric temperatures**. Generally, however, crude oils look rather like thin, brown **treacle.**

There is no single solution to the problem of getting oil out. Production and transport methods will depend on where the oil is found, and in particular, whether it has been found under the land or under the sea. Obviously, it is a lot harder and more expensive to drill for oil beneath the sea than on land, which is one reason why the majority of the oil that we use is produced onshore.

Abridged from: Petroleum Engineering: Course book, TPUPublishing House, 2010.

V. Read the text about maximizing oil yield and match the headings 1–4 with the paragraphs A–D.

1. A recent development ____
2. Basic types of oil production ____
3. A hard task ____
4. Ways used to force more oil ____

MAXIMIZING YIELD

A. When people think of striking oil, they imagine it gushing out of the ground in a huge jet. However, in most cases making the earth give up its oil is much more difficult. A lot depends on the porosity of the rock that holds it, and the oil's viscosity (resistance to flow). In the old days, as little as ten per cent of the available oil was recovered. The technology was not available to bring the rest to the surface. With improvements in technology, up to 60 per cent can be recovered.

B. Primary recovery depends on underground pressure to force the oil to the surface. If pressure drops, pumps can bring more oil up. Sometimes natural gas is pumped down the well below the oil. The gas expands and pushes the oil to the surface. Primary recovery usually extracts just ten per cent of the oil available. Secondary recovery is the most common advanced recovery technique. Water that originally came out of the well with the oil is injected

back into the oil-bearing formation. This forces more oil to the surface. Another 20 per cent can be recovered this way.

C. With enhanced recovery techniques, the amount that can be recovered increases to 60 per cent.There are three main methods: (i) thermal recovery; (ii) gas injection; (iii) chemical flooding. In thermal recovery steam is injected into the formation to make the oil flow more easily. Its increased pressure makes it come to the surface. This method is used with very heavy oils like bitumen. In case of gas injection gases like CO_2, propane, and methane mix with the oil. This lowers its viscosity and increases flow. Immiscible gases (gases that do not dissolve in oil) increase the pressure in the gas cap and force the oil up. Chemical flooding being used, chemicals are mixed with water and injected into the formation. This pushes out more oil.

D. Lately, chemists have experimented with bacteria. Bacteria are injected into the formation and fed with protein like molasses (the sweet sticky substance that is left after sugar is refined).The bacteria produce gas that increases the pressure.

Abridged from: Naunton, J, Pohl, A. Oil and Gas 2, Oxford University Press, 2011.

VOCABULARY AND TERMINOLOGY

VI. Read the text OIL EXTRACTION in detail and match the words in collum A with the words in column B to form word-combinations. Then give Russian equivalents to these word-groups.

Example: *(1b) find underground pockets – находить подземные ловушки*

1)	~~find~~	a)	economically viable reserves
2)	vary	b)	~~underground pockets~~
3)	recover	c)	a recovery factor
4)	transport	d)	in composition and appearance
5)	increase	e)	production facilities
6)	establish	f)	at atmospheric temperatures
7)	inject	g)	colorless sluggish substance
8)	pump	h)	to refinery
9)	obtain	i)	large-scale commercial production
10)	go into	j)	water into the edges of reservoir

VII. For questions 1–5, choose one of the words (a–f) that best completes the gap in the text. You can use each word only once. There is one extra word.

a)	**detect**	**c)**	**recovery**	**e)**	**underground**
b)	**pumps**	**d)**	**extracts**	**f)**	**forces**

Primary Production

Primary (1) ____ depends on (2)_____ pressure to push the oil to the surface. If pressure drops, (3) _____ can bring more oil up. Sometimes natural gas is pumped down the well below the oil. The gas expands and (4)___ the oil to the surface. Using this method we may usually (5)_____ just ten per cent of the oil available.

VIII. Fill in the gaps with the derivatives.

extract extracting extraction extracted extractive

1. After re-utilizing the wastes it will be possible to make _____ industries more efficient.
2. The problem of _____ geothermal energy is under consideration now.
3. _____ of useful minerals by underground methods will be continued in future.
4. Lead, zinc, silver and gold are largely _____ by underground mining.
5. As a rule thick seams are not _____ to full thickness.
6. When we _____ mineral ores there exist two basic types of operations.

IX. Complete the sentences using the information from the texts given above.

1. When oil or gas have been discovered, its reserves must be economically _____ .
2. Crude oil is found in underground _____.
3. As oil is extracted, the pressure _____.
4. We may increase the pressure by _____ water or gas into the reservoir.
5. The composition of oil _____ .
6. Majority of oil is recovered _____ (under the land).

X. Answer the questions.

1. What team is needed to solve the problem of production?
2. What is recovery factor?
3. What substances are usually found in a reservoir?
4. When does reservoir pressure cause problems?
5. Why is pumping so necessary?
6. What is the way to increase pressure?
7. Does oil in one reservoir differ from oil of the other reservoir?
8. What does oil look like?
9. What do production and transport methods depend on?
10. Where is it cheaper to drill oil?

GRAMMAR

XI. Choose the correct translation.

1. One must use special instrument while carrying out this experiment.

a) При проведении этого эксперимента необходимо использовать специальный инструмент.

b) Проводя этот эксперимент, необходимо пользоваться специальным инструментом.

c) Всякий должен использовать специальный инструмент, проводя этот эксперимент.

2. Scientists should not forget that there are a lot of problems remaining still unsolved.

a) Ученым не следует забывать, что существует еще много проблем, которые остаются все еще нерешенными.

b) Ученые не должны забывать, что многие проблемы остаются еще нерешенными.

c) Ученым не следует забывать о еще остающихся нерешенными проблемах.

3. All the waves in a laser beam having the same wavelength, it has a very definite colour.

a) Имея одну длину, все волны в лазерном луче имеют определенный цвет.

b) Все волны в лазерном луче имеют одну длину волны, и это имеет определенный цвет.

c) Так как все волны в лазерном луче имеют одну длину волны, он имеет определенный цвет.

4. The device consists of two electrodes, one of them being coated with photoemissive material.

a) Устройство состоит из двух электродов, один из них покрыт фотоизлучающим материалом.

b) Устройство состоит из двух электродов, причем один из них покрыт фотоизлучающим материалом.

c) Устройство состоит из двух электродов, покрывая один из них фотоизлучающим материалом.

5. Having been heated to a sufficient temperature any body becomes a source of light.

a) После нагрева до нужной температуры всякое тело становится источником света.

b) Нагревшись до нужной температуры, всякое тело становится источником света.

c) Нагретое до нужной температуры тело становится источником света.

6. While melting the ice keeps the same temperature.
   a) В то время как лед тает, он сохраняет одну и ту же температуру.
   b) Тая, лед сохраняет одну и ту же температуру.
   c) Во время таяния лед сохраняет одну и ту же температуру.

TRANSLATION

XII. Translate the following sentences into Russian.

1. The recovery factor is the amount of oil that can be economically extracted compared with the total amount estimated to be in the ground.
2. Improved technology is likely to increase this amount further.
3. In the early stages of production, an oilfield may have freely flowing wells, but as oil is extracted the pressure decreases.
4. Even in the same oilfield, where oil is obtained from different depths, it can vary greatly in composition.
5. The oil may be so heavy that it cannot be pumped at atmospheric temperatures.
6. Production and transport methods depend on where the oil is found.
7. In the old days, ten per cent of the available oil was recovered.
8. Chemical flooding being used, chemicals are mixed with water and injected into the formation.
9. Secondary recovery is the most common advanced recovery technique.
10. Water that originally came out of the well with the oil is injected back into the oil-bearing formation.

WRITING

XIII. Write an abstract (100–120 words) to the following article. (For more details you may see Writing Reference p. 202)

THE OIL INDUSTRY OF MEDIEVAL PERSIA (AZERBAIJAN AND BAKU)

When Marco Polo in 1264 visited the Persian city of Baku, on the shores of the Caspian Sea in modern Azerbaijan, he saw oil being collected from seeps. In addition to oil seeps, Marco Polo also saw spectacular mud volcanos produced by natural gas seeping through ponds, and a flaming hillside, where condensate and natural gas seeping through fractured shales has burned, and been worshipped, for centuries.

Shallow pits were dug at the Baku seeps in ancient times to collect oil, and hand-dug holes up to 35 meters (115 feet) deep were in use by 1594. These holes were essentially oil wells, which makes Baku the first true field. Apparently 116 of these wells in 1830 produced 3,840 metric tons (about 710 to 720 barrels) of oil. Later, Russian engineer F.N. Semyenov used a cable

tool in 1844 to drill an oil well near the Bibi-Eibat (Bibi-Heybat) embayment on the Apsheron Peninsula, ten years before Colonel Drake's famous well in Pennsylvania. Also, offshore drilling started up at Baku at Bibi-Eibat near the end of the 19th century, about the same time that the "first" offshore oil well was drilled in 1896 at Summerland field on the California Coast.

Russian engineers, realizing that production continued offshore, began filling and draining the bay in 1909 to allow continued drilling. Over 300 hectares (741 acres) had been reclaimed by 1927, a project said to be second in magnitude only to construction of the Panama Canal.

Abridged from: The History of Oil Industry. San Joaquin Valley Geology. 2017. http://www.sjvgeology.com/history/index.html

Key to SELF-STUDY

IV. 1F 2F 3T 4F 5T 6F

V. 1D 2B 3A 4C

VI. Suggested answer

2d vary in composition and appearance – отличаться по составу и внешнему виду
3a recover economically viable reserves – добывать экономически рентабельные запасы
4h transport to refinery – доставить на нефтеперерабатывающий завод
5c increase a recovery factor – повышать коэффициент нефтеотдачи
6e establish production facilities – возводить сооружения для ведения добычи
7j inject water into the edges of reservoir – нагнетать воду на границах пласта
8f pump at atmospheric temperatures – добывать глубокими насосами при средних значениях температуры воздуха
9g obtain colorless sluggish substance – получить (добывать) бесцветное вязкое вещество
10i go into large-scale commercial production – приступить к масштабной промышленной добыче

VII. 1c 2e 3b 4f 5d

VIII. 1 extractive 2 extracting 3 extraction 4 extracted 5 extracted 6 extract

IX. 1 viable 2 traps/pockets 3 decreases 4 injecting 5 varies 6 onshore

X. Suggested answer
1. A team of economists, scientists and engineers is needed to solve the problem of oil production.
2. The recovery factor is the amount of oil that can be economically extracted compared with the total amount estimated to be in the ground.
3. Crude oil and gas, water are generally found in the reservoir.
4. Excess pressure may cause problems.
5. When the pressure decreases, pumping may become necessary.
6. It may be possible to increase the pressure by injecting further gas or water into the edges of the reservoir.
7. Even in the same oilfield, where oil is obtained from different depths, it can vary greatly in composition and appearance.
8. Crude oils look rather like thin, brown treacle.

9. Production and transport methods depend on where the oil is found.
10. It is cheaper to drill for oil on land than beneath the sea.

XI. 1c 2a 3c 4b 5b 6a

XII. Suggested answer.

1. Коэффициент нефтеотдачи – это количество нефти, которое можно добывать с экономической выгодой в сравнении с общим количеством нефти в пласте по данным предварительных расчетов.
2. Усовершенствованная технология, скорее всего, позволит увеличить это количество в дальнейшем.
3. На ранних стадиях добычи на месторождении выделяются фонтанные скважины, но в ходе добычи нефти давление уменьшается.
4. Даже на одном и том же нефтяном месторождении, где нефть добывают на разных глубинах, она сильно отличается по составу и внешнему виду.
5. Нефть может быть такой тяжелой, что ее невозможно добывать с использованием глубоких насосов при средних значениях температуры воздуха.
6. Методы добычи и транспортировки зависят от того, где находят нефть.
7. В прежние дни добывали десять процентов имеющейся нефти.
8. Если используют химическое заводнение, химические реагенты смешиваются с водой и закачиваются в пласт.
9. Вторичная добыча – это самый распространенный метод увеличения нефтеотдачи.
10. Вода, которая первоначально извлекается из скважины вместе с нефтью, затем закачивается снова в нефтеносный пласт.

TEST 3

Variant 1

READING

I. Read the text and match the headings (1–4) with the paragraphs (A–D).

1. An alternative fuel for vehicles ____
2. The benefits of hydrogen from oil ____
3. The problems with oil ____
4. Sources of hydrogen ____

USING HYDROGEN AS A FUEL

A. At the moment, most of the energy we need for transportation comes from oil. One problem is that in the future, there may not be enough oil. Another problem is that vehicles cause pollution, particularly in cities. When the car engine burns fuel, it produces poisonous greenhouse gases.

B. Scientists are working hard to find an alternative. Over the next twenty to 30 years we will use less fossil fuel and more renewable energy. Our cars will probably use stored energy from batteries and many scientists are working to develop cars that will run on hydrogen.

C. Hydrogen will never run out, but it doesn't occur by itself naturally. It exists together with other elements in water, fossil fuels, and all plants and animals. To get hydrogen, it has to be separated from other elements, using, for example, water or natural gas. Natural gas is made up of carbon and hydrogen molecules. The process of steam reforming can be used to separate these molecules. Unfortunately, the steam reforming process also produces carbon dioxide – a greenhouse gas.

D. Cars that use hydrogen can use a fuel cell. Fuel cells use hydrogen and take oxygen from the air to produce electricity. The process also produces water and waste heat which don't damage the environment. It's difficult to transport, distribute, and store hydrogen so there are very few hydrogen stations where car drivers can buy hydrogen at the moment. As a result, most fuel-cell-powered vehicles being developed use a reformer to get hydrogen from gasoline. Compared to gasoline or diesel engines, gasoline-powered fuel-cell vehicles could be twice as efficient and reduce air pollution in cities. Some people believe they are an excellent step in making vehicles cleaner and more efficient but they still need more development.

Abridged from: Naunton, J, Pohl, A. Oil and Gas 2, Oxford University Press, 2011.

II. Read about the professional associations in Australia. Write whether the following statements are true (T) or false (F).

Statement	True/False (T/F)	
1. SPE deals with downstream sector of oil industry.		
2. SPE is involved in social activity.		
3. APPEA is concerned with protection of environment.		
4. PESA aims to make profit from its activity.		
5. PESA is interested in providing continuing education for the members.		
6. Engineers Australia is a local organization.		

PROFESSIONAL AND INDUSTRY ASSOCIATIONS IN AUSTRALIA

The Society of Petroleum Engineers (SPE) serves professional engineers, scientists, and managers in the exploration and production segments of the worldwide oil and gas industry. The SPE organises student events and updates on the oil and gas industry.

The Australian Petroleum Production & Exploration Association Ltd (APPEA) represents the upstream oil and gas industry in Australia. APPEA's mission is to provide a legislative, administrative, economic and social basis which efficiently and effectively helps safe, environmentally responsible, socially responsible and profitable oil and gas exploration, development and production.

The Petroleum Exploration Society of Australia (PESA) is a non-profit association of individuals involved in the exploration of oil and gas. PESA aims to promote professional and technical aspects of the upstream petroleum industry throughout Australia. It does this by providing opportunities for individuals interested in oil and gas exploration to discuss technical and professional matters relating to the upstream petroleum industry. It stimulates continuing education of its members and wants to maintain a high standard of professional conduct of its members.

Engineers Australia is the national forum for the advancement of engineering and the professional development of members. With excess of 80,000 members embracing all disciplines of the engineering team, Engineers Australia is the largest and most diverse professional organization for engineers in Australia.

Abridged from: Oil and Gas Industry in Australia. School of Petroleum Engineering, UNSW, Sydney, 2015.

III. Read the text and answer the questions.

1. What natural clothing materials does the text talk about?
2 What did the first big petrochemical plant make?
3 Why did the petrochemical business grow?
4 When were a lot of synthetic materials developed?
5 What synthetic cloth does the text mention?
6 Why are plastics sometimes a problem?

FROM CARBON BLACK TO PVC

Before oil and gas were freely available, people made everyday things from natural materials. Clothes were made from cotton, wool, and leather. Containers, for example bottles and cups, were made from metal, glass, and clay (soft earth that becomes hard when cooked). Paints and cosmetics were made from plants and minerals.

One example of a natural product is carbon black. It's a colouring used in ink for writing and drawing and for paint. It is made by burning wood, oil, or other natural materials. It was discovered in prehistoric times, and it's commonly used today.

The first petrochemical factory was built in 1872, and it made carbon black from natural gas. Carbon black (CB) wasn't a new product, but using a factory was a new way of making it. It became possible to make large amounts of it cheaply because natural gas was plentiful and inexpensive. At that time, carbon black was used to make ink, paint, and crayons. It is now used mostly to make car tyres.

In the early 1900s, the petrochemical business began to grow. There were a lot of oil refineries, and they created chemical by-products. Oil companies wanted to find ways to use these chemicals.

Soon scientists and engineers learned to change the hydrocarbon molecules in coal, petroleum, and refinery by-products. From the 1920s to the 1940s, familiar man-made products like nylon, polystyrene, and polyvinyl chloride (PVC) were developed. Synthetic dyes, paints, and medicines were invented.

Today, petrochemical products are everywhere. They are very useful, but they also have some problems. People throw away a lot of plastic products because they are inexpensive. One problem with plastics is that generally they do not rot or break up like natural materials. Plastic bags are already polluting oceans and killing wildlife. They cannot easily be remelted and reused. Scientists and petrochemical manufacturers continue their work to develop safe and useful products.

Abridged from: Naunton, J, Pohl, A. Oil and Gas 1, Oxford University Press, 2011.

VOCABULARY AND TERMINOLOGY

IV. Read the text FROM CARBON BLACK TO PVC in detail and match the English word-combinations (1–10) with the Russian equivalents (a–j).

1)	freely available	a)	сжигать древесину
2)	be made from plants	b)	в свободном доступе
3)	burn wood	c)	производить побочные продукты химического производства
4)	discover in prehistoric times	d)	изменять молекулы углеводородов
5)	create chemical by-products	e)	быть сделанным из растений
6)	change the hydrocarbon molecules	f)	переплавлять пластиковые упаковки
7)	develop polyvinyl chloride	g)	выделить поливинилхлорид
8)	invent synthetic dyes	h)	производители нефтехимической продукции
9)	remelt plastic bags	i)	изобрести искусственные красители
10)	petrochemical manufacturers	j)	открывать (обнаруживать) в доисторичекое время

V. For questions 1–5, choose one of the words (a–f) that best completes a gap in the text. You can use each word only once. There is one extra word.

a)	**reused**	**c)**	**throw away**	**e)**	**useful**
b)	**surface**	**d)**	**polluting**	**f)**	**rot**

Petrochemicals

Currently, petrochemical products are everywhere. They are very (1)____, but they also have some problems. People (2) ____ a lot of plastic products because they are inexpensive. One problem with plastics is that generally they do not (3) ____ or break up like natural materials. Plastic bags are already (4) _____ oceans and killing wildlife. They cannot easily be remelted and (5) _____.

VI. Fill in the gaps with the given derivatives.

produce produced producing production products

1. A much narrow definition of mining includes only crude or nonprocessed mine _____ such as mineral ores and coal.
2. The _____ of useful minerals involves usually several stages that are generally carried on by large mining firms.

3. The mining complexes usually include concentration of ores for _____ of concentrates with 25 per cent or higher metal content.
4. In the case of other metals such as gold, lead, zinc, metal is _____ in separate plants.
5. Today gas is widely used as a raw material to _____ synthetics.
6. This method applies particularly to the _____ of solid fuels.

VII. Complete the summary of the text FROM CARBON BLACK TO PVC. Use only one word in each sentence.

1 In the past oil and gas were not freely _____ .
2 Many things were _____ from natural materials.
3 _____ is a natural colouring used in ink and paint.
4 Now this substance is used for making car _____ .
5 The petrochemical _____ made this carbon powder from natural gas.
6 The oil refineries created many chemical _____ .
7 Engineers changed the hydrocarbon _____ and PVC were developed.
8 Unfortunately, _____ products cannot easily be reused.

VIII. Match the terms (1–10) with the definitions (a–j).

1)	carbon black	a)	any chemical substance that you obtain from crude oil or natural gas
2)	poisonous	b)	produced by people, not natural
3)	fuel cell	c)	a sector f oil and gas industry connected with finding and drilling for oil and gas.
4)	upstream	d)	any of the gases that can cause global warming, especially carbon dioxide
5)	environmental	e)	able to be replaced and used without the risk of finishing it all, for example energy from the sun, sea, wind, etc.
6)	man-made	f)	a device for producing energy by the action of chemicals, used to provide power for a car or other vehicle.
7)	greenhouse gas	g)	causing death or illness if taken into the body
8)	renewable	h)	the process of finding a source of oil or gas that a company can possibly develop.
9)	petrochemical	i)	connected with the natural world in which people, animals, and plants live
10)	exploration	j)	a fine carbon powder, used to make black paint or ink and some kind of rubber.

GRAMMAR

IX. Choose the correct translation of the word in brackets.

1. The students (обсуждающие) this problem will take part in the scientific conference.
   a) are discussing
   b) discussing
   c) being discussed
2. (Обсуждая) the plan of the conference they made some corrections.
   a) while discussing
   b) having discussed.
   c) be discussing
3. I (перевожу) an article now.
   a) when translating
   b) translating
   c) am translating
4. (Оставшись) alone, I decided to finish my work.
   a) being left.
   b) leaving
   c) having left
5. (Думающие) machines will appear in future.
   a) are thinking
   b) thinking
   c) be thinking
6. (Учась) at the University she was a very good student
   a) studying
   b) is studying
   c) being studied
7. The plant (строящийся) here will produce radio-sets.
   a) building
   b) having been built
   c) being built
8. She (мылась) her bath when I phoned.
   a) taking
   b) was taking
   c) being taken

X. Write the number of the sentence in which *asked* is translated as «заданный» into Russian.

1. Having asked a permission she did not come to the meeting.
2. Being asked in German I could not understand a single word.
3. The teacher did not like the question asked by a boy from the first desk.

4. He will be asked to leave the room.
5. The questions asked at the symposium are very important.
6. Having been asked to translate the article, the student translated it with great interest.
7. I couldn't hear what I was asked to do.
8. When asked about the political situation in the country, I gave a full answer.

XI. Choose the correct translation of the underlined part of the sentence.

1. The temperature increasing, the motion of the molecules of a substance speeds up.
   a) возрастающая температура
   b) когда температура возрастает
   c) то, что температура возрастает
2. The great success achieved in automation improved the conditions of work.
   a) когда успех достигнут
   b) достигнув успех
   c) успех, достигнутый
3. The concert being over, the lottery was next.
   a) закончился
   b) закончившийся
   c) закончившись
4. Sir Henry was deep in his papers, his long hands moving nervously.
   a) когда руки двигались
   b) то, что руки двигались
   c) а руки двигались
5. Having been shown the wrong direction, the travelers soon lost their way.
   a) когда им показали
   b) показав
   c) показывая
6. Then she jumped away and ran around the desks, with Tom running after her.
   a) когда Том бежал за ней
   b) причем Том бежал за ней
   c) после того как Том бежал за ней

TRANSLATION

XII. Translate the sentences from English into Russian.

1. Scientists are working hard to find an alternative to fossil fuels.
2. Our cars will probably use stored energy from batteries.

3. To get hydrogen we must separate it from other elements, using water or natural gas.
4. Natural gas is made up of carbon and hydrogen molecules.
5. Most fuel-cell-powered vehicles being developed use a reformer to get hydrogen from gasoline.
6. Plastic bags are already polluting oceans and killing wildlife.
7. The Petroleum Exploration Society of Australia (PESA) is a non-profit association of individuals involved in the exploration of oil and gas.
8. The organization achieves the aim by providing opportunities for individuals interested in oil and gas exploration to discuss technical and professional matters relating to the petroleum industry.
9. With excess of 80,000 members embracing all disciplines of the engineering team, the association is the largest professional organization for engineers in Australia.
10. Containers, for example bottles and cups, were made from glass, and clay – soft earth that becomes hard when cooked.

WRITING

XIII. Write an abstract (100–120 words) to the following article. (For more details you may see Writing Reference p. 202)

GAS IN CRISIS?

The world is changing fast. There is an energy crisis on the horizon for Europe. If we take natural gas as an example it would seem at first glance that countries such as Norway, Britain and the Netherlands have sufficient gas reserves to supply Europe for some time to come. However, this is misleading; most of these reserves will be used up over the next ten to twenty years. Even if more deposits are found in the North Sea or the Atlantic Ocean the problem will still not be solved. The continent must turn to Russia where there are huge quantities of gas underground. This country is in the happy position of being the gas giant of the world.

Other nations are also approaching Moscow to cover their energy requirements. The economies of countries such as China and India are expanding dramatically and they are going to need massive amounts of energy, which includes gas. Will there be enough of this commodity to satisfy the needs of Asia and Europe? This is by no means certain, and the consequence could be a shortage of gas imports, which could lead to power cuts in some European countries in the future.

There is one other source of gas – LNG, liquefied natural gas. This is transported by ship from such places as the Arabian Peninsula. Nevertheless, it is questionable if these supplies can ever be a realistic alternative to gas

which is imported by pipeline; the simple fact is that the volumes shipped would never meet demand.

People are therefore right to be worried. Political leaders and companies must tackle this issue; we need a secure and reliable supply of gas for the long term. This inevitably means that wholesale prices will soar, but this is still better than the nightmare scenario of freezing in our homes or having no power for our industry.

Abridged from Campbell, S. English for the Energy Industries, Oxford University Press, 2009.

TEST 3

Variant 2

READING

I. Read the text and match the headings (1–4) with the paragraphs (A–D).

1. Separating responsibilities ____
2. A number of tasks to solve ____
3. A really complicated process ____
4. Long-term activities ____

DISCOVERY TO PRODUCTION

A. The process that begins with discovering oil and ends with exploiting is long and difficult. From start to finish it can take as much as eight to ten years, especially if the company has to drill in deep water or Arctic conditions.

B. After the discovery the process begins with studies to see if the field can be exploited at a profit. The oil company has to estimate the future costs of pumping out the oil and getting it to market and predict the prices of oil and gas in many years' time. The company also has to think about the risks the project could bring. These risks can be financial and political; if they are badly judged, they might even damage the company's reputation. For example, if they destroy the habitat of an endangered species, this could bring them a lot of bad publicity.

C. If the company still believes the project is viable and it can obtain the finance, then the detailed planning can begin. The aim is to finish it on time and not go over budget. Next, senior managers in the oil company have to choose the consultants and contractors that can bring their knowledge and skills to each stage of the project. The consulting firms and contractors examine the project and bid for different parts of it.

D. These firms have their own teams and suppliers. During the project, thousands of people can be involved. At each level, the project has to be checked and coordinated. The hundreds of smaller projects that make up the entire project have to be managed. Each job has its own list of tasks and deadlines. Perhaps the most important factor is to have a good project manager and realistic schedules.

Abridged from: Naunton, J, Pohl, A. Oil and Gas 1, Oxford University Press, 2011.

II. Read about the refinery operation. Write whether the following statements are true (T) or false (F).

Statement	True/False (T/F)	
1. An oil refinery is just a complicated maze of steel towers and pipes.		
2. A typical refinery employs as many as three thousand people these days.		
3. Workers need to ride bicycles to get from one part of the refinery complex to another.		
4. An oil refinery needs the distillation tower.		
5. The heaviest products rise to the top.		
6. An oil refinery is environmentally safe.		

HOW A REFINERY WORKS

An oil refinery is a more than just a complicated maze of steel towers and pipes. It is actually a factory that turns crude oil into petroleum gas, petrol, gasoline, kerosene, diesel oil, fuel oil, asphalt, bitumen, and many other products.

A typical refinery these days costs billions of dollars to build, and millions more just to maintain and upgrade. Large refineries are complex operations that run 365 days a year, employ as many as 2,000 people, and may occupy as much land as several hundred football fields. Some are so big and sprawling that workers need to ride bicycles just to get from one part of the refinery complex to another.

Here is how an oil refinery works. First, the crude oil is pumped into the furnace, where it is boiled. Next, the boiling oil enters the bottom of the distillation tower. Boiling separates the crude oil into fractions. Fraction means part. The fractions of crude oil are products with different boiling points: petroleum gas, petrol, and so on. The lightest product, petroleum gas, rises to the top. The heaviest products, like asphalt, sink to the bottom. After the products are separated, they are piped out of the tower. The different products are stored in tanks in the refinery. Finally, they are taken out of the refinery by tanker lorry, rail tanker, boat, or pipeline.

In addition to making useful petroleum products, fractional distillation and other refinery processes also can create noise, odour, air pollution, and water pollution. Most countries have environmental rules that refineries must follow. All refineries must monitor and control possible problems. Every refinery has a safety and environment officer. His or her job is to make sure the refinery follows the rules.

Abridged from: Naunton, J, Pohl, A. Oil and Gas 1, Oxford University Press, 2011.

III. Read the text and answer the questions.

1. What are the three main methods used in oil and gas exploration?
2. Why are satellite photographs useful?
3. What is a well log, and why is it important to keep one?
4. What sort of samples do chemists take? How can this help in the search?
5. What is the difference between a magnetometer and a gravimeter?
6. How do scientists carry out seismic exploration? Which methods are used on land?

OIL AND GAS EXPLORATION METHODS

In geological methods photographs are taken from planes or satellites. These are then examined by geologists.They look for the special rock formations where oil is often found. These can be seen from the air. Afterwards, geologists on the ground collect rock samples and analyse them.

When a possible future oil field is identified, the next step is to drill an exploratory well. These are sometimes called 'wildcat wells'. Each time a new well is drilled, a 'well log' is created. The 'well log' is a record of the rocks and the depths at which they are found. Geologists also keep core samples for analysis. Geologists can use the information from different well logs to construct a map of the area between the wells. This process is called 'geological reasoning'. This can help to identify where there are perhaps 'petroleum traps' for future drilling.

Using geochemical methods geochemists analyse samples of surface water and soil for small amounts of oil and gas that show oil or gas reserves. A gas chromatograph can analyse gas. At sea, hydrocarbons can be found by equipment that is pulled along in the water.

Geophysicists use mathematics and physics to create a picture of the sub-surface. Geophysical methods being used, the scientists can identify types of rock by their density (mass) and magnetic qualities. They use different equipment in their search. A gravimeter shows rock density, and a magnetometer measures magnetic fields. A magnetometer can be used in planes while flying over an area. Another method is seismic exploration, which uses sound. Shock waves are produced by explosives placed in a hole in the ground. These waves are reflected back and show the different kinds of rock under the surface. Instead of explosives, a vibrator truck can be used.

Abridged from: Naunton, J, Pohl, A. Oil and Gas 2, Oxford University Press, 2011.

VOCABULARY AND TERMINOLOGY

IV. Read the text OIL AND GAS EXPLORATION METHODS in detail and match the English word-combinations (1–10) with the Russian equivalents (a–j).

1)	take photographs from satellites	a)	искать особые пластовые образования
2)	look for the special rock formations	b)	выявить возможное нефтяное месторождение
3)	keep core samples	c)	измерять магнитное поле
4)	identify a possible oil field	d)	воссоздавать проекцию приповерхностных пород (разрез)
5)	drill exploratory well	e)	брать образцы керна
6)	measure magnetic field	f)	производить ударные волны
7)	use the information from well logs	g)	использовать данные каротажных диаграмм
8)	create a picture of subsurface	h)	помещать взрывчатые вещества в скважину
9)	produce shock waves	i)	получать фотографии со спутников
10)	place explosives in a hole	j)	бурить поисково-разведочные скважины

V. For questions 1–5, choose one of the words (a–f) that best completes a gap in the text. You can use each word only once. There is one extra word.

a)	**explosives**	**c)**	**measures**	**e)**	**identify**
b)	**qualities**	**d)**	**density**	**f)**	**subsurface**

Geophysical Exploration

In geophysical exploration the scientists 1) ____ types of rock by their mass and magnetic 2) _____. They use different equipment in their search. A magnetometer 3) _____ magnetic fields. A magnetometer can be used in planes while flying over an area. Seismic exploration uses sound. Shock waves are produced by 4) _____ that are placed in a hole in the ground. These waves are reflected back and show the different kinds of rock in the 5) ____.

VI. Fill in the gaps with the given derivatives.

explode explosion explosive explosives explosibility

1. The shooter actuates _____ at certain time in seismic exploration.
2. The responsibilities of a shooter also involve cleaning an area after the _____ .

3. _____ of the substance can result in many problems.
4. The dynamite can ____ at any moment.
5. _____ force of volcanic eruption was enormous.
6. Their mission was to _____ these devices in public places.

VII. Complete the summary of the text OIL AND GAS EXPLORATION METHODS. Use only one word in each sentence.

1. In the geological methods geologists examine _____ photographs.
2. Then geologists collect _____ samples for analysis.
3. At the exploration stage exploratory wells are built which are sometimes called_____ wells.
4. Geologists also help to construct _____ of the area between the wells.
5. Geochemists can use a _____ to find gas that shows oil reserves.
6. Geophysicists measure density of rocks and _____ qualities.
7. They use different _____ in their work.
8. For example, a _____ shows rock density.

VIII. Match the terms (1–10) with the definitions (a–j).

1)	estimate	a)	able to be done in a successful way.
2)	bitumen	b)	a person or a company that does work or provides goods for another company.
3)	viable	c)	the temperature at which a liquid starts to become a gas.
4)	contractor	d)	a thick black substance obtained from oil, used for covering roads or roofs.
5)	maintain	e)	a device that analyses the chemicals contained in a mixture by passing the mixture through a material that separates the different elements.
6)	boiling point	f)	the thickness of a substance measured by its mass per unit of volume.
7)	fractional distillation	g)	to keep a building or a machine in good condition by checking or repairing it regularly.
8)	chromato-graph	h)	an instrument that shows the density of rock by measuring the difference in the force of gravity from one place to another.
9)	density	i)	a guess or a calculation of the likely cost of some-thing, based on the information that you have.
10)	gravimeter	j)	the process of separating the different substances within crude oil by heating it until it becomes a gas and then collecting the gas and liquids that form at different temperatures.

GRAMMAR

IX. Choose the correct translation of the word in brackets.

1. The professor (читающий) lectures at our university is a well-known scientist.
   a) when delivering
   b) delivering
   c) is delivering
2. (Проводя) experiments, students use many devices.
   a) making
   b) having made
   c) being made
3. They (обсуждают) the plans for the next year.
   a) while discussing
   b) discussing
   c) are discussing
4. (Окончив) their work they left the building.
   a) having finished
   b) finishing
   c) have finished
5. The device (измеряющий) a temperature is called a thermometer.
   a) having been measured
   b) measuring
   c) is measuring
6. (Переводя) the article he consulted the dictionary.
   a) translating
   b) is translating
   c) being translated
7. The substance (растворенное) was colourless.
   a) having been dissolved
   b) was dissolved
   c) being dissolved
8. Imagine that the ship (движется) in space.
   a) moving
   b) is moving
   c) while moving

X. Write the number of the sentence in which *sent* is translated as «отправленный» into Russian.

1. Being sent on business to London my friend hoped to improve his English.
2. Telegrams sent at the night time must be paid for reduced price.
3. When he hadn’t received the answer to his invitation, he sent a postcard.
4. The present for her birthday was sent by a stranger.

5. Having sent the article to a magazine he waited for the answer.
6. The new furniture will be sent to your house in two days.
7. Having been sent on the Internet the message came in time.
8. The letter sent was not delivered to the address.

XI. Choose the correct translation of the underlined part of the sentence.

1. The gas being compressed, the number of molecules in the same volume increases.
   a) сжимаемый
   b) сжимается
   c) сжимая
2. Having prescribed the medicine, the doctor went away.
   a) выписано
   b) выписывая
   c) выписав
3. Electrons moving through a wire, electrical current is generated.
   a) перемещающиеся
   b) перемещаются
   c) перемещаясь
4. Radio was invented in russia, its inventor being the russian scientist a.s. popov.
   a) когда его изобретателем был
   b) будучи изобретателем
   c) а его изобретателем был
5. He slowly and carefully spread the paper on the desk, with lowell closely watching.
   a) смотрела
   b) смотрящая
   c) смотря
6. The tree struck by lightning was all black.
   a) ударяет
   b) ударяющее
   c) ударенное

TRANSLATION

XI. Translate the sentences from English into Russian.

1. After the discovery the process begins with studies to see if the field can be exploited at a profit.
2. If the company believes the project is viable, then the detailed planning can begin.
3. The consulting firms and contractors examine the project and bid for different parts of it.

4. During the project, thousands of people can be involved.
5. The different products are stored in tanks in the refinery.
6. Using geochemical methods geochemists analyse samples of surface water and soil.
7. Geophysical methods being used, the scientists can identify types of rock by their density and magnetic qualities.
8. A magnetometer can be used in planes while flying over an area.
9. Shock waves are produced by explosives placed in a hole in the ground.
10. Drake decided to drill a well and locate the source of the seep oil, using the same steam-powered equipment which prospectors used to drill brine wells.

WRITING

XII. Write an abstract (100–120 words) to the following article. (For more details you may see Writing Reference p. 202)

THE EARLY OIL INDUSTRY OF PENNSYLVANIA

Oil Creek in western Pennsylvania abounds in oil seeps that ooze thick black crude into creeks. These seeps were well known to the Seneca Indians, one of the Iroquois Nation tribes, who used the oil as a salve, mosquito repellent, purge and tonic. Many settlers also believed that these oils were medicinal, and sold bottles of it, as a medicine called "Seneca Oil" in 1792.

Historically, oil was collected at Oil Creek by damming the creek near a seep, then skimming oil off the top of the resulting pond. Edwin Drake, an unemployed railroad conductor and express agent, tried this method, but even with improvements and opening up other seeps in the area, he only increased production from three or four gallons a day. Next workers tried digging a shaft to mine the oil, but groundwater flooded in too quickly. Finally, Drake decided to drill a well and locate the source of the oil seep, using the same steam-powered equipment used to drill brine wells.

He hired a blacksmith named "Billy" Smith, who had drilled brine wells for local prospectors in the Pittsburgh area. Smith, with his son Samuel, began drilling in the summer of 1859. Although progress was slow, usually three feet a day, they reached a depth of 69½ feet by August 27. When Billy and Samuel pulled their drilling tools from the well the next morning, they noticed oil rising in the hole. After installing a hand-operated lever pump borrowed from a local kitchen, the production in the first days was about twenty-five barrels. Production soon dropped off to a steady ten barrels a day, and continued at that rate for a year or more.

Although Drake's well was no gusher, it was the beginning of an idea.

Abridged from San Joaquin Valley Geology, Early Oil Industry of Pennsylvania, 2017. Retrieved from http://www.sjvgeology.com.

TEST 3

Variant 3

READING

I. Read the text and match the headings (1–4) with the paragraphs (A–D).

1. Better prevent than recover ____
2. Effective rescue operations ____
3. Effects on the marine environment ____
4. Major or minor- they happen every year ____

OIL SPILLS

A. Oil spill, leakage of petroleum onto the surface of a large body of water. Oceanic oil spills became a major environmental problem in the 1960s, chiefly as a result of intensified petroleum exploration and production on continental shelves. Spectacular oil spills from wrecked or damaged supertankers are now rare because of strict shipping and environmental regulations. Nevertheless, thousands of minor and several major oil spills caused by discharges and tanker operations are reported each year.

B. The costs of oil spills are considerable in both economic and ecological terms. Oil on ocean surfaces is harmful to many forms of life because it prevents sunlight from penetrating the surface. Crude oil ruins the insulating and waterproofing properties of feathers and fur, and thus oil-coated birds and marine mammals may die from hypothermia. Moreover, oil can be toxic to animals, and can damage their habitat and reproductive rate may slow the recovery of animal populations.

C. The immediate environmental effects of oil spills have been readily identified, but their influence on the ecological system of a polluted area is more difficult to assess. The cost of paying compensation to individuals and communities damaged by oil spills has been a major cause to reduce the chances of such events in the future.

D. No really satisfactory method has been developed for cleaning up major oil spills. The rescue workers usually collect the oil and remove enough of it so that economic activity and the natural recovery processes of the marine environment can continue. Floating booms can be placed around the source of the spill to reduce the spreading of an oil slick over the sea surface. Skimming involves various mechanisms that physically separate the oil from the water and place the oil into collection tanks. Another approach is to use various sorbents (e.g., straw, volcanic ash) that absorb the oil from the water. Onshore removal of oil from polluted sandy beaches is an effective ac-

tion which is usually performed with hand tools or operating heavy construction-type equipment to scrape up contaminated debris and haul it away.
Abridged from: Oil spill. Petroleum engineering. Encyclopeadia Britannica, 2018.

II. Read about the types of companies in oil and gas industry and write whether the following statements are true (T) or false (F).

Statement	True/False (T/F)	
1. A drilling operator is a company that owns the drilling rig.		
2. Halliburton is a drilling operator.		
3. The contractors follow the rules and regulations of the operators.		
4. A consultant is a kind of a company which consists of experts who can support a drilling team at some time.		
5. A contractor supplies different software to service companies and operators.		
6. The work of service companies is needed occasionally.		

MAJOR PLAYERS IN PETROLEUM INDUSTRY

A drilling operator is an oil company that has successfully tendered for, and owns the mineral rights, leases and permits to explore in a particular area. After a drilling plan has been approved, the operator orders the necessary materials and equipment, and recruits the contractors and service companies. The operator may be a national oil company (NOC), a public oil company, or a private one. The biggest groups are the national oil companies that control and produce three quarters of the world's oil. Examples include Sinopec and Petrobras. The most well known operators are the public companies such as Exxon Mobil and Shell.

The drilling operator is responsible for the project, they win the contracts, and deal with governments and other official bodies. There might be 10-30 different companies involved in a project but the operator is there at the beginning, and the end, from planning to decommissioning.

Contractors are companies that own the drilling rigs. The crew includes the roughnecks, drillers, toolpushers and other staff that tend to be less skilled, and local. Examples include Transocean, Ensco or Patterson UTI. The contractors work for the operators and follow the drilling plan. The rules, guidelines and regulations are also set out for the staff of the contractor to follow.

A version of a contractor is a consultant who might work individually, or for a small group. These are specialists and subject matter experts. They might be called upon to support a drilling team during a particularly challenging well operation.

A service company fills in the supply gaps for the contractors and operators. These can include many different physical products as well as services such as logistics, supply chain, software and training. Halliburton, Baker Hughes and Schlumberger are huge service companies, so not all service companies are small.

There are so many parts of a drilling and completions operation, the contractors and operators choose not to do absolutely everything. They focus on what they specialise in. Many of the roles of a service company are only needed occasionally or are very specialised. This means that it makes more sense to contract on-demand, or for fixed job scopes.

Abridged from: Lavis, J. Drilling operators, contractors and service companie, 2017.

III. Read the text and answer the questions.

1. Why do people believe that oil production from conventional wells will decline?
2. What does "easy oil" mean?
3. What does Hubbert's bell-shaped curve tell us?
4. Why do some people think that oil production peaked at some time in the last ten years?
5. Why do some people believe that oil prices will increase in the future?
6. How will technology help produce enough oil in the future?

ARE OIL SUPPLIES NOW FALLING?

Over the last 150 years, there has been a rapid increase in the amount of oil produced around the world. The result has been a rapid economic growth and a higher standard of living. However, oil is a finite, non-renewable resource and many people believe that there will be a time when oil production (extraction and refining) from conventional wells begins to decline. This will happen when we have used up about half of the possible reserves.

Up until now oil companies have extracted oil from easy-to-reach places – on land, near the surface, under pressure. Now oil extraction is taking place offshore, in deep wells, and in environmentally sensitive areas and in the future it will become increasingly expensive to extract oil in these more difficult environments.

M King Hubbert was a geophysicist who worked for Shell Oil Company. He developed a theory known as the Hubbert Peak. The theory which

says that production of oil reaches a maximum point, or peak, and then begins to decline. He showed this in a bell-shaped curve.

Deciding on a time when world oil production will peak is very difficult. Most people agree that oil production will peak but they cannot agree when this will happen. Production from many of the world's largest oilfields is now in decline and some people believe oil production peaked up to ten years ago. However, new oilfields are beginning production and many people believe that the peak has not been reached yet. We will only know when production has peaked after it has happened!

People also disagree about the results of peak oil. Some believe that as oil supplies fall, prices will rise because supply will not meet demand and we will have to change the way we live dramatically. Other people believe that developments in technology will mean that life will change very little. It is already possible to extract a higher percentage of oil from conventional wells. Oil can be extracted from unconventional sources, for example heavy crude oil, oil sands, but production costs are high. Some people believe that new technology in transport and more efficient use of power will mean that the demand for oil will fall and that there will be enough oil to meet demand for many years in the future. If we control oil production carefully, there will be enough oil for the next hundred years.

Abridged from: Naunton, J, Pohl, A. Oil and Gas 2, Oxford University Press, 2011.

VOCABULARY AND TERMINOLOGY

IV. Read the text ARE OIL SUPPLIES NOW FALLING? in detail and match the English word-combinations (1–10) with the Russian equivalents (a–j).

1)	a rapid increase in the amount	a)	более высокий процент нефти, полученной из обычно применяемых скважин
2)	decline of production	b)	природоохранные зоны
3)	higher percentage of oil from conventional wells	c)	достигать максимального значения
4)	environmentally sensitive areas	d)	удовлетворять спрос на нефть
5)	reach a maximum point	e)	падание уровня добычи
6)	show in a bell-shaped curve	f)	добывать (извлекать) из нетрадиционных источников
7)	oil supplies fall	g)	запасы нефти снижаются
8)	meet demand for oil	h)	показывать в виде колоколообразной кривой

9)	extract from unconventional sources	i)	происходить (проходить) на шельфе (в море)
10)	take place offshore	j)	резкое увеличение количества

V. For questions 1–5, choose one of the words (a–f) that best completes a gap in the text. You can use each word only once. There is one extra word.

a)	**demand**	**c)**	**percentage**	**e)**	**production**
b)	**curve**	**d)**	**fall**	**f)**	**unconventional**

Effects of Oil Peak

Some people believe that if oil production peaks, oil supplies will not meet 1) ____ of society and we will change our live dramatically. Other people believe that developments in technology will help to extract a higher 2) _____ of oil from conventional wells. Experts will extract oil from 3) _____ sources but the costs of 4) _____ are high. Many people believe there will be new technology in transport and more efficient use of power and the demand for oil will 4) _____.

VI. Fill in the gaps with the given derivatives.

investigate investigations investigators investigative

1. The task is to _____ a hydrocarbon deposit that can be economically exploited.
2. A team of _____ have had a great success in the search.
3. Geophysical _____ employ electronic equipment that can detect slight contrasts in specific gravity.
4. Exploration is commonly carried out by an _____ team that includes geologists, geochemists and geophysicists.
5. _____ have studied the possible effects of pollution.
6. Specialists _____ oil deposits by means of numerous drillings to obtain samples.

VII. Complete the summary of the text ARE OIL SUPPLIES NOW FALLING? Use only one word in each sentence.

1. At present we see a rapid ___ in the amount of oil production.
2. The oil production from _____ wells declines.
3. Oil companies often extract oil in environmentally _____ areas.
4. M King Hubbert _____ a theory which is called the Hubbert Peak.
5. This theory tells that oil production reaches a maximum ____ and then declines.

6. If oil supplies fall, the prices will _____.
7. New technology will help to extract oil from unconventional _____.
8. More efficient use of the power will help to _____ the demand for oil in the future.

VIII. Match the terms (1–10) with the definitions (a–j).

1)	production	a)	an amount of something that is available for use, reserves.
2)	peak	b)	all people working on a ship, plane.
3)	supply	c)	to flow somewhere.
4)	rig	d)	the place where a particular type of animal or plant is normally found.
5)	crew	e)	to remove rubbish, dir from somewhere, such as oil that has split because of an accident.
6)	roughneck	f)	to harm or spoil something.
7)	discharge (of a gas or fluid)	g)	a large structure in the sea with equipment for drilling for oil and gas under the seabed.
8)	habitat	h)	a skilled person who works on a drill, for example , by connecting and separating the pipes.
9)	clean up	i)	to reach the highest level or best point.
10)	damage	j)	the process of removing oil or gas from the ground and transporting it.

GRAMMAR

IX. Choose the correct translation of the word in brackets.

1. Scientists (изучающий) the properties of a substance will apply it in research.
   a) studying
   b) while studying
   c) is studying
2. (Используя) the device, we got accurate data.
   a) having used
   b) using
   c) being used
3. The staff of the laboratory (заканчивает) the work on the apparatus.
   a) is finishing
   b) was finishing
   c) is being finished

4. (Подвергшись охлаждению) to a low temperature many substances get new properties.
   a) having cooled
   b) cooling
   c) having been cooled
5. The changes (влияющие) the composition of materials are chemical changes.
   a) is affecting
   b) affecting
   c) if affecting
6. (Изучая) elements Mendeleyev found that they could be divided into nine groups.
   a) studying
   b) is studying
   c) having studied
7. When I came into the office the secretary (просматривала) the papers.
   a) looking through
   b) was looking through
   c) looked through
8. The house (строящийся) here will have been finished by 2012.
   a) building
   b) having been built
   c) being built

X. Write the number of the sentence in which *heated* is translated as «нагретый» into Russian.

1. The heated air is lighter than cold.
2. Some substances can be heated under pressure.
3. Being heated for a long time the liquid becomes viscous.
4. When heated the mixture changed its colour.
5. Having heated the solution we used it for the second time.
6. The compound heated melted slowly.
7. The scientists heated the gas which increased in volume.
8. Having been heated to a high temperature the glass bottle broke.

XI. Choose the correct translation of the underlined part of the sentence.

1. The dress <u>bought</u> at the department store was very beautiful.
   a) купленное
   b) купил
   c) покупая

2. Having eaten all the potatoes, she drank a cup of coffee.
   a) ест
   b) съев
   c) поедая
3. The engineer testing the device, nobody is allowed to come in.
   a) проверяя
   b) проверяющий
   c) проверяет
4. He stood, with his arms folded.
   a) когда его руки были связаны
   b) а его руки были связаны
   c) с его руками связанными
5. It being late, they decided to go home.
   a) было поздно
   b) будучи поздними
   c) опоздали
6. She sat looking into the fire, the sock forgotten on her knee.
   a) забытый
   b) забыла
   c) забыв

TRANSLATION

XII. Translate the sentences from English into Russian.

1. Over the last 150 years, there has been a rapid increase in the amount of oil produced around the world.
2. Now oil extraction is taking place offshore.
3. However, new oilfields are beginning production and many people believe that the peak has not been reached yet.
4. Oil can be extracted from unconventional sources.
5. Contractors are companies that own the drilling rigs.
6. Oceanic oil spills became a major environmental problem in the 1960s, chiefly as a result of intensified petroleum exploration and production.
7. Spectacular oil spills from wrecked or damaged supertankers are now rare.
8. Thousands of minor and several major oil spills caused by discharges and tanker operations are reported each year.
9. Crude oil ruins the insulating and waterproofing properties of feathers and fur.
10. Their influence on the ecological system of a polluted area is sufficient.

WRITING

XII. Write an abstract (100–120 words) to the following article. (For more details you may see Writing Reference p. 202)

RESERVOIR ENGINEERS AT WORK

Reservoir engineering involves assessing oil and gas deposits. Reservoir engineers firstly estimate the size of a reservoir and then determine how much oil and gas reserves are in the reservoir and finally work out how to maximize the economic return from extracting them.

Since it is usually not possible to physically ascertain what's under the ground, a reservoir engineer needs to find other ways to establish what is there. They work together with geologists and geophysicists to find the reserves of oil and gas while relying on the basic laws of physics and chemistry. These include applying the behavioral effects of liquid and vapour phases of oil, natural gas, and water in rock.

The next step is to determine the economic feasibility of extracting the gas. Then, assuming it is viable on paper, a well is produced. After that, the reservoir engineer will keep track of reserve production progress until completion.

The ultimate responsibility of the reservoir engineer is to maximise the output of the reservoir without causing overproduction. Overproduction implies producing more than storage, transport, processing and selling capacity at any given time. This generally leads to wasted resources and shortens the lifespan of the reservoir. Reservoir engineers generally operate in an office with occasional site visits.

One type of reservoir engineers is a production engineer. A production engineer's job involves designing and selecting the equipment that will get the well to produce oil and gas after it is drilled. The production engineer will then oversee the well to ensure it is flowing making oil or gas and continues to be economically viable. They also recommend modifications to maximise the efficiency of oil and gas recovery.

Production engineers are usually petroleum engineers, however sometimes an engineer from a different discipline will be trained on production engineering tasks.

Abridged from: What do Petroleum Engineers Do? School of Petroleum Engineering, UNSW, Sydney, 2015.

TEST 3

Variant 4

READING

I. Read the text and match the headings (1–4) with the paragraphs (A–D).

1. It is about producibility ____
2. Percentage of geological risk ____
3. Estimates used in practice ____
4. From resources to reserves ____

RESERVES AND RESOURCES

A. Resources are hydrocarbons which may or may not be produced in the future. A resource number may be assigned to an undrilled prospect or an unappraised discovery. Appraisal by drilling additional wells or getting extra seismic data will confirm the size of the field and lead to project sanction. At this point the government gives the oil company a production licence to develop the field. After this oil reserves can be formally booked.

B. Oil reserves are primarily a measure of geological risk. They show the probability of oil which is producible under current economic conditions. The three categories of reserves generally used are proven, probable, and possible reserves.

C. Proven reserves are defined as oil and gas "Reasonably Certain" to be producible using current technology at current prices are also known in the industry as 1P. Some industry specialists refer to this as P90 – i. e having a 90 % certainty of being produced. Probable reserves are oil and gas "Reasonably Probable" of being produced using current or likely technology at current prices. Some industry specialists refer to this as P50 – i. e having a 50 % certainty of being produced. This is also known in the industry as 2P or Proven plus probable. Possible reserves – i. e "having a chance of being developed under favourable circumstances". Some industry specialists refer to this as P10 – i.e having a 10 % certainty of being produced. This is also known in the industry as 3P or Proven plus probable plus possible.

D. Oil and gas reserves are the main asset of an oil company. Booking is the process by which they are added to the Balance sheet. This is done according to a set of rules developed by the Society of Petroleum Engineers (SPE). For practical purposes companies will use proven plus probable estimate (2P), and for long term planning they will be looking primarily at possible reserves.

Abridged from: Reserves and Resources. Mineral Resource Classification http://en.wikipedia.org

II. Read about the accident at the refinery and write whether the following statements are true (T) or false (F).

	Statement	True/False (T/F)	
1	There was a warning on the instrument panel.		
2	An alarm was not working.		
3	An operator opened the valves.		
4	The blow-down drum was supposed to deal with excess liquid.		
5	The gas and liquid escaped through a broken pipe.		
6	The vehicle was in a dangerous area.		

THE BP TEXAS CITY REFINERY ACCIDENT

Accidents do not happen very often, but when they do, they can have terrible results. On 23 March 2005, an explosion at BP's Texas City Refinery killed fifteen workers and injured more than 170 others.

A splitter that separates light and heavy gasoline was started up after a two-week shutdown. Operators did not follow orders on the instrument panel. As a result, the splitter filled up with too much liquid that then became too hot. Someone had turned off the alarm that warned about over-filling. So much pressure built up in the production tower that three valves opened automatically. Liquid flowed into the blow-down drum: a container that was supposed to deal with this. Unfortunately there was too much fuel in the drum so that liquid and vapour went up the 113-foot vent into the open air. Although experts had recommended a flare system to burn off dangerous gas, BP said it did not need one. So the mixture of gas and liquid fell to the ground. There, a spark from a vehicle set off an enormous explosion. The vehicle should not have been in the area. The explosion blew up a large part of the area and could be heard many miles away. Eleven of the people who were killed were having a meeting in a trailer in the danger zone. The trailer should have been further away. Other victims were carrying out maintenance work nearby. An enquiry into the accident indicated the basic causes were equipment failure, risk management, staff management, and working culture.
Abridged from: Naunton, J, Pohl, A. Oil and Gas 2, Oxford University Press, 2011.

III. Read the text and answer the questions.

1. How were oil-producing countries paid before OPEC was formed?
2. How did OPEC manage to increase the price of oil?
3. What happened to oil prices in the 1970s?
4. Why is OPEC no longer as powerful as it once was?
5. Who invented the term the 'Seven Sisters'?

6. How do you think the supply of oil and gas will change? Who will be the 'Seven Sisters' of 2050?

OIL AND POWER

OPEC (the Organization of Petroleum Exporting Countries) was created in 1960 by Iran, Kuwait Iraq, Saudi Arabia, and Venezuela. At that time the oil industry was still dominated by foreign oil companies operating in those countries. The governments of countries where the oil was found only received a share of these companies' profits. Despite the increase of world demand for oil, the price continued to drop.

OPEC was formed to protect the interests of oil-producing countries. It is a cartel, that is, a club of producers. Members realized that they could get a fairer price for their oil by agreeing on how much oil to supply to the market. The law of supply and demand would do the rest. During the 1960s, OPEC gradually increased its influence. In the early 1970s, it caused a large increase in the price of petroleum by limiting production.

Currently there are eleven members, although countries do join and leave. Nowadays, OPEC has less influence over oil prices as there have been discoveries by non-OPEC countries. Nevertheless OPEC members still control almost half of the world's oil supply.

The 'Seven Sisters' were the most important companies and controlled most of the oil-wealth of the world. They were given this name by the Italian oil executive Enrico Mattei. The Seven Sisters were the members of a consortium that was created to reintroduce Iranian oil to the market after nationalization. They were Standard Oil of New Jersey, Royal Dutch Shell, Anglo Persian Oil Company, Standard Oil of New York, Standard Oil of California, Gulf Oil, Texaco.

However, since then, the power of these companies has declined as oil-producing countries have claimed the industry as their own. In addition, new discoveries and new companies have changed the face of the oil and gas industry. According to the Financial Times newspaper, the new Seven Sisters are (listed in order of importance): Saudi Aramco (Saudi Arabia), Gazprom (Russia), CNPC (China), NIOC (Iran), PDVSA (Venezuela), Petrobras (Brazil), Petronas (Malaysia).

VOCABULARY AND TERMINOLOGY

IV. Read the text OIL AND POWER in detail and match the English word-combinations (1–10) with the Russian equivalents (a–j).

1)	dominate in oil industry	a)	поставлять на рынок
2)	receive a share of profits	b)	защищать интересы
3)	increase world demand for oil	c)	получать долю доходов

4)	protect the interests	d)	вызывать увеличение цен на нефть
5)	supply to the market	e)	объявить эту сферу промышленности своей собственной
6)	have the influence over oil prices	f)	представлять нефть вновь на рынке
7)	cause an increase in the price of petroleum	g)	иметь влияние на цены на нефть
8)	limit production	h)	увеличить мировой спрос на нефть
9)	reintroduce oil to the market after nationalization	i)	преобладать в нефтяной промышленности
10)	claim the industry as their own	j)	ограничить добычу

V. For questions 1–5, choose one of the words (a–f) that best completes a gap in the text. You can use each word only once. There is one extra word.

a)	**protect**	**c)**	**supply**	**e)**	**caused**
b)	**demand**	**d)**	**influence**	**f)**	**share**

Aim of OPEC Foundation

OPEC was formed to 1) _____ the interests of oil-producing countries. The members of the cartel realized that they could get a fairer price for their oil if they control the amount of oil which they will 2) _____ to the market. Then the law of supply and 3) ____ will work. Over the decade OPEC gradually increased its 4) _____ on the market. After limiting production it 5) _____ a large increase in the price of petroleum.

VI. Fill in the gaps with the given derivatives.

store stored storing storage

1. There is a lot of energy _____ in the molten part of the Earth.
2. Wind, ocean currents and evaporation of water only temporary ___ energy.
3. There is also kinetic and potential energy _____ in the Earth-Moon-Sun system.
4. Oil tanks are used for ____ of oil.
5. It is known that there are different methods of ____ energy.
6. His speciality is oil transport and _____.

VII. Complete the summary of the text OIL AND POWER. Use only one word in each sentence.

1. In 1960, foreign oil companies _____ the oil industry.
2. The governments of Iran, Kuwait Iraq, Saudi Arabia, and Venezuela received only a share of operating companies _____ .
3. The oil-producing countries created OPEC, a club of _____ .
4. OPEC members controlled oil supply to the _____ .
5. At present OPEC has less _____ over the oil prices.
6. The most important companies who controlled the oil market are the Seven ____ .
7. Later the power of these companies has _____ .
8. In course of time the members of this consortium have _____ .

VIII. Match the terms (1–10) with the definitions (a–j).

1)	seismic	a)	an unpleasant event that happens unexpectedly and lead to injury or damage.
2)	rules	b)	a place where oil is separated into different substances.
3)	accident	c)	provide somebody with something that they need.
4)	explosion	d)	to manage an organization or process.
5)	refinery	e)	make sure that a person or a thing is not harmed or damaged.
6)	operate	f)	a device that opens and closes and which is used for controlling the flow of a liquid or gas through a pipe.
7)	supply	g)	relating to earthquakes or other vibrations of the Earth.
8)	protect	h)	the sudden violent burstimg of something like a bomb.
9)	valve	i)	to make something happen, especially something bad
10)	cause	j)	regulation or principle that determines what someone can or cannot do in a particular situation.

GRAMMAR

IX. Choose the correct translation of the word in brackets.

1. Electrons (образующие) an atom are in motion.
   a) are forming
   b) when forming
   c) forming
2. (Разрабатывая) a device, an engineer used a new method.
   a) being developed
   b) developing
   c) having developed

3. Our scientists (готовят) programmes for automatic devices.
   a) are preparing
   b) preparing
   c) while preparing
4. (Сдав) all the examinations he went on holidays.
   a) passing
   b) having passed
   c) being passed
5. Electrons (движущиеся) from one atom of any substance to another form the flow called an electric current.
   a) are moving
   b) if moving
   c) moving
6. (Ожидая) for him I looked through the magazines lying on the table.
   a) waiting
   b) is waiting
   c) having waited
7. While I was reading a book my wife (слушала) to the news on the radio.
   a) listening
   b) was listening
   c) is listening
8. The questions (обсуждаемые) at the conference are very important.
   a) being discussed
   b) discussing
   c) having discussed

X. Write the number of the sentence in which *produced* is translated as «произведенный» into Russian.

1. The new kinds of plastics will be produced in future.
2. They produced good products.
3. Having produced a positive impression he continued to talk.
4. The new film produced was met by the audience with enthusiasm.
5. These synthetic materials have been produced for ten years.
6. When produced the substance changed its properties.
7. The products produced at our plant have a high quality.
8. Having produced in the reactor the energy is then transformed into heat

XI. Choose the correct translation of the underlined part of the sentence.

1. She rang the bell, with her <u>heart beating</u> fast.
   a) когда сердце билось
   b) с сердцем бившимся
   c) причем сердце билось

2. Having left the house he went to the nearest bus stop.
   a) покидающий.
   b) покинув
   c) покидая
3. The speaker looked at the audience, his hand raised for silence.
   a) подняв
   b) поднятая
   c) поднял
4. The medicine prescribed by the doctor was bitter.
   a) выписал
   b) выписанное
   c) выписывая
5. All the necessary preparations having been made, the army began the attack.
   a) когда подготовка была осуществлена
   b) осуществив подготовку
   c) и подготовка была осуществлена
6. Electron microscopes being very useful instruments, they are used today in many laboratories.
   a) являющиеся
   b) являясь
   c) являются

TRANSLATION

XII. Translate the sentences from English into Russian.

1. Someone had turned off the alarm that warned about over-filling.
2. Eleven of the people who were killed were having a meeting in a trailer in the danger zone.
3. The enquiry into the accident indicated the basic causes were equipment failure, risk management, staff management, and working culture.
4. At that time the oil industry was still dominated by foreign oil companies operating in those countries.
5. OPEC was formed to protect the interests of oil-producing countries.
6. New discoveries and new companies have changed the face of the oil and gas industry.
7. The governments of countries where the oil was found only received a share of these companies' profits.
8. Resources are hydrocarbons which may or may not be produced in the future.
9. A resource number may be assigned to an undrilled prospect or an unappraised discovery.
10. The three categories of reserves generally used are proven, probable, and possible reserves.

WRITING

XIII. Write an abstract (100–120 words) to the following article. (For more details you may see Writing Reference p. 202)

FUTURE OF FOSSIL FUELS

The rise in oil prices in early 2008 sparked discussion over whether the world was beginning to run out of oil. It was clear that the Earth had a finite amount of oil and that global demand was expected to increase. In 2007 the National Petroleum Council, an advisory committee to the U.S. secretary of energy, projected that demand for oil would rise from 86 million bbl to as much as 138 million bbl per day in 2030. Yet experts remained divided on whether the world would be able to supply so much oil. Some argued that the world had reached "peak oil" – its peak rate of oil production.

The controversial theory behind this argument drew on studies that showed how production from individual oil fields and from oil-producing regions tended to increase to a point in time and then decrease thereafter. (Oil production in the continental United States increased steadily through the early and mid-20th century until it peaked in 1970; by 2008 it had declined by almost 50 %.) Peak-oil theory suggested that once global peak oil had been reached, the rate of oil production in the world would progressively decline, with severe economic consequences to oil-importing countries.

A more widely accepted view was that, through the early 21-st century at least, production capacity would not be limited by the amount of oil in the ground but could be limited by other factors, such as geopolitics or economics. One concern was that growing dominance by nationalized oil companies, as opposed to independent oil firms, could lead to a situation in which countries with access to oil reserves would limit production for political or economic gain. A separate concern was that nonconventional sources of oil-such as tar-sand reserves, oil-shale deposits, or reserves that are found under very deep water-would be significantly more expensive to produce than conventional crude oil unless new technologies were developed that reduced production costs.

Abridged from: https://www.britannica.com/topic/Future-of-Fossil-Fuel-The-1517282

TEST 3

Variant 5

READING

I. Read the text and match the headings (1–4) with the paragraphs (A–D).

1. The reasons for oil spills ____
2. The main source of oil pollution ____
3. Preventing oil pollution ____
4. Damage to the environment ____

WHAT CAUSES OIL POLLUTION?

A. Oil causes pollution of rivers, lakes, and oceans. But where does this oil come from? Scientists believe that waste oil is responsible for the most pollution. Some of this comes from industry, some from our roads, and some is thrown away by people.

B. Oil leaks and spills happen because of technical problems, mistakes, vandalism (damage caused by people for no reason), accidents, or war. The smallest amount of oil comes from offshore drilling activities where oil is sometimes spilled because of burst (broken) pipes or human error (mistakes made by people). Major oil tanker disasters account for slightly more oil pollution. Accidents with ships are the result of ships hitting each other or hitting sand or rocks below the water. Accidents happen because of human error, poor maintenance, or poor communication between the crew members working on the ship. They can also happen when bad weather forces an oil tanker against a rocky coast.

C. A major oil leak or spill can result in very serious damage to plants and animals, the environment, and the local economy. Some parts of the environment are more easily damaged than others. For example, in water near the coast there are thousands of plants and animals that could die.

D. Governments and oil companies around the world are working together to reduce oil pollution. Improved safety training and management means fewer spills. Satellite and aircraft are used to quickly identify new cases of pollution. New technical measures include double-hulled tankers, ships with one body inside another.

Abridged from: Naunton, J, Pohl, A. Oil and Gas 2, Oxford University Press, 2011.

II. Read about the search for oil traps and decide whether the following statements are true (T) or false (F).

Statement	True/False (T/F)	
1. Oil companies make maps of the surface.		
2. Seismic waves can't go through rocks.		
3. Vibrator trucks make seismic waves.		
4. One rock layer reflects all the waves.		
5. Geophones send electrical signals to the recording truck.		
6. The geophones produce 3D maps.		

HOW TO FIND OIL TRAPS

Drilling is expensive. So oil companies plan carefully before they start drilling. First they make 3D maps of the rocks below the surface. Then they study these maps carefully. They look for possible oil traps. How do they make these maps? How do they find out what is below the surface? The answer is 'seismic waves'.

Seismic waves are sound waves, and they can travel through rock layers. Most oil companies use vibrator trucks to make seismic waves. These heavy trucks make vibrations on the surface, and the vibrations send waves down to the rocks below.

Each rock layer reflects some of the waves. The reflected waves travel up to geophones on the surface. Geophones are like microphones: they convert the waves into electrical signals, a machine in the recording truck records the signals. Computers can convert these signals into 3D maps.

These days, many oil companies use sophisticated computer programs to create three-dimensional computer models of the reservoirs they produce oil and gas from. These models can simply show where the different faults and rock types are within the reservoir, or they can show things such as the distribution of porosity within the reservoir sandstones. The beauty of 3D models is that they can be sliced in any direction to produce two-dimensional views, such as 2D maps (horizontal views).

Seismic reflection works at sea too. But the crews use hydrophones, not geophones, and they use an underwater gun to make seismic waves. The guns are actuated every few seconds as the ship moves over a predetermined course. The seismic waves are picked up by detectors embedded in a cable (called a streamer) trailing the ship. As in land surveys, the data are transmitted to a central recording unit and recorded in digital form.

Abridged from: Naunton, J, Pohl, A. Oil and Gas 1, Oxford University Press, 2011.

III. Read the text and answer the questions.

1. How does gas flaring act as a safety device?
2. What happens at normal pressure?
3. What is associated gas?
4. Why were large amounts of gas flared in Nigeria?
5. Why is gas flaring a problem?
6. What does GGFR aim to do?

A WASTE OF RESOURCES

People throughout the world need energy but every year billions of dollars worth of natural gas are wasted. Natural gas is flared on oil production rigs, in refineries, and in chemical plants across the world. Flaring is the burning of natural gas which is not required or a way of reducing pressure at oil and gas facilities. People now realize that it is a waste of energy, resources, and money.

Pressure release valves release gas when the pressure in plant equipment is too high. This is a safety device to protect vessels and pipes. The released gases are burned and they leave the flare stack. When a large amount of gas is released, the flame burns very brightly. Even when pressure is normal, a small amount of gas is constantly burned so the system is ready.

In some countries, for example Nigeria, large amounts of natural gas are trapped with the oil as it is extracted. This is known as associated gas. Because there was little demand for natural gas in the country in the past the large quantities of associated gas were burned off. Oil companies are now working to reduce this.

Flaring and venting of natural gas from oil and gas wells is responsible for large quantities of greenhouse gases which are responsible for global warming. Experts estimate that over 150 billion cubic metres of natural gas are flared each year. This is about 25 per cent of the United States' gas consumption or 75 per cent of Russia's gas exports. Russia is responsible for the highest levels of flaring, followed by Nigeria, Iran, and Traq. Information about the amount of gas flaring has been collected from satellite data.

Major oil companies and governments are now working together to reduce flaring and to recover and use this associated natural gas. The Global Gas Flaring Reduction Public-Private Partnership (GGFR) was set up in 2002. Its aim is to support governments, agencies, and the petroleum industry to reduce flaring and venting of gas. GGFR offers advice to governments and oil companies and also helps develop markets for the associated gas. Associated gas is now being used to supply domestic customers, and to produce electricity and liquefied natural gas (LNG).

Abridged from: Naunton, J, Pohl, A. Oil and Gas 2, Oxford University Press, 2011.

VOCABULARY AND TERMINOLOGY

IV. Read the text A WASTE OF RESOURCES in detail and match the English word-combinations (1–10) with the Russian equivalents (a–j).

1)	waste of energy	a)	защищать суда и трубопровод
2)	protect vessels and pipes	b)	потеря энергии
3)	trap with the oil	c	снабжать бытовых потребителей
4)	large quantities of associated gas	d)	залегать совместно
5)	flaring and venting of natural gas	e)	большие количества попутного газа
6)	leave the flare stack	f)	выделять большое количество газа
7)	reduce pressure at oil facilities	g)	сжигание газа на факеле и сброс
8)	release large amount of gas	h)	производить сжиженный природный газ
9)	supply domestic customers	i)	оставлять факельный ствол
10)	produce liquefied natural gas	j)	понижать давление на объектах нефтепромысла

V. For questions 1–5, choose one of the words (a–f) that best completes a gap in the text. You can use each word only once. There is one extra word.

a)	**venting**	**c)**	**quantities**	**e)**	**useful**
b)	**estimate**	**d)**	**satellite**	**f)**	**consumption**

Some Statistics on Flaring

Flaring and 1) _____ of natural gas from oil and gas wells lead to large 2) ____ of greenhouse gases in the atmosphere. Experts 3) _____ that over 150 billion cubic metres of natural gas are flared each year. This makes 25 per cent of the United States' gas 4) _____ or 75 per cent of Russia's gas exports. Russia has the highest levels of flaring, Nigeria, Iran, and Traq follow this country in the list. Information about the amount of gas flaring is based on 5) _____ data.

VI. Fill in the gaps with the given derivatives.

survey surveyors surveyed

1. In recent years combined geophysical ____ by air has been used in many projects.
2. Now the _____ need only to set up instrument in the field and it will do all recordings automatically.
3. In modern _____automation is being used in recording the field measurements.

4. Lasers are being used by ____ now.
5. Underground deposits can be _____ by modern methods.
6. To ____ an area geologist must make a lot of observations.

VII. Complete the summary of the text A WASTE OF RESOURCES. Use only one word in each sentence.

1. Gas is flared at oil and gas _____ .
2. At present people consider flaring to be a _____ of resources and money.
3. Associated gas is burned when there is no _____ for the associated gas.
4. The burning of gas is a ____ device to reduce pressure in plant equipment.
5. Flaring of gas produces _____ gases.
6. These harmful gases lead to global _____.
7. GGFR is working together with oil companies and governments to _____ the amount of gas that is flared.
8. This organization finds new ____ for the gas.

VIII. Match the terms (1–10) with the definitions (a–j).

1)	offshore	a)	mistakes made by people.
2)	tanker	b)	a large amount of oil that has poured out of its container by accident.
3)	human error	c)	a large vehicle with devices that producevibrations to examine what kind of rock are underthe ground.
4)	oil spill	d)	outside or top layer of something.
5)	surface	e)	to change something from one form to another.
6)	vibrator trucks	f)	happening or existing in the sea, not far from the land.
7)	convert	g)	the amount of force that a gas or a liquid produces in a pipe or container.
8)	rig	h)	to make something less or smaller in size.
9)	pressure	i)	a ship or truck that carries oil in large quantities.
10)	reduce	j)	a large structure in the sea with equipment for drilling for oil and gas under the seabed.

GRAMMAR

IX. Choose the correct translation of the word in brackets.

1. Air is a substance (состоящее) of mixtures of several gases.
   a) consisting
   b) being consisted
   c) is consisting

2. (Слушая) to the tapes you will improve your pronunciation.
   a) is listening
   b) listening
   c) having listened
3. There are many brilliant scientists (работающих) in different fields of science and technology in our country.
   a) having worked
   b) is working
   c) working
4. (Читая) a lecture professor Petrov used some diagrams.
   a) while delivering
   b) having delivered
   c) being delivered
5. They (обсуждают) the agenda of the conference now.
   a) discussing
   b) having been discussed
   c) are discussing
6. The questions (обсуждаемые) at the conference are very interesting.
   a) being discussed
   b) discussing
   c) having discussed
7. The parents (смотрели) television when I came in.
   a) watching
   b) were watching
   c) while watching
8. (Сдав) all the examinations, he left for his native town.
   a) having passed
   b) passing
   c) being passed

X. Write the number of the sentence in which *used* is translated as «использованный» into Russian.

1. Various materials will be used for our report.
2. Atoms energy must be used for peaceful purposes.
3. We used fundamental units to measure time, space and mass.
4. The thermometer used in the experiment was very expensive.
5. Having used the modern device the engineer obtained a successful result.
6. Being used as a conductor the wire must be installed.
7. When broadly used, the term “coal” may include a number of substances.
8. Iron used in this chemical reaction helped to speed up the process.

XI. Choose the correct translation of the underlined part of the sentence.

1. Mendeleyev being a great chemist, his name is well-known not only in our country but also abroad.
   a) то, что Менделеев является великим химиком
   b) Менделеев, являясь великим химиком
   c) так как Менделеев является великим химиком
2. The phenomenon discovered by him helped us greatly in our research work.
   a) явление открыли
   b) явление, открытое
   c) явление, открывающее
3. Government pays great attention to education, our students being provided with everything necessary for their studies.
   a) когда студентов обеспечили
   b) студенты, обеспеченные
   c) причем студентов обеспечивают
4. Pressure increasing, the distance between molecules decreases.
   a) увеличивая давление
   b) если давление увеличивается
   c) когда давление увеличивалось
5. Having been interested in the solution of the problem, we studied various combinations of facts.
   a) заинтересовавшись решением
   b) интересовались решением
   c) интересуясь решением
6. Acids react with oxides of all the metals, a salt and water being formed.
   a) образовав соль и воду
   b) когда соль и вода образованны
   c) причем соль и вода образуются

TRANSLATION

XII. Translate the sentences from English into Russian.

1. The smallest amount of oil comes from offshore drilling activities where oil is sometimes spilled because of burst (broken) pipes or human error (mistakes made by people).
2. Oil leaks and spills happen because of technical problems, mistakes, vandalism (damage caused by people for no reason), accidents, or war.
3. Accidents with ships are the result of ships hitting each other or hitting sand or rocks below the water.
4. Some parts of the environment are more easily damaged than others.
5. Improved safety training and management means fewer spills.

6. Satellite and aircraft are used to quickly identify new cases of pollution.
7. The seismic waves are picked up by detectors embedded in a cable (called a streamer) trailing the ship.
8. Natural gas is flared on oil production rigs.
9. The released gases are burned and they leave the flare stack.
10. Associated gas is now being used to supply domestic customers.

WRITING

XIII. Write an abstract (100–120 words) to the following article. (For more details you may see Writing Reference p. 202)

THE PHYSICS OF THE EARTH

In a broad sense, the methods of geophysics are used to detect the very deep structure of the earth itself, to study earthquakes and earth's magnetic field, and to give us a better understanding of our physical environment. These particular geophysical fields of knowledge are not directly applicable in the search for mineral deposits, but they frequently provide a useful background of indirect information. For example, we now know that earthquakes occur along zones of weakness on earth, often between continents and oceans, in regions that are also related to places where ore minerals are being deposited. Mineralized districts on the earth bear a relationship to areas where there has been past mountain building, and we can now see and predict places where ore deposits are in the process of being formed. Thus, through the study of the physical processes of earth movements and the broader, deeper aspects of geophysics we will learn more about the distribution and the regional location of mineralized areas.

Regional geophysical surveys, in which data are gathered somewhat sparsely over a large area, are often part of a preliminary resource evaluation program of an underdeveloped area. These surveys are carried out for the general purposes of learning the background subsurface physical characteristics of an area. Maps made from these gravity, magnetic, electrical, or radiometric data are also useful for making geologic maps. This procedure could be called "geological mapping by geophysical methods".

Regional geophysical survey maps are generally not too complex in detail. But mainly these surveys are useful in providing fundamental geological information about a region, and can also be useful in planning more detailed exploration and general engineering programs.

In mineral exploration, geophysics is used as part of the overall program. Team effort has been the most successful approach to exploration, and here geophysics plays its role as a cooperative member of the technical group.

Abridged from: Petroleum Engineering: Course book, TPU Publishing House, 2010.

UNIT 7

DRILLING

LEAD-IN

There are many different jobs on an oil and gas rig. Some are managerial, requiring sensitivity and high-level leadership skills. Some are technical and detail-oriented. Many are dirty and tiring manual jobs.

Match the job title from the box to its description. Write your answer in the first column.

Driller, installation manager, roustabouts, assistant driller, toolpusher, company man, crane operator, chief engineer, mud logger, wireline operator, roughneck

Job title	Job description
	represents the oil and gas operator
	sets up and handles the rotary drilling equipment
	is in charge of the platform
	analyzes samples of rock cuttings
	carries out drilling operations under supervision
	handles supplies and equipment
	operates the various electronic tools used in the well
	sets up and operates lifting equipment
	supervises operations on the rig
	is responsible for overall operation of the drilling rig
	handles pipes and other equipment for the rig

I. Read and remember the list of words associated with Drilling.

1) drilling rig – буровая вышка, буровая
2) drilling crew – буровая бригада
3) maintain – поддерживать в рабочем состоянии
4) contractor – подрядчик
5) to be responsible for – быть ответственным, отвечать за
6) to be in charge of – быть ответственным, отвечать за
7) rig superintendent – мастер буровой установки
8) toolpusher – буровой мастер, мастер буровой установки
9) on site – на месте, на площадке
10) driller – бурильщик, буровик

11) derrickman – верховой рабочий
12) rotary helper – помощник бурильщика
13) roughneck – разнорабочий, подсобный рабочий
14) rig floor – рабочая площадка буровой, буровая площадка
15) land rig – наземная буровая установка
16) headquarter – размещаться
17) offshore drilling – шельфовое бурение, оффшорное бурение
18) supervise – осуществлять технический контроль
19) hire – нанимать, устраивать на работу
20) control console – пульт управления
21) drill a hole – бурить скважину
22) pipe-handling equipment – оборудование для спуска-подъема труб
23) take over – принимать, брать на себя
24) drill pipe – буровая труба, бурильная колонна
25) mount – устанавливать
26) mast – подъемная вышка
27) derrick – вышка
28) work shift – рабочая смена
29) trip in – спускать бурильную колонну
30) trip out – поднимать бурильную колонну
31) wrench – гаечный ключ
32) tongs – щипцы, ключ для труб
33) screw – завинчивать, закручивать
34) repair – чинить, налаживать

II. Read the following words and remember their pronunciation.

[dʒ] manger, objective
[ɔ:] offshore, floor, portable, board
[ai] supervise, mobile
[ʌ] roughneck, company, monkeybourd
[ɛə] repaire, affair
[u] crew, screw, unscrew, true
[ju:] superintendant, surpervise, duty

READING

III. Read the text and write whether the following statements are true (T) or false (F).

Statement	True/False (T/F)	
1. A rig operates all the time, 365 days a year.		
2. Contractor may hire an assistant rig superintendent if he drills on land rigs.		

Statement	True/False (T/F)	
3. The rig superintendent is in charge of the drilling crew and supervises drilling operations.		
4. The additionally hired roughnecks handle the upper end of the drill pipe tripping it in or out of the hole.		
5. Rotary helpers and roughnecks have the same responsibilities.		
6. The number of hours per day depends on rig's location and other economic factors.		

DRILLING JOBS

While it is true that one cannot drill a well without a **drilling rig** and several companies to back up the rig, it is equally true that one cannot drill a well without skilled people. Personnel run the rig and keep it running until the well reaches its objective. Many people are involved in drilling. It is necessary to consider the **drilling crew** – the group whose job is to make the rig drill.

The **contractor** requires trained and skilled personnel to operate and **maintain** a drilling rig. It should be kept in mind that a rig, when **on site** and drilling, operates virtually all the time, night and day, all year long. Personnel **responsible for** making the rig drill are collectively known as the drilling crew.

The person **in charge of** the drilling crew, the top hand, may be called the rig manager, **rig superintendent, or toolpusher**, depending on the drilling contractor's preference. Besides the rig manager, each rig has **drillers, derrickmen**, and **rotary helpers** (also called **roughnecks**).

The rig superintendent (toolpusher) oversees the drilling crews that work on **the rig floor**, supervises drilling operations, and coordinates operating company and contractor affairs. **On land rigs**, the rig superintendent is usually **headquartered** in a mobile home or portable building at the rig site and is on call at all times. Because **offshore drilling** and large land drilling operations can be very critical, the contractor may **hire** an assistant rig superintendent. The assistant rig superintendent often relieves the superintendent during night-time hours and sometimes nicknamed the night toolpusher.

The rig superintendent supervises the driller, who, in turn, **supervises** the derrickman and roughnecks. From a **control console** or an operating cabin on the rig floor, the driller manipulates the controls that keep the drilling operations underway. This person is directly responsible for **drilling the hole**.

A few of the latest rigs feature automated **pipe-handling equipment** that **takes over** the duties of the derrickman. Most rigs, however, require a derrickman when crew members run **drill pipe** into the hole. The derrickman handles the upper end of the pipe from the monkey board. The contractor **mount**s the monkeyboard in the **mast** or **derrick** at a height ranging from

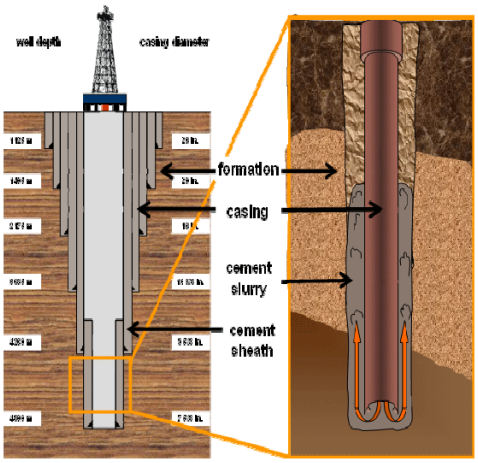
about 15 to 34 meters depending on the length of the joints of pipe crew members pull from the hole.

In addition, a contractor usually hires two or three roughnecks for each **work shift**. They handle the lower end of the drill pipe when they are **tripping** it **in** or **out** of the hole. They also use large **wrenches** called **tongs** to **screw** or unscrew pipe. Besides handling pipe roughnecks also maintain the drilling equipment, help **repair** it, and keep it clean and painted.

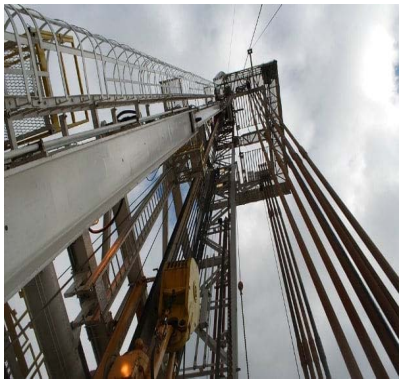
Because of a rig's location, economic factors, and other reasons, the number of days and the number of hours per day that a drilling crew works vary a great deal.

Abridged from: Baker R. A Primer of Oilwell Drilling, Petroleum extension service, 2001.

IV. Amwar is training a group of field service engineers and he is giving them a presentation about the basics of rotary drilling. Match the slides from A to E to the transcript (what he says about each slide) from 1 to 5.



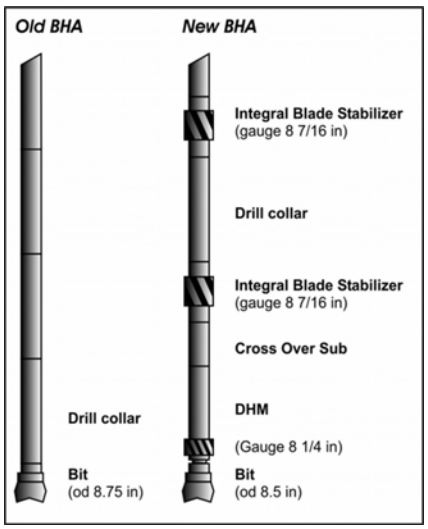
a



b

c

d



e

Slide 1

If you look at this first slide, you can see that often there is more than one string. This diagram shows an operation in Alaska where a riser has been passed through the ice and down to the seabed, and the cement casing is in place in the rock. Only the innermost string is actually operational.

Slide 2

The bottomhole assembly (BHA) is made up of a drill bit which is used to break up the rock formations, drill collars (which are heavy, thick-walled tubular used to apply weight to the drill bit) and subs (smaller sections of pipe), such as stabilizers, which keep the drilling assembly centered in the hole. The BHA may also contain other components, such as a downhole motor, Rotary Steerable System, measurement while drilling (MWD) and logging while drilling (LWD) tools.

Slide 3

Heavyweight drillpipe (HWDP) is used to make the transition between the drill collars and drillpipe. The function of the HWDP is to provide a flexible transition between the drill collars and the drillpipe. This helps to reduce the number of fatigue failures seen directly above the BHA. A secondary use of HWDP is to add additional weight to the drill bit. Drillpipe makes up the majority of a drillstring. A drillstring is typically about 15,000 feet in length for an oil or gas well vertically drilled onshore in the United States, and may extend to over 30,000 feet for an offshore deviated well. The components of the string are joined together with special threaded connections known as tool joints, on the ends of each joint.

Slide 4

Drill tubulars are manufactured in 31-foot lengths, although they can also be manufactured in 45-foot lengths. Each 31-foot component is referred to as a joint. Typically, two, three or four joints are joined together to make a strand. Pulling the drillstring out of or running the drillstring into the hole is referred to as tripping. Drillpipe, HWDP and collars are typically tripped in strands to save time. This photo shows a device used for safe automated handling of double or triple strands.

Slide 5

This photo shows a typical tricone drilling bit. In today's modern industry, the two main types of drill bits are classed as PDC (Polycristalline Diamond Compact) and Roller Cone; although the tricone dominates, bicone and mono cone bits do exist. Natural and synthetic diamonds are used in coring bits, as well as for very hard rock drilling with mud motors and turbines.

Abridged from: Oliver, S. Oil and Gas. A study and practice book for oil and gas professionals. Garnet education, 2010.

VOCABULARY AND TERMINOLOGY

V. Read the text Drilling Jobs in detail and match the English word-combinations (1–10) with the Russian equivalents (a–j).

1)	oversee the drilling crew	a)	нуждаться в обученном и квалифицированном персонале
2)	vary a great deal	b)	быть ответственным за бурение скважины
3)	depending on the length of the pipe joints	c)	поддерживать буровую установку в рабочем состоянии
4)	keep the drilling operations underway	d)	курировать буровую бригаду
5)	headquarter in a portable building	e)	отвечать за буровую бригаду
6)	require trained and skilled personnel	f)	в зависимости от длины соединений трубы
7)	mount the monkeyboard in the mast	g)	размещаться в портативной конструкции
8)	be responsible for drilling the hole	h)	устанавливать площадку на вышке
9)	maintain a drilling rig	i)	продолжать буровые операции
10)	be in charge of the drilling crew	j)	значительно варьироваться

VI. Choose the correct variant a, b or c.

1. The drilling crew is the group of people___.
   a) whose job is to make the rig drill
   b) who headquarter in a portable building
   c) oversee the drilling crew
2. Rig superintendent___.
   a) is directly responsible for drilling the hole
   b) supervises drilling operations
   c) mounts the monkeyboard in the mast or derrick
3. Another name of rig superintendent is___.
   a) a derrickman
   b) an assistant rig superintendent
   c) a tool pusher
4. Which of the operations are NOT included in a roughneck's responsibilities?
   a) to screw or unscrew a pipe
   b) to run drill pipe into the hole
   c) to keep drilling equipment clean

5. What are the driller's responsibilities?
   a) to keep the drilling operations underway
   b) to handle the lower end of the drill pipe
   c) to coordinate operating company
6. What are the duties of the derrickman?
   a) to trip in or out the drill pipe of the hole
   b) to operate and maintain the pipe-handling equipment
   c) to mount the monkeyboard in the derrick
7. What does the number of working days and the number of working hours per day of a drilling crew depend on?
   a) the size of oil field
   b) the drilling contractor's preference
   c) a rig's location and economic reasons
8. The mast or derrick is mounted at a height___.
   a) from about 15 to 34 meters
   b) from 2 to 10
   c) from 30 to 40

VII. Compose the sentences of the given words.

1. The hole / directly/ the driller/ for / responsible /drilling /is.
2. Is/ and/ the drilling crew/ in charge of/ the drilling contractor's/ may be called/ depending/ rig superintendent/on/ preference/ the rig manager.
3. Also/ wrenches/ or / pipe/ unscrew /roughnecks/ tongs/ large/ called/ to screw/ use.
4. Requires/ the contractor /trained and skilled/ a drilling rig/ to operate and maintain/ personnel.
5. That/ takes over/ the latest rigs/ a few of /automated /the duties/ equipment/ of /the derrickman/ feature/ pipe-handling.
6. The monkeyboard/ mounts/ meters/ a height/ the contractor/ from about/ in /at /ranging/ 15 to 34/ the derrick.

VIII. Complete the following sentences with one of the words in bold in the text A FIRST-TIME VISIT OF A DRILLING RIG.

1. ____ was very strict and did permit us to visit the drilling rig.
2. A____ is a machine that creates holes in the earth subsurface.
3 He is learning how to pilot a _____.
4. What is the ____ of your visit to the drilling rig?
5. The drilling rig operated very ___, but that didn't bother me.
6. The frameworks of ____ towered above us.

A FIRST-TIME VISIT OF A DRILLING RIG

If you are interested in oilwell drilling, a good way to learn about it is to visit a **drilling rig**. A first-time visit can be educational as well as confusing. Most drilling rigs are large and **noisy** and, at times, the people who work on them perform actions that don't make much sense to an uninitiated observer. A drilling rig has many pieces of equipment and most of it is huge. But a rig has only one **purpose**: to drill a hole in the ground. Although the rig itself is big, the hole to be drilled is usually not very big (usually less than a foot) in diameter by the time it reaches final depth. The skinny hole, however, can be deep (often thousands of meters). The hole's purpose is to tap an oil and gas reservoir, which more often than not lies buried deeply in the earth.

Although rigs operate both on land and sea – "offshore" is the oilfield term – a land rig is best for a first visit. In most cases, land rigs are easier to get to. Getting to offshore rigs is more complicated, because they often work many miles from land and you need a boat or a **helicopter** to reach them.

When driving to a land rig, it is possible to see one of the most distinctive parts of a drilling rig, its tall, strong structural tower called a mast or a **derrick**. Rig masts and derricks are tall because they have to accommodate long lengths of pipe to be raised into it during drilling process. A mast or derrick can be as high as a 16-story building.

Upon arriving at the rig, the first step is to check in with the boss. He or she is probably in a mobile home or a portable building on the site that serves as an office. Nowadays, the drilling industry leans towards the term **rig superintendent** or rig manager for the person in charge, but it is possible to hear rig hands call him or her the toolpusher.

Now put on your hard hat and steel-capped boots to keep your body from being crushed. In addition, you have to wear safety glasses to safeguard your eyes. This style of dress is regular for everyone. Whether working on a rig or merely visiting it, everyone must wear personal protective equipment (PPE). Rig workers also wear gloves to protect their hands. With protective gear on and the rig superintendent's permission you may go to the rig floor.

Abridged from: Baker R. A Primer of Oilwell Drilling, Petroleum extension service, 2001.

IX. Read the sentences and match the words in bold (A–K) with the definitions (1–10).

A **helicopter** (A) was circling around looking for somewhere to land.
Eight derricks (B) and other auxiliary equipment are in operation.
To enable our sustained growth, we have a **rig superintendent** (C) position.

Offshore drilling (D) presents environmental challenges, both from the produced hydrocarbons and the materials used during the drilling operation.
The guy was not allowed to go to the site because he didn't have a **hard hat** (F).
All crew members should use safety **glasses** (G) and special **gloves** (H) during welding.
Our **land rig** (I) is a small rig which can be transferred from one location to another.
All necessary devices and personal **protective equipment** (J) for each activity are available for all crew members.
Thus you can always enjoy the feeling of warm, dry **steel-capped boots** (K).

1) a mechanical process where a wellbore is drilled below the seabed
2) a drilling rig which is specially designed to drill holes on onshore locations
3) a type of rotorcraft in which lift and thrust are supplied by rotors
4) a lifting device composed at minimum of one guyed mast, which may be articulated over a load by adjusting its guys
5) a person who oversees the drilling crews that work on the rig floor supervises drilling operations, and coordinates operating company and contractor affairs
6) a type of helmet predominantly used in workplace environments such as industrial or construction sites to protect the head from injury due to falling objects, impact with other objects, debris, rain, and electric shock
7) a durable boot that has a protective reinforcement in the toe which protects the foot from falling objects or compression, usually combined with a mid sole plate to protect against punctures from below
8) glasses with additional safety features that make it less likely to break, or less likely to pose a threat when broken
9) protective clothing, helmets, goggles, or other garments or equipment designed to protect the wearer's body from injury or infection
10) a garment covering the whole hand

GRAMMAR

The Infinitive

Forms

	Active	**Passive**
Indefinite	to ask	to be asked
Continuous	to be asking	–
Perfect	to have asked	to have been asked
Perfect Continuous	to have been asking	–

Uses

1. As a a subject.

***Eg. To solve** this problem is very important.*
*It is important **to solve** this problem*

2. An attribute.

- After ordinal numbers and words *the next ..., the last ..., etc.*

***Eg.** He was the first **to solve** this problem.*

- After the associated noun, the invinitive takes the place of a longer phrase with *which, who*, etc.

***Eg.** Methods **to solve** this problem are very important.*

3. As an adverbial modifier.

The invinitive takes the place of a longer phrase with *in order to*, etc.

- At the beginningof a sentence

***Eg. To solve this problem** they made many experiments.*
*They made many experiments **to solve this problem.***

(For more details you may see Grammar Reference p. 194)

X. Match the uses of Infinitive (A–C) with the sentences (1–8).

A. Where infinitive is a subject
B. An attribute
C. An adverbial modifier

Example: *0. To make water or oil exert the correct amount of pressure, the operator adds weighting material. – The answer is 0.C (As **To make** is an adverbial modifier)*

1. Mud is circulated for a period of time to remove any remaining cuttings.
2. The amount of bit weight depends on the type of formation to be drilled.
3. Most rig engines today are diesels, because diesel fuel is safer to transport and store than other fuels such as natural gas, LPG, or gasoline.
4. It is necessary to position auxiliary equipment for generating electricity, compressing air, pumping hydraulic fluid, and pumping water.
5. To successfully drill, a rig requires many pieces of equipment.
6. To manage and coordinate the activities of many rigs is drilling superintendent's job.
7. The company will move the rig to other field to drill the first of five development wells to be drilled in the field this year.
8. The derrickman uses special equipment to prevent falls.

XI. Point out the correct translation of the underlined Infinitive.

1. To do jobs better and more economically became possible by means of electronic equipment.
   a) чтобы выполнить
   b) выполнение

c) выполнив
d) выполненная

2. Some changes to be introduced into this equipment will improve its control.
   a) вводятся
   b) должны вводиться
   c) которые должны вводиться
   d) чтобы внедрять

3. To detect objects over great distance a radio-electronic set-up called radar is to be used.
   a) обнаруживая
   b) обнаружение
   c) чтобы обнаружить
   d) обнаруженные

4. The speed of measurement will be greatly increased due to new devices to be used in these set-ups.
   a) применяют
   b) чтобы применить
   c) которые будут применяться
   d) будет внедряться

5. To improve the accuracy of measurement meant to increase production efficiency.
   a) улучшение
   b) чтобы улучшить
   c) которые будут улучшены
   d) улучшенная

6. To use the different parts of the crude oil mixture they must be separated from each other.
   a) использование
   b) использованные
   c) чтобы использовать
   d) использовать

7. Gold was one of the first metals to be found by man.
   a) обнаруживаются
   b) обнаружение
   c) которые должны быть обнаружены
   d) обнаруженный

8. To develop a new method of field exploration is the work of reservoir engineer.
   a) должны быть разработаны
   b) разработка
   c) которые должны быть разработаны
   d) чтобы разработать

TRANSLATION

XII. Find 8 sentences with Infinitive in the texts of Unit 7. Write them down and translate into Russian.

SPEAKING

XIII. Read the text. Underline the words from the diagram.

The swivel hangs from a hook. The kelly connects the swivel to the drill pipe. After that the kelly goes through the turntable. The engine turns the turntable. Next, the turntable rotates. The turntable turns the kelly. Finally, the kelly turns the drill pipe. The crown block does not move. It is fixed to the top of the derrick. The travelling block hangs from the crown block. It moves up and down.

Complete these sentences

Example: *The swivel hangs from a hook.*

1. The _____ connects the swivel to the drill pipe.
2. The kelly goes through the _____.
3. The _____ turn the turntable.
4. The turntable _____.
5. The turntable turns the _____.
6. The kelly turns the _____ pipe.
7. The crown block _____.
8. The travelling block _____ .

Work in pairs. Close the books. Draw a diagram of the rotary system. Explain how it works to a partner.

A: How does the rotary system work?

B: Well, the ….

Abridged from: Frendo, E, Bonamy, D. English for Oil industry 1, Pearson, Longman, 2011.

WRITING

XIV. Write an abstract (100–120 words) to the following article. (For more details you may see Writing Reference p. 202)

WYTCH FARM

In 1973 the British Gas Corporation discovered a large oilfield in the south of England. There were 65 million tonnes of crude oil in the ground. And on the ground? A nature reserve including forests, trees, animals, birds, and a perfect beach and seaside – and a village. The engineers faced many challenges such as noise from construction and drilling, noise from trucks going to and from the site, bad smells from the site, possible oil spills, fires, and explosions, and possible damage to the plants and animals in the area.

British Gas planned the work very carefully. They studied the plants and animals in the area and developed a wildlife protection programme. In 1979, they began drilling. They put the drilling rig in a wood. It was behind the trees so people couldn't see it easily. And they used a special drilling technique: horizontal drilling.

The easiest way to drill oil is straight down vertically into the oil. Horizontal drilling (sometimes called extended reach drilling) starts straight down, but then it turns. The drill goes into the oil from the side. Oil companies sometimes drill this way to help the oil flow into the well more easily. But at Wytch Hill, it was a way to protect the environment. When you use horizontal drilling, the oil can be under a beautiful forest, a village, or even the sea, but the drilling rig and the gathering station can be far away. At Wytch Farm, some of the drilling started more than ten kilometres away from the oil.

Wytch Farm is the largest onshore oilfield in Western Europe. But environmental damage at the site is very small.

Abridged from: Naunton, J, Pohl, A. Oil and Gas 2, Oxford University Press, 2011.

UNIT 8

OIL AND GAS TRANSPORT AND STORAGE

LEAD-IN

Look through this introduction to MIDSTREAM SECTOR.

A. Match the words in bold with the pictures a–d.

Getting oil to market is a process that requires various transportation and storage technologies. In petroleum industry, this stage is usually referred to as "midstream". Oil is often produced in remote locations away from where it will be consumed; therefore, transportation networks have been built to transport the crude oil or gas to where they will be consumed. Storage facilities are used to balance supply and demand of oil and refined products. There are the four primary methods of transporting oil and gas: **pipeline**, **rail transport** (oil tank car), **trucks** and **18 wheelers**, **tankers**.

a

b

c

d

B. Study the brief descriptions of petroleum transportation methods. Which of these:

1) is used to transport small amount of oil and gas?
2) requires no or small construction costs?
3) is used to carry petroleum from the field?
4) is more energy efficient?
5) is used to move huge amount of gas or oil at once?

Pipeline is the most commonly used form of petroleum transportation. Pipelines are typically used to move crude oil from the wellhead to processing facilities and tanker loading facilities. Pipelines require significantly less energy to operate than trucks or rail.

Rail transport has been a popular choice for crude oil transportation for more than 150 years. Shipping oil by rail does not require long-term contracts and it offers more options for where oil is picked up and delivered. The capital costs and construction period are relatively small.

Trucks are free to go anywhere the road will take them. In addition, there is no need to build roads as they are already constructed. Trucks carry much smaller volumes of oil, so when there is a crash or a leak, it tends to be less difficult to clean up.

Tankers are the one of the best ways to transport extremely large quantities of oil or gas. These tankers traverse the oceans and vast waterways of the world with millions of gallons of oil and liquefied natural gas.

I. Read and remember the list of words associated with pipeline engineering (pipeline types and elements).

1)	liquids pipeline	– трубопровод, транспортирующий жидкость
2)	natural gas pipeline	– газопровод
3)	flowline	– выкидная линия, подводящая труба
4)	gathering line (gathering main, field pipeline, inter-field pipeline)	– сборный коллектор, промысловый трубопровод
5)	trunk pipeline (transmission line, main line)	– магистральный трубопровод
6)	product line	– продуктопровод
7)	to produce	– добывать
	production	– добыча
8)	storage	– хранение
	to store	– хранить
9)	throughput	– пропускная способность трубопровода
10)	field-processing facilities	– пункт (система) сбора и подготовки нефти или газа к транспорту
11)	storage facilities	– сооружения для хранения
12)	tank farm	– резервуарный парк
13)	operating pressure	– рабочее давление
	to operate	– эксплуатировать

14) pump – насос
pump station – нефтеперекачивающая станция
15) compressor – компрессор
compressor station – компрессорная станция
16) to maintain – поддерживать; проводить техническое обслуживание
maintenance – поддержание; техническое обслуживание
17) friction – трение
18) batching – последовательная перекачка
batch – партия перекачиваемого продукта
19) branch (spur) – ветка трубопровода
20) loop (looped line) – лупинг
21) bypass – байпас
22) fitting – трубопроводная обвязка
23) pipeline valves – трубопроводная арматура
24) flowmeters – расходомер
25) pig traps – камера приема и пуска очистных устройств
26) corrosion control system – система защиты от коррозии
27) transmission lines – линия электропередач
28) telemetry system – система телеметрии, телемеханика
29) refinery – нефтеперерабатывающий завод
to refine – перерабатывать
30) crossing – пересечение

II. Read the following words and remember their pronunciation.

[ʃ] friction, operation, production, transmission, pressure
[ʒ] corrosion, engineering
[æ] batch, trap, gas, gathering, capacity
[ai] bypass, pipeline, refine, diameter
[ou] flowline, process, petroleum, undergo
[ju:] consumer, producing, distribution, accumulation

III. Pay attention to the stress in the following words.

'maintenance	'process	ˌengi'neering
to main'tain	'processing	te'lemetry
'throughput	'product	ˌele'vation
to 'transport	pro'ducing	ˌdistri'bution

READING

IV. Read the text and write whether the following statements are true (T) or false (F).

Statement	True/False (T/F)	
1. In general, all pipelines are divided into two basic types.		
2. Flowlines move hydrocarbons from the wellhead to storage and processing facilities in the field.		
3. Gathering lines are usually operated at high pressure.		
4. For cross-country purposes, trunk pipelines are used.		
5. Compressor stations must be installed along the pipeline to assist oil in overcoming friction and elevation changes.		
6. Each product line is intended for carrying a certain product.		

PIPELINE TYPES AND ELEMENTS

There are two major types of pipelines, **liquids pipelines** and **natural gas pipelines.** Liquid pipelines transport crude oil or natural gas in liquid form to refineries where they undergo processing. Natural gas pipelines are used solely for the transport of natural gas to processing plants or consumers. Most oil and gas pipelines fall into one of four categories: **flowline**, **gathering**, **trunk** (transmission or main), and **product line**.

Flowlines (feed lines), the first link in the transportation chain from **producing well** to consumer, are used to move produced oil from individual wells to a central point in the field for processing and **storage**. Flowlines are generally small-diameter pipelines operating at relatively low pressure. The **throughput** of oil flowlines ranges from a few barrels per day upward depending on the capacity of the well being served.

The next link in the oil pipeline chain is gathering lines that transport oil from **field-processing** and **storage facilities** to a large **tank farm** where it is accumulated for pumping into the long-distance crude trunk line. Gathering system throughput obviously varies widely, depending on the number of field storage tanks served and the producing capacity of the wells in each field. **Operating pressure** is higher than that of field flowlines.

Trunk pipelines transport petroleum products long distances, including over international boundaries. They are large diameter pipes which are operated at high pressure.

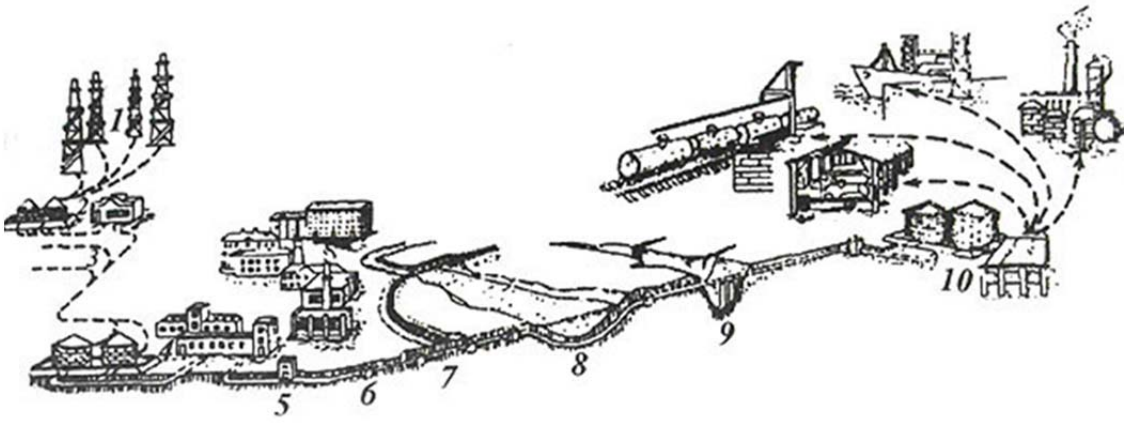
Pumps, in a case of oil transport or **compressors**, if gas is transported, are required at the beginning of the trunk line, and **pump stations** or **compressor stations** must also be spaced along the pipeline to **maintain** pipeline pressure at the level required to overcome **friction**, changes in elevation, and other losses.

Product pipelines are used to move various products between cities or within the refinery. Products pipelines can often carry several different products in the same pipeline. Movement of more than one product in a single pipeline is called **batching**.

Pipeline system consists of the following compulsory elements: pipe with **branches**, **loops** and **bypasses**, **fittings** and **valves**, tank farms, pumps (pump stations) for liquid or compressors for gas (compressor stations), and auxiliary equipment (**flowmeters**, **pig traps**, **corrosion control system**, **crossings, transmission lines**, and **telemetry system**).

Abridged from: Kennedy, John L. Oil and gas pipeline fundamentals / by John L. Kennedy, 2nd ed., 1993.

V. Use the information given in the text PIPELINE TYPES AND ELEMENTS to label a diagram of an oil pipeline system. Use the dictionary to help you if necessary.



VOCABULARY AND TERMINOLOGY

VI. Read the text PIPELINE TYPES AND ELEMENTS in detail and match the English word or word-combination (1–10) with its definition (a–j).

1)	throughput	a)	complete pipeline from inlet to outlet, including any expansion offsets, valve assemblies, isolation couplings, spur lines, pig traps, etc.
2)	tank	b)	pipeline components that do not have operational functions (e.g. flanges, tees, wyes).

3)	friction	c)	pipeline section laid parallel to the main pipeline. It is connected to the linepipe constructively and technologically.
4)	flowline	d)	gradual destruction of materials (usually metals) by chemical and/or electrochemical reaction with their environment.
5)	pipeline system	e)	a large receptacle or storage chamber, especially for liquid or gas.
6)	pump	f)	internal pressure at which the pipeline is normally operated
7)	field-processing facilities	g)	the volume of gas flowing (or transported) through a pipeline
8)	operating pressure	h)	pipeline transporting untreated well fluids from the wellhead
9)	looping	i)	the equipment between the wells and the pipeline, or other transportation system, used for treatment of produced hydrocarbon to ensure further safety transport
10)	flowmeter	j)	the resistance that one surface or object encounters when moving over another.
11)	corrosion	k)	device used to measure the flow rate or quantity of a gas or liquid moving through a pipe
12)	fittings	l)	a mechanical device using suction or pressure to raise or move liquids, compress gases

VII. Choose the correct option a, b or c.

1. From the point of the medium being transported there are:
   a) 3 types of pipeline
   b) 4 types of pipeline
   c) 2 types of pipeline
2. The smallest pipeline in diameter that links the wellhead with field facilities is usually called:
   a) gathering line
   b) product line
   c) flowline
3. The throughput of a gathering line does not depend on:
   a) number of storage tanks
   b) pipeline length
   c) well flowrate

4. What device is used to maintain pressure in gas transmission line?
   a) pump
   b) compressor
   c) flowmeter
5. the manner when various products are moved in the same pipeline is called:
   a) batching
   b) branch
   c) looping
6. before pumping into the trunk line, oil must undergo:
   a) treatment in processing field facilities
   b) ordoring
   c) freezing

VIII. Name the pipeline component or equipment. Identify the following items of equipment or pipeline system component mentioned in the text PIPELINE TYPES AND ELEMENTS.

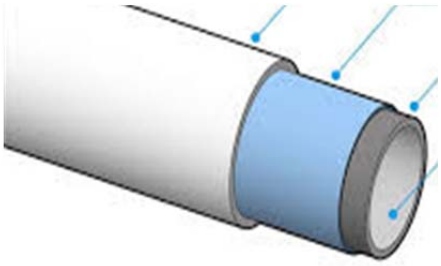
1. Intersection of pipeline with a previously installed (operational or abandoned) pipeline or cable.
2. Facilities connected to a pipeline (separated by valves) for the dispatch and collection of pigs.
3. Tubular conduit made from linepipe or flexible pipe transporting a medium, the driving force being a pressure differential between inlet and outlet.
4. Branch pipeline connected to the main pipeline by a tee or a wye.
5. Pipeline (normally large diameter) transporting a treated medium (e. g. crude oil or sales gas), usually over long distances.
6. Devices that are used to control the flow and pressure of contents, whether that is oil, gas, liquid or vapors.
7. It is to collect data at a place that is remote or inconvenient (say an oil production offshore installation) and relay to a point where the data may be evaluated (say a business onshore office).

IX. Here is a list of verbs that you will often find in describing oil and gas transportation. Decide which verbs to be used in passive and active voices. Complete the table. Find the sentences with these verbs in the text PIPELINE TYPES AND ELEMENTS.

move, transport, deliver, run, carry, go

Passive	Active
e. g. Oil /gas is transported	

X. Use the information given in the first paragraph of the text PIPE MANUFACTURE AND DESIGN to label the cross section of a coated pipe. Only use the words which are italicized for your labels.



PIPE MANUFACTURE AND DESIGN

The principal building block of any pipeline is the **pipe joint**, which is an approximately 12.2 m (40′) section of steel tube. Before being assembled into **pipe strings** and installed on the seabed the *individual pipe joint*s are provided with some or all of the features listed below, which comprise the entire *wall thickness* (as required by the design):

- *internal coating*;
- *external anti-corrosion coating*;
- thermal insulation;
- sacrificial anodes;
- *concrete weight coating* (for marine pipeline or underwater crossing).

Two general types of pipe for pipeline system are manufactured: seamless and welded. These designations refer to how each joint of pipe is manufactured, not how the joints are connected in the field to form a continuous pipeline. **Seamless steel pipe** is made without a **longitudinal weld**. In the welded category, there are several manufacturing processes. They differ both by the number of **longitudinal weld seams** in the pipe and the type of welding equipment used.

In general, seamless pipe is manufactured in the smaller sizes because the process is not practical for very large-diameter pipe. Welded pipe is manufactured in a wide range of sizes.

Internal coating of the pipeline may be specified to prevent internal corrosion, to resist erosion, or to reduce the **flow resistance**. The latter is only suitable for pipelines transporting a gaseous medium, such as natural gas, where the throughput may be increased significantly (by approximately 10%) by **drag-reducing coating**. A drag-reducing internal coating is normally applied in the form of liquid, two-component epoxy paint.

Internal protective coating of a pipeline is insufficient. Pipelines must also be protected from the surrounding external environment against a variety

of dangers arising from **soil stress**, soil-born chemicals and salt water. **Thermal insulation** may be incorporated into the **external anti-corrosion coating**. An alternative approach to insulation is to use a **pipe-in-pipe system**, where the product pipe is inserted into a larger sleeve pipe that resists the water pressure, and the **annulus** is filled with insulating foam.
Abridged from: Design and installation of marine pipelines / M.W. Braestrup [et al.], 2005.

XI. Fill in the table below in as much detail as you can from the information provided in the text PIPE MANUFACTURE AND DESIGN. See if you can complete the table by carrying out further research on the Internet. Some information is given.

Term	Translation	Alternative term (if possible)	Intended purpose	Details
pipe joint	секция трубопровода, отдельная труба		to be welded into a continuous pipe string	
pipe string	плеть трубопровода			
seamless steel pipe				
longitudinal weld				
welded pipe	сварная труба			
welding		fusion		Most processes used in pipeline welding use a filler metal, do not involve pressure, depend on an electric arc for the heat source.
seam	шов			

Term	Translation	Alternative term (if possible)	Intended purpose	Details
concrete weight coating	бетонное покрытие (утяжеляющее бетонное покрытие)	concrete coating, weight coating		
drag-reducing coating		lining		
pipe-in-pipe system				
annulus				
thermal insulation	теплоизоляция			

XII. The following sentences contain a number of factual mistakes. Amend or rewrite the sentences in the spaces provided so that they make sense. Most information can be found in the text "Pipe manufacture and Design".

1. The pipeline consists of numerous pipe joints and pipe strings which are equal in length.

_____

2. In pipeline engineering, two general types of pipes are applied for pipeline construction: seamless welded pipe and longitudinal pipe.

_____

3. Internal coating is intended for corrosion prevention.

_____

4. Two types of pipes (seamless and welded) refer to the process the pipe joints are fused on the construction site.

_____

5. Drag-reducing coating is applied on the outside of the pipe.

_____

6. Concrete-weight coating is applied to cause the pipeline to float up to the ocean floor and remain in position on the seabed.

_____

7. The annulus between two types in the pipe-in-pipe system remains empty.

_____

GRAMMAR

The -ing Form (Gerund)

- **a non-finite form of the verb that combines the properties of the verb with those of the noun.**

Forms

	Active	**Passive**	
Indefinite	asking	being asked	The **simple active form** and the passive form usually express an action that is simultaneous with the action expressed by the main verb
Perfect	having asked	having been asked	The **perfect form and the perfect passive form** express an action that precedes the action expressed by the main verb.

Uses

1. as a subject. ***Eg. Smoking*** *is not allowed here.*
2. as a part of predicate. ***Eg.*** *His hobby is* ***driving*** *a car.*
3. as an attribute. ***Eg.*** *There are different ways of* ***obtaining*** *this substance.*
4. as an adverbial modifier (often after prepositions). ***Eg.*** *After* ***receiving*** *good results they stopped experiments.*
5. as an object. ***Eg.*** *The car needs* ***repairing***

(For more details you may see Grammar Reference p. 197)

XIII. Match the functions of Gerund (a–e) with the sentences (1–8).

a) subject
b) part of predicate
c) attribute
d) adverbial modifier
e) object

Example: *0. Inhibiting is more preferable to other corrosion protection methods. – Answer is A (Inhibiting performs the function of a subject).*

1. Before constructing pipeline, geodesic survey should be carried out.
2. A given volume of gas could be transported through a relatively small-diameter pipeline by operating the pipeline at a high pressure and using a large amount of compression horsepower.
3. Balancing is done by adjusting the position of the rods.
4. The incremental cost for laying the larger pipeline would be small.
5. The individual lengths of pipe are normally joined by welding.
6. Upon closing the valve the pressure increased.
7. Launching the pig requires an operator to have vast experience and deep knowledge.
8. They are usually referred to trenchless technologies as they do not require digging a long trench for laying a pipe.
9. Many such new technologies for renovating pipes have been developed in recent years.

XIV. Match column A with column B to make correct sentences.

Example: (*1d)- Engineers started laying the pipeline when all welded pipe sections were hydrostatically tested*.

A		**B**
1) ~~Engineers started laying the pipe-line~~	a)	beveling the pipe edges.
2) Before pumping gas into trans-mission line	b)	rather than being pipelined to a shore-based terminal for load-ing.
3) Welding crew is busy	c)	developing special offshore pipelaying equipment as off-shore oil and gas reserves con-tinue to be found.
4) Pipeline systems can be expanded by	d)	~~when all welded pipe sections were hydrostatically tested~~.
5) Produced crude is piped directly into a tanker	e)	preheating or postheating of the weld area.
6) The process does not require	f)	either adding more pumping or compression horsepower at ex-isting stations.
7) Interest will continue in	g)	it should undergo multi-stage treatment

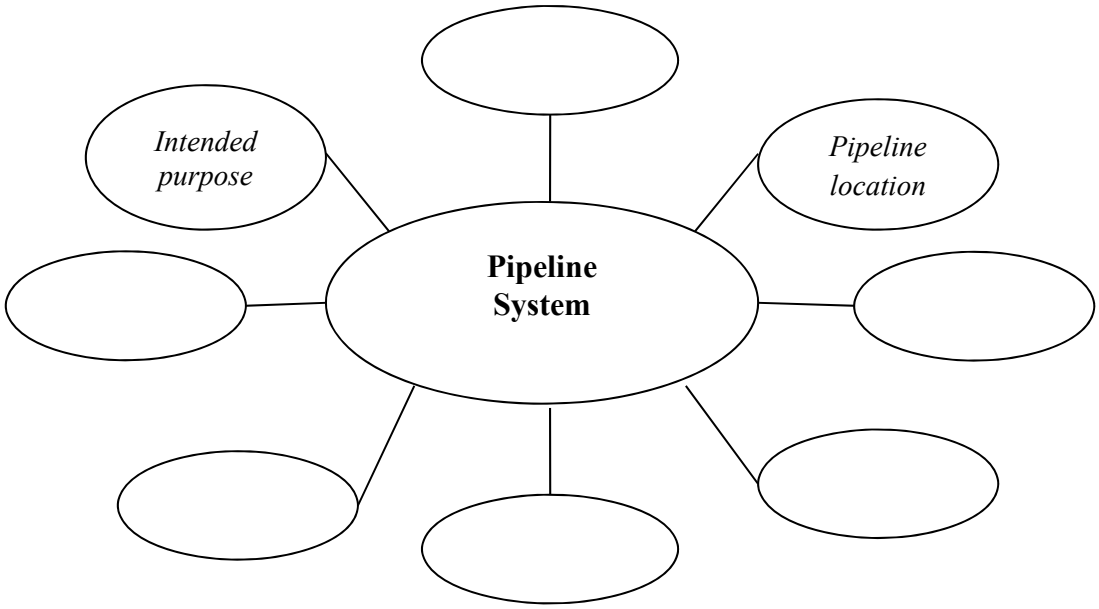
TRANSLATION

XV. Translate the sentences paying attention to Gerund used in a function of adverbial modifier.

1. These traps "catch" the pigs and allow them to be removed from the line without taking the entire pipeline out of service.
2. Several types of pumps are used in handling crude and petroleum products.
3. The choice in such cases may be made by studying the rating curves of different pumps and determining which will operate most efficiently.
4. Sections of welded line await a series of inspections before being lowered into place.
5. Prior to the commissioning of any pipeline system, it is critical to verify that the pipeline's construction conforms to standard regulations.

SPEAKING

XVI. Fill in the spidergram with the basic specification parameters of pipeline system and explain your ideas.



Example: *The first and one of the most important pipeline specification parameter is the purpose the pipeline has been constructed. This actually defines its type: whether it is a flowline, gathering line or trunk line. The second is pipeline location. It can be underground, above-ground, ground, marine or suspended. The next is ….*

XVII. Read the extract from the Internet about one of the most famous pipeline projects. Use a search engine, such as Google, to find information about the following distinguished pipeline projects:

The Keystone XL Pipeline
The Sakhalin 2 Pipeline Project
The Druzhba pipeline
The Yamal-Europe pipeline
The Trans-Mediterranean (Transmed) pipeline
Be ready to describe and discuss the pipeline project characteristics according to the ideas discussed in exercise XIV and the extract given below.

The Nord Stream gas pipeline is a fundamentally new route for Russian gas exports to Europe. The target markets for gas supplies via Nord Stream are Germany, the UK, the Netherlands, France, Denmark and others.
The project consists of a twin-pipeline with a throughput of 55bcm a year. Construction of the first pipeline commenced in April 2010 and was completed in June 2011. Construction of the second line began in May 2011 and was completed in April 2012. Commercial gas deliveries began in November 2012.

WRITING

XVIII. Read this slide from the power Point presentation.

1. What is the aim of the presentation, do you think**?**
2. Who is the audience for the presentation?
Using the presentation slide, write a paragraph (100–120 words) about pipeline valves, its classification and intended purpose.
(For more details you may see Writing Reference on Graphic Information p. 204)

Example: *There are various approaches to classifying pipeline valves. One of them is based on the valve function or purpose. According to this approach, pipeline valves are divided into….*

SELF-STUDY

UNDERGROUND PIPELINE CONSTRUCTION STAGES

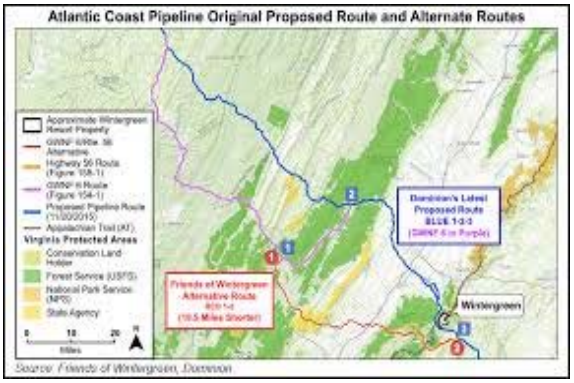
LEAD-IN

Look through this introduction to pipeline construction and match the words in bold with the pictures a–j.

The construction of all pipelines includes the following stages: **design** and route selection, **survey and setting out**, **clearing** and **grading**; **trenching**; **pipe stringing**; **bending**; **welding**; **lowering-in**; **backfilling**; **tie-in**; hydrostatic testing; and cleanup.

a

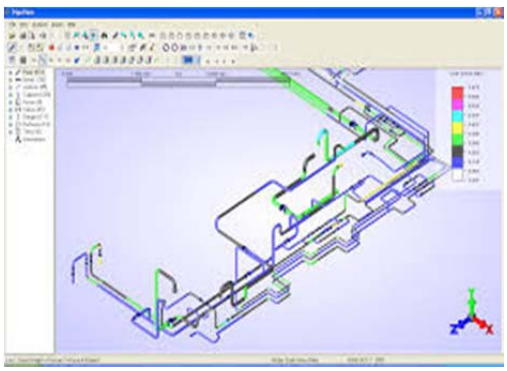
b



c

d

e



f

g

h

i

j

I. Read and remember the list of the words associated with pipeline construction.

1) survey	– инженерные изыскания; разведка, поиск; геологическая съемка, топографическая съемка; геофизические исследования;
2) setting out	– трассирование
3) right-of-way (ROW)	– охранная зона; технический коридор; полоса отвода
4) cleaning	– расчищение
5) grading	– планировка; выравнивание
6) ditching (trenching)	– разработка траншеи
7) stringing	– укладка плетей трубопровода
8) bending	– сгибание труб
9) road crossing	– пересечение трубопровода с дорогой
10) skidding the pipe	– укладка трубы на опорную раму для сварки
11) welding	– сварка
12) line-up	– центровка
13) internal welding	– внутренняя сварка
14) external welding	– наружная сварка
15) beveling	– подготовка кромки трубы
16) horizontal directional drilling (HDD)	– горизонтально-направленное бурение; наклонно-направленное бурение

17) cover – глубина залегания
18) non-destructive testing (NDT) – неразрушающий контроль
19) field-joint coating – изоляция сварного шва
20) tie-in – соединение участков трубопровода; врезка в трубопровод; точка подключения (присоединения)
21) bed (bedding) – мягкая подсыпка, подушка
22) lowering – спуск трубопровода в траншею
23) backfilling – засыпка траншеи трубопровода
24) hydrostatic testing – гидравлические испытания
25) final tie-in – последнее соединение секции
26) final clean-up/ROW restoration – восстановление, рекультивация
27) topsoil – слой плодородной почвы
28) to bury – прокладывать (трубу, трубопровод)
29) circumference – окружность
30) (to) leak – утечка
31) sideboom – трубоукладчик

II. Pay attention to the pronunciation of the following terms.

[ai] tie-in, right-of-way, line-up, pipeline, directional
[e] testing, bedding, welding, bevelling, setting, bury
[i:] field, seam, decrease, increase
[ɪ] skidding, drilling, stringing, ditching

III. Pay attention to the stress in the following words.

ˌhoriˊzontal	ˌhydroˊstatic	ˌrestoˊration
diˊrectional	ˊbackfilling	ˊbevelling

READING

IV. Read the text and write whether the following statements are true (T) or false (F).

Statement	True/False (T/F)	
1. According to the construction regulations, after all required legal procedures and survey right-of-way cleaning is always the first step in pipeline construction.		
2. Pipe sections are laid along the trench.		
3. HDD is often used for crossing water bodies.		
4. Pipes are lifted onto skids for visual inspection.		

Statement	True/False (T/F)	
5. To prevent damage to pipeline, bedding is placed in the bottom of the trench or around the pipe.		
6. Pipeline strength and tightness are checked during hydrostatic testing.		

STAGES OF UNDERGROUND PIPELINE CONSTRUCTION

After a pipeline operator obtains the required permits and when **surveying** of the intended route is completed, **construction** of the pipeline may begin.

First, the **right-of-way** of the pipeline is cleared of trees, boulders, brush, and anything else that may impede the construction. Once the right-of-way has been cleared sufficiently to allow construction equipment to gain access, **topsoil** is removed. On agricultural land where clearing is not necessary, topsoil removal is the first construction activity. Sections of pipes are then laid out along the intended route – a process called "**stringing**" the pipe.

After the pipe is in place, **trenches** are dug alongside the laid-out pipe. These trenches are typically 5 to 6 feet deep. In certain areas, however, including **road crossings** and bodies of water, the pipe is **buried** deeper. Soil from trenching is stockpiled separately from the topsoil stockpiles. **Horizontal directional drilling** (HDD) is often the preferred method for constructing the pipeline across such obstacles as streams or wetlands.

Once the trenches are dug, the pipe is assembled and contoured. This includes **welding** the sections of pipe together into one continuous pipeline and **bending** it slightly, if needed, to fit the contour of the **pipeline's route**. Before being welded, line pipe is lifted onto **skids** made of timber and stockpiles along the ROW so that the entire circumference is accessible. **Coating** is applied to the ends of the pipes. This process is called "**field-joint coating**".

Once the pipe is welded, bent, and coated, it can be **lower**ed into the previously dug trenches. This is done with specialized **construction equipment (sideboom)** acting in tandem to lift the pipe relatively uniformly and lower it into the trench. Before the pipe strings are lowered into the ditch, selected **bedding**, usually sand, is placed on the ditch bottom to cushion the pipe. In rocky soil, the fill may be placed around and on top of the pipe. After the pipe has been lowered into the ground, the trench is carefully **backfilled** to ensure that the pipe and its coating do not incur damage.

The last step in pipeline construction is the **hydrostatic test**, which consists of filling the pipe with water at pressures higher than will be needed for product transportation, through the entire length of the pipe. This serves as a test to ensure that the pipeline is strong enough and absent of any **leaks** before transporting hydrocarbons through the pipeline.

Grading the ROW smooth and clear, placing marker signs to identify the pipeline location, repairing any fences or other structures temporarily removed for construction and seeding the soil to reintroduce vegetation are the final activities.

Abridged from: Marcellus Community Science. Penn State project supported by a National Science Foundation STEM grant. Pipeline Construction Steps: Access mode: https://www.e-education.psu.edu/marcellus/

V. Read and remember the list of words associated with offshore pipeline construction.

1) lay-barge method	– спуск на морское дно с трубоукладочных судов
2) S-lay method	– монтаж в слабонаклонном положении, S-метод
3) J-lay method	– монтаж в вертикальном положении, J-метод
4) reel-laying, reeling	– укладка трубопровода с барабана, G-метод
5) stinger	– стингер
6) pipe overbend	– перегиб
7) pipe sagbend	– прогиб
8) derrick, high tower	– монтажная вышка
9) supply ship (boat)	– судно для поставки труб
10) survey boat	– исследовательское судно
11) straightening device	– выпрямляющее устройство
12) shore approach	– прибрежный участок, береговая зона
13) intermediate offshore point	– укладка плетей трубопровода с поверхности моря путем наращивания, начало укладки трубопровода в море
14) suspended pipe	– свободноподвешенная труба (плеть), свободно провисающий участок
15) tension machine (tensioner)	– натяжной механизм (натяжное устройство)
16) firing line	– основная монтажная линия; сварочная линия; технологическая линия
17) to moor	– становиться на якорь
18) tug boat	– буксирное судно
19) seabed	– морской дно

VI. Read the text about offshore pipeline construction methods and match the headings 1–5 with the paragraphs A–E.

1. Laybarge installation details ____
2. J-lay method description ____
3. Basic types of laybarge methods ____
4. Reeling fundamentals ____
5. S-lay method description ____

OFFSHORE PIPELINE CONSTRUCTION

A. Laybarge pipeline installation is the most common method, where the pipeline is produced offshore by welding individual pipe joints into a pipe string, which is paid out from the laybarge to the seabed. Depending on the shape of the **suspended pipe**, there are S-lay or J-lay methods. Pipelaying may be initiated at a **shore approach** or at an **intermediate offshore point**.

B. In most cases the laybarge is **moored** to eight or twelve anchors, and moves forward by pulling on the anchor cables. The anchors are relocated by **tugboats**, which together with the **supply ships** and **survey boats** assist in the laybarge spread.

C. From the laybarge the pipeline describes an S-curve to the **seabed**. In the upper part (the **overbend**) the curvature is controlled by the laybarge **stinger** that supports the pipeline on rollers. The curvature in the lower part (the **sagbend**) is controlled by lay **tension** transferred to the pipeline by tension machines gripping the pipe string on the laybarge

D. Unlike S-lay method, in J-lay one the pipe string enters the water in a vertical or nearly vertical position. Therefore, J-lay barges are equipped with a high **tower** to support the two to four pipe joints while they are being added to the pipe string.

E. There is one more installation method when the pipe string is unwound from a vertically or horizontally mounted **reel** of diameter up to 30 m, pulled through a **straightening device**, and leaves the vessel over the stern. Reeled pipeline is usually small in diameter and is not provided with concrete coating.

Abridged from: Design and installation of marine pipelines / M.W. Braestrup . . . [et al.], 2005.

VOCABULARY AND TERMINOLOGY

VII. Look through the texts STAGES OF UNDERGROUND PIPELINE CONSTRUCTION and OFFSHORE PIPELINE CONSTRUCTION in detail and match the words in column A with the words in column B to form word-combinations. Then give Russian equivalents to these word-groups.

Example: *(1b) hydrostatic testing – гидравлические испытания*

A		B	
1)	~~hydrostatic~~	a)	the pipe
2)	horizontal	b)	~~testing~~
3)	pipeline	c)	offshore point
4)	topsoil	d)	boat
5)	skidding	e)	device
6)	field-	f)	removal
7)	intermediate	g)	directional drilling
8)	straightening	h)	machine
9)	tension	i)	route
10)	supply	j)	joint coating

VIII. Complete the sentences below using one of the word combinations from the previous exercise. You can use each word combination only once.

1. They note that the proposed _____ crosses the Missouri and Yellowstone Rivers.
2. In the context of pipeline installation _____ is used to designate an installation method in which the prefabricated pipe string is pulled through a hole in the ground made by a directed drill string.
3. The coated pipe joints are transported to the laybarge on pipe _____.
4. In the case of _____ the laybarge may pick up a previously laid pipe string or it may start pipelaying with an initiation head, connected to a dead man anchor.
5. In certain areas, particularly farmland, the ditch will be excavated in two passes: _____ and excavation of the remaining soil.
6. At a certain sea state, it becomes impossible to add more pipe to the string, which is then kept under constant tension by the _____.
7. The 498-ft-long vessel has eight welding stations, one _____station, one inspection station, and one X-ray control station.
8. Several techniques can be used, but the most common is _____ – filling the line with water and subjecting it to a pressure greater than the design operating pressure.
9. _____ is obligatory before welding.
10. _____ is used as the pipe is unreeled into the water.

IX. Arrange these words from the texts given in self-study part into three vocabulary topic columns.

straightening machine survey boat trenching stinger ROW survey hydrostatic testing reeling seabed welding J-method backfilling
sideboom field-joint-coating S-lay method supply boat internal clamp

Pipeline construction devices and equipment	Onshore and offshore pipeline construction	Offshore pipeline construction

X. Choose the correct option a, b or c.

1. Construction of pipeline may begin when __.
   a) the destination is known
   b) survey is completed
   c) grading is done
2. ROW is cleared to __.
   a) place equipment
   b) carry out hydrostatic testing
   c) to avoid pipeline damage
3. Bending is done to __.
   a) accommodate pipeline to elevation changes
   b) change flow regime
   c) install pipeline valves
4. Before lowering the pipe into the ditch, __.
   a) it is backfilled
   b) it is filled with water
   c) bedding is placed
5. What is not a part of hydrostatic testing?
   a) pipeline is filled with water
   b) pipeline is coated with fiberglass
   c) pipeline is operated under pressure higher than intended one
6. J-lay barges are equipped with a high tower to __.
   a) provide barges with helicopter deck
   b) support long pipe joint
   c) mark the construction site
7. In J-lay method pipe string enters the water __.
   a) in horizontal position
   b) parallel to the water surface
   c) in vertical or almost vertical position

GRAMMAR

XI. Use the words in brackets in Passive or Active, Simple or Perfect Gerund forms.

1. The first step of internal corrosion prevention in hydrocarbon pipelines is to avoid water, either by _____ (remove) it before transportation or by _____ (keep) a flow regime that prevents water dropout.
2. The finished, coated pipe joints are stored at the coating yard, or possibly an intermediate storage area, before _____ (load out) to the pipeline installation contractor.
3. Unbonded flexible pipes are characterized by _____ (have) a low bending stiffness combined with a high axial tensile stiffness.
4. Figure 1 shows a concrete coating after _____ (receive) five blows.
5. Hot-tapping is a connection of a branch line to an existing pipeline without emptying the latter, as an alternative to _____ (use) a pre-installed tee.
6. Pipe joints are subjected to non-destructive testing after _____ (weld).

XII. Read these statements about pipeline construction. Complete them with the gerund form of the verbs given below. Choose between affirmative and negative.

increase	**construct**	**grade**
check	**survey**	**lower**

1. _____ is aimed at preparing the intended pipeline route for further construction activities.
2. _____ the pipe in unsafety manner may result in its damage.
3. Engineers suggest _____ the trench depth in road crossing areas.
4. Some pipeline operators neglect welding joint inspection norms but _____ almost 100% of the welds can lead to pipeline rupture.
5. It is reasonable to avoid _____ pipelines in environmentally-sensitive areas.
6. _____ the intended pipeline route before construction may increase the overall construction costs.

TRANSLATION

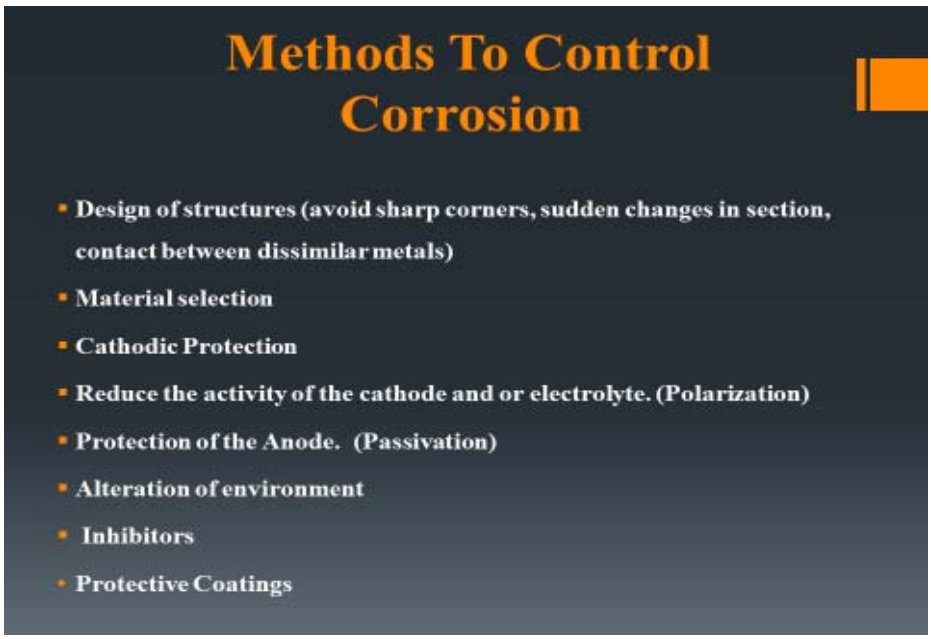
XIII. Find 9 sentences with Gerund in the texts of Self-study section. Write them down and translate into Russian.

WRITING

XIV. Read this slide from the power Point presentation.

a) What is the aim of the presentation, do you think?
b) Who is the audience for the presentation?

Using the presentation slide, write a paragraph (100–120 words) about pipeline corrosion protection methods.



(For more details you may see Writing Reference on Graphic Information p. 204).

Key to SELF-STUDY

Lead-in. a) lowering; b) welding; c) survey and setting out; d) stringing; e) clearing and grading; f) design; g) trenching (ditching); h) tie-in; i) bending; j) backfilling.

IV. 1F (On agricultural land, topsoil removal is the first stage); 2F (pipe sections are laid along the intended rout and only after this the trench is dug); 3T 4F (pipes are lifted to provide the access to the entire circumference) 5T 6T

VI. 1-B; 2-D; 3-A; 4-E; 5-C

VII. Suggested answer
1b hydrostatic testing – гидравлические испытания
2g horizontal directional drilling – горизонтально-направленное бурение
3i pipeline route – трасса трубопровода
4f topsoil removal – снятие плодородного слоя почвы
5a skidding the pipe – укладка трубы на опорную раму для сварки
6j field joint coating – изоляция сварных швов
7c intermediate offshore point – укладка плетей трубопровода с поверхности моря путем наращивания, начало укладки трубопровода в море
8e straightening device – выпрямляющее устройство
9h tension machine – натяжной механизм (натяжное устройство)
10d supply boat – судно для поставки труб

VIII. a) – 3; b) – 2; c) – 10; d) – 7; e) – 4; f) – 9; g) – 6; h) – 1; i) – 5; j) – 8.

IX. Suggested answer

Pipeline construction devices and equipment	**Onshore and offshore pipeline construction**	**Offshore pipeline construction**
Straightening device Survey boat Supply boat Internal clamp Sideboom	Trenching, ROW, survey, Hydrostatic testing, welding, Backfilling, field-joint coating	Stinger, reeling, sea-bed, J-lay method, S-lay method

X. 1 –B; 2 – A; 3 – A; 4 – C; 5 – B; 6 – B; 7 – C.

XI. 1**.** removing; keeping 2. being loaded out 3. having 4. having received 5. Using
6. having been welded

XII. 1. – grading; 2 – lowering; 3 – increasing; 4 – not checking; 5 – constructing;
6 – not surveying

XIII. Suggested answer

1. On agricultural land where clearing is not necessary, topsoil removal is the first construction activity. – *В районах земель сельскохозяйственного назначения, где расчистка охранной зоны планируемого трубопровода не требуется, удаление плодородного слоя земли является первым этапом строительства.*

2. Soil from trenching is stockpiled separately from the topsoil stockpiles. – *Изъятый из траншеи грунт складируется отдельно от плодородного слоя.*

3. Horizontal directional drilling (HDD) is often the preferred method for constructing the pipeline across such obstacles as streams or wetlands. – *Горизонтально-направленное бурение обычно является предпочтительным методом строительства трубопровода через такие преграды, как реки и болота.*

4. Before being welded, line pipe is lifted onto skids made of timber and stockpiles along the ROW so that the entire circumference is accessible. – *Перед сваркой трубы укладываются на деревянные опорные рамы вдоль охранной зоны таким образом, чтобы обеспечить доступ ко всей окружности трубы*.

5. The last step in pipeline construction is the hydrostatic test, which consists of filling the pipe with water at pressures higher than will be needed for product transportation. – *Гидравлические испытания, под которыми подразумевается заполнение трубы водой под давлением выше, чем планируемое рабочее давление, являются завершающим этапом строительства трубопровода*.

6. This serves as a test to ensure that the pipeline is strong enough and absent of any leaks before transporting hydrocarbons through the pipeline. – *Такие испытания предназначены для проверки трубопровода на прочность и отсутствие утечек перед транспортировкой углеводородов.*

7. Grading the ROW smooth and clear, placing marker signs to identify the pipeline location, repairing any fences or other structures temporarily removed for construction and seeding the soil to reintroduce vegetation are the final activities. – *Выравнивание охранной зоны трубопровода, установка опознавательных знаков, ремонт ограждений и любых других временно убранных сооружений, посев семян являются заключительными этапами строительства трубопровода*.

8. Laybarge pipeline installation is the most common method, where the pipeline is produced offshore by welding individual pipe joints into a pipe string. – *Спуск трубопровода на морское дно с трубоукладочных судов является распространенным способом, при котором секции трубопровода свариваются в нитку на трубоукладочных судах.*

9. In most cases the laybarge is moored to eight or twelve anchors, and moves forward by pulling on the anchor cables. – *В большинстве случаев трубоукладочное судно удерживается при помощи восьми или двенадцати якорей и продвигается вперед за счет натяжения якорного троса.*

TEST 4

Variant 1

READING

I. Read the four extracts and match each extract (a–d) to one of the summary description (1–4).

1. An operator was hit by a pipe which had been forced from its assembly by gas pressure. ____
2. An operator was killed and another injured during an escape of poisonous gas. ____
3. Some operators were injured during a small fire caused by sudden ignition of a gas line. ____
4. Some operators were killed in a serious fire. ____

INCIDENT REPORTS

A. The plant housed separation equipment used to produce oil and natural gas from nearby wells. Workers were purging a two-mile pipeline between an oil and gas well and the facility when vessel ruptured due to over-pressuarization, releasing flammable material, which then ignited. Natural gas from the ruptured vessel produced a large fireball, which damaged nearby piping and released and ignited additional flammable materials. Four workers were killed in the accident.

B. At a well stimulation site, an operator needed to release excess carbon dioxide (CO_2) from a mobile tanker unit, known as a queen. The queen was parked between two other queens, so the excess gas could not be released directly out to the side. To redirect the venting gas to the front of the queen, the CO_2 operator constructed a pipe assembly using available piping components. When the CO_2 operator opened the discharge valve to release the excess CO_2, the pressure of the venting gas unthreaded the pipe assembly and it spun counter-clockwise. The pipe assembly struck the CO_2 operator, causing fatal injuries.

C. Three employees of JT Oilfield Construction Company were performing maintenance work on an oil separator unit when the accident occurred. One was on a ladder at the top of the tank while the other two were disconnecting a water line at the base of the unit. A gas line next to the water line became dislodged. The local Sheriff, David Masters, said the gas immediately ignited: “The pipe was pointing down with about 40 pounds of pressure when it ignited”. Local Fire Chief, Grant Hogan, reported that the gas fire was not major. No oil ignited. “It was more or less a flash fire from the raw gas and was put out quickly”.

D. A service rig company had been hired by an oil company to 'complete' a well. The service company believed the well to be 'sweet'. Prior to the accident, the producing formation had been acidized and two members of the crew had been requested to stay overnight and flow the well. At approximately 01:00, after all the acid flush water had been returned to surface, oil began to flow. At 02:30, after gauging the rig tank, one worker was overcome with H_2S. The second worker, who was sleeping at the time of the first knockdown, awoke at 03:30 and found the first worker down. While attempting to rescue the first worker, the second worker was knocked down. Both workers were found on the ground the next morning, one had expired, the other was unconscious, but alive, and has since recovered.
Abridged from: Oliver, S. Oil and Gas. A study and practice book for oil and gas professionals. Garnet education, 2010.

II. Read about Going Offshore. Write whether the following statements are true (T) or false (F).

Statement	True/False (T/F)	
1. Nobody can visit an offshore platform without some safety training.		
2. If you visit offshore platform, you do not need to have a medical test.		
3. The helicopter you arrived by is as big as a football field.		
4. Drilling platforms are smaller than production platforms.		
5. The accommodation area separates oil from gas and water.		
6. The utilities area provides electricity.		

GOING OFFSHORE

You arrive by helicopter. But first, you receive safety training. Even day visitors must have safety training. Offshore work is more hazardous than onshore work, so workers must also have a medical test and do a fire-fighting and escape course before they go.

You get out of the helicopter and hold on to your hat. You are now standing on a production platform high above the water. It is as big as a football field. The top of the derrick is higher than a twenty-storey building.

Drilling platforms are not as big as this because they only do drilling. Production platforms are bigger because they do more things and must accommodate more people.

A typical production platform has four main areas above the water. One is the accommodation area, where the workers eat and sleep. Another is the well head or drilling area. That contains the derrick, well heads, and drilling equipment. Crude oil comes up to the well heads with gas and water in it. So it goes to the process area, which separates the oil from the other things. All the areas need electricity and other utilities. The utilities area provides these: a generator makes electricity, and there is equipment for heating, ventilation, air conditioning, and water distribution.

Abridged from: Landsford L., Vallance A. Oil and Gas 1. Oxford University Press, 2011.

III. Read the text and answer the questions.

1. What is MODU?
2. Where do floaters work when drilling?
3. What are floaters capable of?
4. Which units do bottom-supported units include?
5. What are offshore platforms designed for?
6. What are floating drilling platforms designed for?
7. What special equipment is needed for offshore drilling, completion and production?

MOBILE OFFSHORE DRILLING RIGS

A widely used offshore drilling rig is a mobile offshore drilling unit, or MODU, for short. Another is a platform. Although drilling occurs from platforms, companies employ them on the producing side of the oil and gas business. MODUs are either floaters or bottom-supported. When drilling, floaters are used to work on top of, or slightly below, the water's surface.

Floaters include semi-submersibles and drill ships. They are capable of drilling in waters thousands of metres deep. MODUs that contact the ocean bottom and are supported by it are known to be bottom-supported.

Bottom-supported units include submersibles and jackups. Submersibles are further divided into posted barges, bottle types, inland barges, and arctic. Generally, bottom-supported rigs are considered to drill in waters shallower than floaters.

Implementation of operations offshore such as field exploration, well drilling and oil and gas production requires application of offshore platforms designed for well drilling and production, separation of produced well fluid into oil, gas condensate, gas and water with further pumping of the first three components through pipelines to onshore terminals.

Classification of offshore platforms includes fixed and floating platforms. Fixed platforms can be applied only in shallow waters and are in-

stalled with their basement against sea bottom. Such platforms are not mobile and are designed for long-term operation in a permanent location.

However, fixed platforms are said to be technically difficult and economically inefficient to be used for drilling of oil and gas wells in deep waters of seas and oceans. Floating drilling platforms capable independently or by means of towboats change drilling locations are designed to operate in deep waters.

Floating offshore platforms can be divided into jack-up drilling platforms, semi-submersible drilling platforms and gravity-based drilling platforms.

To drill, complete, and produce offshore wells it is necessary to apply special equipment. For example, a marine riser is used to protect drill pipe string against sea environment in the course of well drilling and production operations and prevent environmental contaminations. Marine riser is known to be a pipe of large diameter connecting moon pool on a drillship or semi-submersible platform with preventer stack installed on subsea wellhead. In the process of drilling drill pipe string rotates inside the marine riser.

Abridged from: Baker R. A Primer of Oilwell Drilling, Petroleum Extension Service, International Association of Drilling Contractors, Texas, 2001.

VOCABULARY AND TERMINOLOGY

IV. Read the text MOBILE OFFSHORE DRILLING RIGS in detail and match the English word-combinations (1–10) with the Russian equivalents (a–j).

1)	for short	a)	мелководье
2)	marine riser	b)	быть способным
3)	long-term operation	c)	постоянное местонахождение
4)	be capable of	d)	буровая шахта
5)	be designed for	e)	морская буровая платформа на колоннах
6)	to protect drill pipe	f)	быть предназначенным для
7)	moon pool	g)	предохранять буровая трубу
8)	shallow water	h)	для краткости
9)	permanent location	i)	длительная эксплуатация
10)	jack-up drilling platform	j)	морская водоотделяющая колонна

V. For questions 1–5, choose one of the words (a–f) that best completes the gap in the text. You can use each word only once. There is one extra word.

a	**move**	**c**	**designed**	**e**	**destroy**
b	**ice-free**	**d**	**deflect**	**f**	**exert**

Arctic Drilling Rig

A special type of a submersible rig is an arctic submersible. It is 1) ____ to work during the arctic winter, when massive chunks of ice form and then 2) ____ with currents on the water's surface. Called "floes", these moving ice blocks 3) ____ great force on any object they contact. The force is great enough to 4) _____ the legs of a jackup or the hull of a conventional ship. Arctic submersibles have a reinforced hull, a caisson. When the sea is 5) ____ in the brief arctic summer, boats tow the submersible to the drilling site. When ice floes form and begin to move, the arctic submersible's strong caisson hull can 6) _____ the floes, enabling operations to continue.

VI. Fill in the gaps with the given derivatives.

prevent preventer preventing prevention prevented

1. Marine riser is a pipe of large diameter connecting moon pool on a drillship with ___stack installed on subsea wellhead.
2. The main function of marine riser is _____ of environment contamination.
3. A marine riser is used to protect drill pipe string against sea environment in the course of well drilling and _____environmental contaminations.
4. The government developed measures that included rising oil field productivity and thus _____ oil crisis.
5. Road traffic injuries can be _____ if everybody follows the traffic rules.

VII. Complete the summary of the text MOBILE OFFSHORE DRILLING RIGS. Use only one word in each sentence.

1. A widely used offshore drilling rig is a mobile offshore drilling unit, or _____ for short.
2. MODUs are either floaters or _____.
3. Floaters are capable of _____ in waters thousands of metres.
4. Generally, bottom-supported rigs drill in waters shallower than _____.
5. Implementation of operations offshore requires offshore platforms designed for well drilling and separation of well fluid into oil, gas condensate, gas and water with pumping of the first three components to onshore _____.
6. Fixed platforms can be installed with the _____ against sea bottom.
7. Floating platforms are capable independently or by means of _____ changing drilling locations.
8. Marine riser is a pipe of large diameter connecting _____ on a drillship with preventer stack.

VIII. Match the terms (1–10) with the definitions (a–j).

1)	offshore platform	a)	an open shaft in the bottom of a ship, through which deepwater drilling is done.
2)	marine riser	b)	a stationary structure without significant movement in response to waves and currents in operating conditions.
3)	jack-up platform	c)	an oil drilling rig that is installed in an offshore location.
4)	bottom-supported platform	d)	a channel used by drilling vessels to offer temporary extension for flowing fluids to the subsea blowout preventer.
5)	environmental	e)	a type of mobile offshore drilling unit that floats and is not in contact with the seafloor (except with anchors) when it is in the drilling mode.
6)	floater	f)	an assembly of well control equipment, including preventers, spools, valves, and nipples, connected to the top of the wellhead.
7)	preventer stack	g)	a bottom supported, stationary structure without significant movement in response to waves in operating conditions.
8)	fixed platform	h)	A powerful shallow-draft boat with a broad bow intended to push barges on rivers and canals
9)	moon pool	i)	connected with the natural world in which people, animals, and plants live
10)	towboat	j)	a type 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.

GRAMMAR

IX. Find 10 sentences with Infinitive, Infinitive Constructions and Gerund in the texts and translate them into Russian.

X. Match the uses of Infinitive (A–C) with the sentences (1–8).

A. Where there is infinitive of any function
B. Complex Subject
C. Complex Object

Example: *0. To make water or oil exert the correct amount of pressure, the operator adds weighting material. – The answer is 0.C (As* ***To make*** *is an adverbial modifier)*

1. He was the first to invent an electrical measuring instrument.
2. The apparatus to be designed is to be used at the power station.
3. For a long time atom was thought to be indivisible.

4. We know him to have taken interest in many scientific and technical problems of his time.
5. To estimate nickel ore geologists must know how the nickel is distributed.
6. I believe the well to be completed.
7. He is sure to have tested the device.
8. The possibility of making direct observations in workings depends on the mining system to be applied.

XI. Put the verbs in brackets into the correct *infinitive form or the –ing form*.

1. It is difficult to understand the nature of fossils without _____ (study) their origin.
2. The geological prospecting indicates if it is available _____ (continue) the exploration or not.
3. The products ____ (measure) can be combustible liquids, gases, mists or vapors.
4. _____ (use) modern equipment allowed the producers to increase the output of oil.
5. While studying at the engineering institutions, every student is _____ (go) through practical training in the field.
6. _____ (produce) oil from shale has been successfully carried out for many years.
7. The engineer wanted the crew ____ (use) a new method.
8. A gas is assumed _____ (have) different specific heats, depending on the manner in which it is heated.

TRANSLATION

XII. Translate the sentences from English into Russian.

1. Heat is known to be a form of energy.
2. We know the electrons to flow from the negative terminal of the battery to the positive one.
3. We know crude oil to be a complex mixture of hydrocarbons.
4. To know principles of drilling equipment operation petroleum engineers must thoroughly study electricity and physics.
5. This scientist was the first to invent an electrical measuring instrument.
6. It is important to solve the problem of well drilling.
7. The engineer wants the new devices to be tested in the laboratory.
8. Some semisubmersible rigs have built-in power units to drive rig from one site to another.
9. To drill offshore means to work in the sea.
10. It is necessary to cover a little drilling history before studying equipment and processes.

WRITING

XIII. Write an abstract (100–120 words) to the following article. (For more details you may see Writing Reference p. 202)

SOME FACTS ABOUT OIL AND GAS WELL DRILLING

The Chinese were the first people to drill wells, in around 2000 BC, using the cable tool percussion method to produce brine. The first wells in Russia (percussion-rod method) were drilled in the 9th century and were also used to produce a solution of common salt. The development of oil production began with subsequent advances in drilling technology. Oil had been extracted in only small amounts until the mid-19th century, usually from shallow wells around naturally exposed oil. From the second half of the 19th century, the demand for oil and especially its components began to rise. This happened with the increased use of steam engines and other industrial developments, which required huge quantities of lubricants.

The birth of the Russian oil industry dates to 1864, when Colonel Ardalion Novosiltsev drilled the first oil well (to a depth of 55 metres) in Kuban in the Kudako river valley, by mechanical cable tool percussion. The first oil gusher was registered in February 1866.

Global oil production underwent intensive development from the turn of the 19th and 20th centuries with the invention of diesel and petrol internal combustion engines and their application to industry. Mining engineer G.D. Romanovsky used a steam engine to drill a well near Podolsk (Moscow province) in 1859. A productive well 45 metres deep began operating in Baku in 1872, and this spelled the end of oil sump construction in the Baku region and a transition to drilled wells. The first steam engines appeared in Baku's oil fields in 1873, within ten years they had totally replaced horse traction.

The percussion method was developed in the first stages of well drilling. Rotary drilling with a circulating flow of fluid to flush the well was applied for the first time in the United States in 1901. In Russia, rotary drilling with flushing was first used in Grozny to drill a well 345 metres deep. We should note here that lifting rocks with a circulating flow of water was invented by a French engineer, Fawell, in 1845, who applied the method to drill an artesian well in the Saint Dominique abbey. He circulated liquid into the internal cavity of the pipe with the cutting transport to increase the efficiency of rod tool drilling.

Abridged from: Petroleum Engineering: Course book, TPUPublishing House, 2010

TEST 4

Variant 2

READING

I. Read the text and match each extract (a–d) to one of the headings (1–4).

1. Beginning of oilwell drilling in the US ____
2. Establishment of the first oil company ____
3. A mysterious sample ____
4. Whale oil as a source of light ____

HISTORY OF DRILLING IN THE UNITED STATES

A. The story of modern oilwell drilling in the United States begins in the mid-1800's, at the start of the industrial revolution. It was a time when people were beginning to need something better than candles to work and read by. Responding to the demand for reliable lighting, companies began making oil lamps, which were brighter than candles, lasted longer, and were not easily blown out by errant breezes.

B. The best source of oil to burn in the early oil lamps was sperm whale oil. Whale oil was clear, almost odorless, light in weight, and burned with little smoke. While everyone preferred whale oil, by the mid-1800s it was so scarce that only the wealthy could afford it. Virtually everyone preferred whale oil, but by the mid-1800's, it was so scarce that only the wealthy could afford it. The New England whalers had all but hunted whales to extinction. Thus, the time was ripe for an inextensive lamp oil to replace whale oil. At the same time, steam-powered machines that required good-quality lubricants were becoming common.

C. About this time – 1854 – a New York attorney named George Bissel received a sample of an unusual liquid from a professor at Darthmouth College. The professor wanted Bissel's opinion of the liquid value as a lamp oil and lubricant. The sample has been collected near a creek that flowed through the woods of Crawford and Venango countries in northwestern Pennsylvania. Besides water, the creek also carried an odorous, dark-colored substance that burned and, when applied to machinery, was a good lubricant. The substance was, of course, oil.

D. After examining the oil sample, Bissel was convinced that refined rock oil would burn as cleanly and safely as any of the oils available at the time, including whale oil. He also believed that it would be a good lubricant. Bissel thus began raising money to collect oil from the Titusville spring and to market it for illumination and lubrication. After a false start or two, Bissel,

a Connecticut banker named James M. Townsend, and others formed what ultimately became the Seneca Oil Company in New Haven, Connecticut.
Abridged from: Baker R. A Primer of Oilwell Drilling, Petroleum Extension Service, International Association of Drilling Contractors, Texas, 2001.

II. Read about types of offshore oil platforms. Write whether the following statements are true (T) or false (F).

Statement	True/False (T/F)	
1. Tension leg platforms are more rigid than fixed platforms.		
2. Fixed platforms are more flexible than compliant towers.		
3. Fixed platforms are the smallest platforms and operate in the shallowest waters.		
4. Tension leg platforms are larger than sea star platforms.		
5. Spar platforms can operate in deeper water than tension leg or sea star platforms.		
6. All of the platforms move sideways in storms, except fixed platforms.		

TYPES OF OFFSHORE OIL PLATFORMS

Offshore oil platforms must be strong enough to resist wind speeds of over 150 km per hour and waves over 20 m high.

Spar platforms are the largest type of offshore platform. They are mounted on a large cylinder. This is attached to the sea bed by cables and lines. The cylinder stabilizes the platform in the water and allows it to move a little during storms. Spar platforms can operate in water from about 700 m to over 3 000 m deep.

Tension leg platforms do not have a cylinder. The platform is mounted on long, flexible legs. These go down from the platform to the sea bed. They allow the platform to move from side to side in a storm but not up and down. Tension leg platforms can operate in water up to about 2,300 m deep.

Fixed platforms are attached to the sea bed with rigid legs. These legs are fixed to the sea bed with piles. They are stable and resist wind and water forces. Fixed platforms can operate in water depth up to about 500 m.

Compliant towers are like fixed platforms. The platform is mounted on a narrow, flexible tower. The tower extends from the platform to a solid foundation on the sea bed. It is flexible, and this allows the platform to operate in much deeper water, between 450 m and 900 m.

Sea star platforms are similar to tension leg platforms but smaller. The platform floats on a short cylinder and a hull. The cylinder and hull are below sea level, and the hull is filled with water. The hull is attached to tension legs. These narrow, flexible legs extend from the hull to the sea bed. The platform can move a little from side to side but not up and down. It can operate in water depth of up to about 1,000 m.

Abridged from: Baker R. A Primer of Oilwell Drilling, Petroleum Extension Service, International Association of Drilling Contractors, Texas, 2001.

III. Read the text and answer the questions.

1. Why is usually an offshore drilling less complicated than onshore drilling?
2. How are offshore rigs stabilized onsite?
3. What is the major difference of land rigs from offshore rigs?
4. What does well depth depend on?
5. Why is it required to disassemble land rig?
6. What does assembly of the land rig involve?
7. What does elevating the rig floor provide?

LAND RIGS

Rigging up an offshore drilling rig is usually not as complicated as rigging up a land rig. Most offshore rigs can be moved over water with almost no need to disassemble major parts. Onsite, the offshore rig is known to be stabilized by placing rig supports on the ocean floor for bottom-supported rigs or, by anchors, anchor chains, and wire or polyester rope for floaters. Only the dynamically positioned floaters require no additional support to stay in position during drilling.

Land rigs are much alike, although details vary. A major difference is their size, and size determines how deep the rig can drill. Well depths to be drilled range from a few hundred or thousand feet (meters) to tens of thousand of feet (meters). The depth of the foundation that contains, or is believed to contain, oil and gas controls well depth. Classified by size, land rigs are light duty, medium duty, heavy duty, and very heavy duty.

It should be kept in mind that a rig can drill holes shallower than its maximum rated depth. On the other hand, a rig cannot handle the heavier weight of the drilling equipment required for deeper holes.

To move most land rigs, crewmembers must disassemble many of its components. Disassembly is required so that parts can be transported to the next location and then reassembled. For safety, rigging up is certain to takes place only during daylight hours. Even with lighting after dark, there is too much heavy equipment to move safely during rig-up.

On most land rigs during rigging up, the rig parts are put back together to drill a hole. It involves unloading and hooking up the rig engines, the mud tanks and pumps, and other equipment to be used on the site. One of the last steps, and one of the more dramatic, is raising the mast from horizontal - the position in which it was transported - to the vertical drilling position. The first rig component positioned by the crew is the rig's substructure, which is the base, or foundation.

A substructure is the framework located directly over the hole; it is the foundation of the rig. The bottom of the substructure rests on level ground. The crew places a work platform on top of the substructure called the rig floor. The substructure raises the rig floor to approximately 10 to 40 feet (3 to 12 metres) above the ground. Elevating the rig floor provides room under the rig for special high-pressure valves and a blowout preventer (BOP) stack that the crew connects to the top of the well's casing. The exact height of a substructure depends on the space needed for this equipment. A cellar also provides more space for the equipment.

Abridged from: Baker R. A Primer of Oilwell Drilling, Petroleum Extension Service, International Association of Drilling Contractors, Texas, 2001.

VOCABULARY AND TERMINOLOGY

IV. Read the text LAND RIGS in detail and match the English word-combinations (1–10) with the Russian equivalents (a–j).

1)	onsite	a)	обслуживать
2)	light duty	b)	приблизительно
3)	mud tank	c)	якорная цепь
4)	complicated	d)	клапан высокого давления
5)	handle	e)	емкость для бурового раствора
6)	anchor chain	f)	буровая площадка
7)	approximately	g)	легкий режим
8)	high-pressure valve	h)	на площадке
9)	rig floor	i)	буровой двигатель
10)	rig engine	j)	сложный

V. To complete the gaps 1–5, choose one of the words (a–f) that best completes the gap in the text. You can use each word only once. There is one extra word.

a	**move**	**c**	**feature**	**e**	**destroy**
b	**definition**	**d**	**accurate**	**f**	**drill**

Feature of Land Rigs

One of the characteristic 1) ____ of land rigs is portability. A rig can 2) ____ a hole at one site, be disassembled if required, 3) ____ to another site, and be reassembled to drill another hole. Indeed, land rigs are so mobile that one 4)_____ terms them "portable hole factories". The definition sounds odd, but it is 5) _____.

VI. Fill in the gaps with the given derivatives.

disassemble assemble assembly reassemble assembled

1. The air cooler section is ____ with a stainless steel tray and a water trap.
2. Never try to ____ the valve; rather change the valve together with all tubes.
3. ____ the suction filter in the reverse sequence.
4. ____ of the land rig took much time as it took place during daylight hours only.
5. They can ____ the house on wheels under condition that you will support them with the chassis.

VII. Complete the summary of the text LAND RIGS. Use only one word in each sentence.

1. Most offshore rigs can be moved over water with almost no need to disassemble major ____.
2. To move most land rigs, _____ must disassemble many of its components.
3. The substructure raises the rig floor to approximately 10 to 40 feet above the _____.
4. The dynamically positioned floaters require no additional ____ to stay in position during drilling.
5. One of the last steps is raising the ____ from horizontal to the vertical drilling position.
6. The exact height of a substructure depends on the_____ needed for this equipment.
7. A major difference of land rigs is their ____ as it determines how deep the rig can drill.
8. The _____ of the substructure rests on level ground.

VIII. Match the terms (1–10) with the definitions (a–j).

1)	land rig	a)	complicated conditions of drilling operations.
2)	heavy duty rig	b)	the foundation structure on which the derrick, rotary table, draw-works, and other drilling equipment are supported.

3)	offshore drilling rig	c)	a drilling rig which is specially designed to drill holes on onshore locations.
4)	drilling equipment	d)	a type of safety valve used to control or limit the pressure in a system.
5)	mud tank	e)	a type of mobile offshore drilling unit that floats and is not in contact with the seafloor (except with anchors) when it is in the drilling mode.
6)	floater	f)	drilling rig consisting of an offshore platform (floating or fixed to the sea bed) from which many oil wells can be bored radially.
7)	preventer stack	g)	equipment that includes derrick/mast, substructure, drawworks, BOP, driller's cabin, drill floor equipment, etc. used to implement hoisting and rotating functions during drilling operations.
8)	pump	h)	a container that holds a reserve store of drilling fluid until it is required down the wellbore.
9)	high-pressure valve	i)	a large, specialized valve installed in stacks used to seal, control and monitor oil and gas wells to prevent blowouts,
10)	substructure	j)	a machine or device that is used to force a liquid or gas to flow in a particular direction.

GRAMMAR

IX. Find 10 sentences with Infinitive, Infinitive constructions and Gerund in the texts and translate them into Russian.

X. Match the uses of Infinitive (A–C) with the sentences (1–8).

A. Where there is infinitive of any function
B. Complex Subject
C. Complex Object

Example: *0. To make water or oil exert the correct amount of pressure, the operator adds weighting material.- The answer is 0.C (As* ***To make*** *is an adverbial modifier)*

1. It is difficult to complete the well.
2. The problem to be solved will contribute to the progress of our investigation.
3. The exploration is likely to give good results.
4. We know electronics to play a great part in human life.
5. To learn two foreign languages simultaneously is difficult.
6. I want my friends to come on Sunday.
7. The vehicle is reported to have developed a high speed.

8. The information to be received is very important for further well development.

XI. Put the verbs in brackets into the correct *infinitive form or the –ing form*.

1. _____ (extract) useful minerals by underground methods will continue in future.
2. It is the job of a derrickman _____ (handle) the upper end of the pipe from the monkeyboard.
3. Oxygen is frequently chosen as one of the first elements ____ (study) in chemical investigations.
4. Instead of _____ (burn) fossil fuels we should concentrate on more economic uses of electricity.
5. We consider him _____ (be) a good petroleum engineer.
6. _____ (add) noncorrosive powdered components to the drilling mud, the derrickman often uses a mud hopper.
7. Geology appears ____ (be) one of the principal subjects for petroleum engineers.
8. The form of the mineral body is taken into consideration in _____ (select) the method of mining.

TRANSLATION

XII. Translate the sentences from English into Russian.

1. Geologists examine the samples to determine the conditions of the well drilling.
2. These products will be replaced by a dry gas to be produced at the Shushufindi petroleum refinery as a result of the optimization plan.
3. To get hydrogen we must separate it from other elements using water or natural gas.
4. This new plant is expected to process the associated petroleum gas produced by the Snezhnoye oil treatment plant.
5. Most fuel-cell-powered vehicles to be developed will use a reformer to get hydrogen from gasoline.
6. Some experts believe a rising cost of petrol to be the best way to tackle the problems of environmental pollution.
7. Development prospect was estimated to be between 285 and 1,219 106 m^3 of gas.
8. The mast or derrick is erected on a substructure, which serves two main purposes: to support the rig floor, providing space for equipment and workers, and to provide space under the floor for special, large valves called blowout preventers.

9. It is complex and expensive to liquefy and ship natural gas overseas.
10. New technologies are allowing biogenic methane to be harvested and used to add to the supply of natural gas.

WRITING

XIII. Write an abstract (100–120 words) to the following article. (For more details you may see Writing Reference p. 202)

SPOUTERS OF BAKU

The Baku region of Azerbaijan was especially known for gushers, which the Russians called spouters and fountains. In fact, the practice of letting wells flow unchecked was encouraged, as it was realized that when the flow of a spouter was restrained, production went up in competing wells on neighboring leases. Thus, when flow from a spouter dropped, the competition got more oil and the spouter got less. However, when a spouter flooded the countryside in oil and buried it in sand, the owners of the well were responsible for the resulting property damage. Consequently, several spouters brought ruin to their owners when the flood of crude oil on the market dropped oil prices, and income from the well was not enough to compensate neighbours for the damage caused by the rain of sand and oil.

The first big Baku spouter was drilled on the Balakhani plateau of the Apsheron Peninsula by the Khalifi Company in June 1873, when their Vermishev fountain raged out of control for four months. A huge cone of mud and sand formed around the well, down which rivers of oil flowed out across the entire field. The stalk of this spouter was still forty feet tall and nine feet in diameter two years later. The Vermishev was followed by the even bigger Kormilitza (Wet Nurse) spouter, and then the Soutchastniki spouter in 1875, both on the plateau, and the Orbelovi brothers' spouter in 1877 at Shaitan (Devil's) Bazaar.

The most famous of the Baku spouters was drilled by the Droozhba (Friendship) Company, a small Armenian outfit that picked up a lease on the Balakhani plateau. Their well, which became known as the Droojba fountain, was drilled to a depth of 574 feet when it blew out on September 1, 1883 at a rate of 40,000 to 50,000 BOPD. The fountain spouted oil 200 to 300 feet into the air and raged out of control until it was capped on December 29, having produced an estimated 220,000 to 500,000 tons of oil (1.8 to 3.6 MMBO).
Abridged from http://www.sjvgeology.com/old_stuff/drilling.html

TEST 4

Variant 3

READING

I. Read the text and match each extract (A–E) to one of the stages of drilling process (1–5).

1. Advantages of rotary tables _____
2. The difference of cable-tool rig and rotary rig _____
3. The principle of rotary system operation _____
4. Systems of rig rotation _____
5. Downhole motor application _____

A. Unlike cable tool rig, a rotary rig uses a bit that isn't anything like a cable tool's chisel bit. Instead of a chisel, a rotary bit has rows of teeth or other types of cutting devices that penetrate the formation and then scrape or gouge out pieces of it as the rig system rotates the bit. Further, a rotary rig doesn't use cable to suspend the bit in the hole. Rotary crew members attach the bit to the end of a long string of hollow pipe. By screwing together several joints of pipe, they put the bit on the bottom of the hole. As the hole deepens, they add joints of pipe.

B. With the bit on bottom, the rig can rotate it in one of three ways. Many rigs use a machine called a rotary table, a sort of heavy-duty turntable. Others rotate the bit with a top drive, a device with a powerful built-in electric motor that turns the pipe and bit. And, in special cases, a slim downhole motor, usually powered by drilling fluid, but in some cases by electricity, rotates the bit. A long metal housing with a diameter a little less than a hole's holds the motor. The bit screws onto the end of it.

C. Generally, the latest rotary rigs use a top drive to rotate the pipe and bit. However, rigs using rotary tables have been around a long time and many drilling companies still own and use them. Moreover, rotary tables are simple, rugged, and easy to maintain.

D Rotary rig owners often use downhole motors where they have to rotate the bit without rotating the entire string of pipe. Such situations occur when the rig is drilling a slant, or directional hole, a hole that is intentionally diverted from vertical to better exploit reservoir.

E. Regardless of the system used to rotate the bit, the driller allows some of the weight of the pipe to press down the bit. The weight causes the bit's cutters to bite into formation rock. Then, as the bit rotates, the cutters roll over the rock and scrape or gouge it out.

Abridged from: Baker R. A Primer of Oilwell Drilling, Petroleum Extension Service, International Association of Drilling Contractors, Texas, 2001.

I. Read about truck-mounted units. Write whether the following statements are true (T) or false (F).

Statement	True/False (T/F)	
1. To handle the jobs truck hoists were provided with double masts.		
2. Field roads weren't improved for the long time that's why there was no need for better trucks.		
3 Truck-mounted service hoists were originally employed on wells where derricks were installed.		
4. It became practical to mount well servicing units on trucks.		
5. There were no advantages of using trucks.		

TRUCK-MOUNTED UNITS

Truck-mounted service hoists were originally employed on wells where derricks were installed. Later, to handle the jobs where derricks had been removed, truck hoists were provided with pole or structural masts. These rigs are not usually employed for heavy-duty work over service because they must handle tubing as single-joint lengths, and a structure to permit work above the wellhead cannot be conveniently arranged.

As better trucks were developed and field roads improved, it became practical to mount well servicing units on trucks instead of using tractors. There were two main advantages of using truck. First, rigs could be moved over greater distances. Second, trucks had more powerful engines that could supply twice the power of the tractor engines used in the 1930s. Truck-mounted hoists today are driven by engines with as much as 200 horsepower and are used for well servicing work to medium depth.

Abridged from: Introduction to Oilwell Service and Workover. Petroleum Extension Service, Dallas, Texas, 1991.

III. Read the text and answer the questions.

1. What is drilling mud?
2. Where is drilling mud used?
3. What three categories can the mud be classified into?
4. Why is mud pumped from the mud pit?
5. What can the returning mud contain? Why?
6. What safety measured should be taken to prevent explosions?
7. What does the ability of drilling fluid to carry rock depend on?

DRILLING MUD

Drilling mud, also known as spud mud (when beginning the drilling process), is a drilling fluid used to drill boreholes into the earth. It is often used while drilling oil and natural gas wells and on exploration drilling rigs but can also be used for much simpler boreholes, such as water wells.

The main classification scheme used broadly separates the mud into 3 categories based on the main component that makes up the mud: 1) Water Based Mud' (WBM); 2) 'Non Aqueous' or more commonly 'Oil Based Mud' (OBM) this also includes synthetic oils (SBM); 3) Gaseous or Pneumatic mud.

On a drilling rig, mud is expected to be pumped from the mud pits through the drill string where it sprays out on the drill bit to clean and cool the drill bit in the process. The mud then carries the crushed rock ("cuttings") up the annular space ("annulus") between the drill string and the sides of the hole to be drilled, up through the surface casing, and emerges back at the surface. Cuttings are then filtered out at the shale shakers and the mud returns to the mud pits. The returning mud can contain natural gases or other flammable materials. These can collect in and around the shale shakers area or in other work areas. There is a potential risk of a flare, an explosion or a detonation occurring if they ignite. To prevent this safety measures have to be taken. Safety procedures, special monitoring sensors and explosion-proof certified equipment has to be installed, e.g. explosion-proof certified electrical wiring or control panels. The mud is then pumped back down and is continuously recirculated. After testing, the mud is treated periodically in the mud pits to give it properties that optimize and improve drilling efficiency.

Drilling fluid is known to carry the rock excavated by the drill bit up to the surface. Its ability to do so depends on cutting size, shape, and density, and speed of fluid traveling up the well. These considerations are analogous to the ability of a stream to carry sediment; large sand grains in a slow-moving stream settle to the stream bed, while small sand grains in a fast-moving stream are carried along with the water. The mud viscosity is considered to be another important property, as cuttings will settle to the bottom of the well if the viscosity is too low.

Abridged from: http://en.academic.ru/dic.nsf/enwiki/778225.

VOCABULARY AND TERMINOLOGY

IV. Read the text DRILLING MUD in detail and match the English word-combinations (1–10) with the Russian equivalents (a–j).

1)	separate into	a)	меры безопасности
2)	mud pit	b)	сертифицированное оборудование

3)	sand grains	c)	горючий материал
4)	safety measures	d)	разделять на
5)	flammable material	e)	переносить осаждения
6)	carry sediment	f)	эффективность бурения
7)	annular space	g)	вязкость бурового раствора
8)	certified equipment	h)	частицы песка
9)	mud viscosity	i)	амбар для бурового раствора
10)	drilling efficiency	j)	затрубное пространство

V. For questions 1–5, choose one of the words (a-f) that best completes a gap in the text. You can use each word only once.

a	**rotate**	**c**	**consists**	**e**	**kelly**
b	**main parts**	**d**	**rotating equipment**	**f**	**bit**

Rotary Drilling Rig

The 1) __ on a rotary drilling rig consists of the components that actually serve to 2) __ the drill bit, which in turn digs the hole deeper and deeper into the ground. Generally, rigs can rotate the 3) __ in one of the three ways. The traditional way is to use a rotary table and kelly. A second way uses a top-drive system, which drilling contractors began to employ widely in the 1980s. A third way uses a downhole motor, which contractors use in special cases. A rotary table system 4) __ of five 5) __: a rotary table with a turn table, a master bushing, a 6) __ drive bushing, a kelly, and a swivel.

VI. Fill in the gaps with the given derivatives.

explore exploratory exploration exploring

1. __ includes drilling and driving of __ openings. These __ openings can supply the most accurate information on the mineral exposed by them.
2. __ deals with a complex range of geological, mining and economic problems. Its main task is to determine the quality, shape and mode of occurrence of mineral deposits and their main properties.
3. The geological party was sent to __ a new deposit.
4. While __ a deposit the geologists establish its general size, determine shape, dimensions and quality.

VII. Complete the summary of the text DRILLING MUD. Use only one word in each sentence.

1. Drilling mud is a drilling fluid used to drill _____ .
2. The classification scheme used broadly separates the mud into 3 categories based on the main ____ that makes up the mud.

3. _____ are filtered out at the shale shakers and the mud returns to the mud pits.
4. There is a potential risk of a flare or an explosion occurring if they _____ .
5. The mud is treated in the mud pits to give it properties that optimize and improve drilling ____.
6. Drilling fluid carries the rock excavated by the drill bit up to the _____ .
7. The mud _____is another important property.
8. Cuttings will settle to the ____of the well if the viscosity is too low.

VIII. Match the terms (1–10) with the definitions (a–j).

1)	cuttings	a)	a drilling fluid that is an emulsion containing oil as the base fluid.
2)	water based mud	b)	solid material that settles at the bottom of a liquid, especially earth and pieces of rock that have been carried along and then left somewhere by water, ice, or wind.
3)	mud pit	c)	a large tank that holds mud used as a drilling fluid.
4)	oil based mud	d)	able to catch fire and burn easily.
5)	borehole	e)	the quality that some liquids have of being thick and sticky.
6)	drilling mud	f)	a deep round hole made by a special tool or machine, especially one that is made in the ground when searching for oil or water.
7)	sediment	g)	a type of drilling mud consisting mainly of water, which has additives to modify it and make it more effective.
8)	viscosity	h)	the process of finding a source of oil or gas that a company can possibly develop.
9)	flammable	i)	the broken bits of solid material removed from a borehole drilled by rotary, percussion, or auger methods.
10)	exploration	j)	a mixture of clays, water, and chemicals pumped down the drill string while an oil well is being drilled to lubricate the mechanism, carry away rock cuttings, and maintain pressure so that oil or gas does not escape

GRAMMAR

IX. Find 10 sentences with Infinitives, Infinitive constructions and Gerund in the texts and translate them into Russian.

X. Match the uses of Infinitive (A–D) with the sentences (1–9).

A. Where there is infinitive of any function
B. Complex Subject
C. Complex Object
D. Gerund

Example: *0. To make water or oil exert the correct amount of pressure, the operator adds weighting material.- The answer is 0.C (As* ***To make*** *is an adverbial modifier)*

1. It is preferable to use downhole motors because they rotate the bit without rotating the entire string of pipe.
2. We are waiting for the new data to be published on site.
3. The work is likely to contribute to the solution of the problem.
4. Dr. Messy believes the data to be reliable.
5. To interpret these results in terms of your concept is rather difficult.
6. They watched the temperature rise gradually.
7. After testing the mud is treated periodically in the mud pits.
8. The first step towards success is said to be efficient time management.
9. Where are the articles to be translated by the students?

XI. Put the verbs in brackets into the correct *infinitive form or the –ing form*.

1. In _____ (prospect) for useful minerals, aerial photography will play an important part.
2. Mud components _____ (store) in large tanks are needed in large quantities.
3. ____ (evaluate) the well depth we used the test method.
4. Nowadays natural gas is utilized as a raw material for _____ (manufacture) synthetics.
5. Coal is still the most important fuel and is likely _____ (remain) the main source of energy for years to come.
6. Everyone knows automation ____ (introduce) in all fields of national economy.
7. Petroleum is believed ____ (form) from decaying vegetables and animal remains.
8. Drilling is extremely useful ___ (map) the survey area.

TRANSLATION

XII. Translate the sentences from English into Russian.

1. Dalton's hypothesis was later proved to be true.
2. The substance to be dissolved is called the solute.
3. Everybody considers him to be an expert in his field.
4. To imagine a molecule of water means to imagine a certain combination of hydrogen and oxygen atoms.
5. Pressure causes gas to compress.
6. Mud is drilling fluid to be treated periodically in the mud pits to give it properties that optimize drilling efficiency.
7. We know this young man to work as a drilling superintendent in the field.
8. To maintain a constant temperature in a small or large container was for years a very important technical problem.
9. Plastics are known to be a class of materials not to be found in nature.
10. The atmosphere was found to have a significant effect on the wettability and surface tension of the metal.

WRITING

XIII. Write an abstract (100–120 words) to the following article. (For more details you may see Writing Reference p. 202)

NEW ELEMENTS OF A MAST STRUCTURE

Today's deeper wells require masts that are stronger and heavier, and these heavier masts, in turn, require stronger and more reliable means for raising them to the vertical position and extending them to full height. Masts have increased from a 60-foot nominal height for pulling 30-foot lengths of tubing as singles and 50-foot rod doubles to those that are more than 90 feet in height for tubing doubles and rod thribbles. Wellhead clearance requirements have also increased to provide working space for blowout preventers.

All of these changes have led to the latest generation of service and work over rigs: self-propelled carrier units. These units became feasible as highway weight and length regulations were liberalized, which permitted longer and heavier units to be constructed. Instead of adapting a truck to transport and power a hoist, the carrier unit is designed to fit the desired engine-hoist mast combination, and an appropriate drive to the wheels is provided. Instead of driving the rig hoist with the truck engine, the carrier design takes power from the rig engine or engines to propel the unit. The addition steering gear and a cab for the drive converts the unit better weight distribution on the wheels and more power full engine-transmission combinations.

Some carrier rigs arranged with the derrick mounted on the rear; this is known as the back-in unit. Others have the driver's cab and the derrick base on the same end-the drive-in unit. This arrangement gives the driver good visibility of the well when he is placing the unit on location. The disadvantage, however, is that the cab will be covered by the oil and dirt that inevitably accumulate around the wellhead.

Abridged from: Пособие_Заочники/Drilling_and_Servicing_Tools...110_A5.pdf file:///C:/Users/ДНС/Desktop/

TEST 4

Variant 4

READING

I. Read the text and match each extract (A–D) to one of the headings (1–4).

1. Bases of bimetallic corrosion ____
2. Models to explain environmentally assisted cracking ____
3. Basic types of corrosion ____
4. Corrosion phenomenon ____
____

PIPELINE CORROSION TYPES

A. Corrosion in a pipeline is a naturally occurring phenomenon defined as the gradual deterioration of the pipe material or its properties due to a reaction of the pipe with its environment. The environment is referred the fluid in the pipe, the surrounding soil, and the atmosphere. The corrosion risk is related to the presence of water and corrosive components such as CO2 and H2S. There are several types of pipeline corrosion. Most corrosion failures occur due to a combination of more than one of these types.

B. First of all, corrosion types are divided into general attack corrosion and localized corrosion. The first one proceeds at approximately the same rate over the whole surface being corroded and the extent can be measured as mass loss per unit area. The latter occurs at a specific area of the pipe surface. This includes pitting, crevice, and filiform corrosion. Pitting results in deep, narrow attack causing rapid penetration of the pipe wall thickness. Crevice corrosion occurs in or immediately around a break in the material. Filiform corrosion is a form of oxygen cell corrosion that occurs underneath organic or metallic coatings on pipe materials.

C. Galvanic corrosion occurs due to the potential differences between metals when they are in electrical contact and exposed to an electrolyte. Dissimilar metals accelerate the process. This is due to electrochemical action that causes one metal to be the anode and the other the cathode.

D. Environmental cracking is the brittle failure of a ductile material due to the combined effect of corrosion and tensile stress. This type includes stress corrosion cracking (SCC), hydrogen-induced cracking (HIC), liquid metal embrittlement (LME), and corrosion fatigue (CF).

Abridged from: Pipeline planning and construction field manual / E. Shashi Menon, 2011.

II. Read about the methods of pipeline corrosion protection. Write whether the following statements are true (T) or false (F).

Statement	True/False (T/F)	
1. Engineers distinguish two basic methods to protect the pipeline from corrosion: impressed current method and sacrificial anode method.		
2. The first practical use of cathodic protection was in the 1820s, England.		
3. Lining is basically applied on the outside of the pipe.		
4. External coatings are used to protect welded joints of pipe.		
5. In cathodic protection, a buried pipeline is made as the cathode and another metal is used as the anode that gets corroded by electrochemical process instead of the pipe.		
6. Inhibitors decrease corrosion rate by forming thin films at the outer metal surface.		

PIPELINE CORROSION PROTECTION

There are four common methods used to control corrosion on pipelines: protective coatings and linings, cathodic protection, materials selection, and inhibitors.

External coatings, applied on the outside of the pipe to form a barrier between the pipe material and the environment consist of the following: 1. Bitumastic materials, cast iron, and concrete pipes 2. Epoxies and other polyester materials 3. Wrappings consisting of tape applied around the pipe used on coated and uncoated pipes 4. Shrink sleeves used to protect welded joints of pipe. Internally coated pipe (lining) is used to protect the interior of the pipe from caustic and abrasive fluids transported through the pipeline.

The concept of cathodic protection goes back to 1824, in London, when the copper sheeting on British ships was being corroded. Experiments were conducted that resulted in protecting copper against corrosion from seawater utilizing iron anodes. Since then, corrosion protection has grown to have many uses in marine and underground structures, water storage tanks, gas pipelines, oil platform supports, and many other facilities exposed to corrosive environments.

Cathodic protection prevents corrosion by converting all of the anodic (active) sites on the metal surface to cathodic (passive) sites by supplying

electrical current (or free electrons) from an alternate source. The two main methods of achieving this goal are by either sacrificial anodes or the impressed current method.

Corrosion can be mitigated by proper selection of materials for the specific application and inhibitors. Corrosion-resistant materials include stainless steels, plastics, and special alloys used in conjunction with pipelines. Corrosion inhibitors are used to decrease the rate of corrosion by adding them to the transported medium. These inhibitors control corrosion of the metal by forming thin films at the metal surface.

Abridged from: Pipeline planning and construction field manual / E. Shashi Menon, 2011.

III. Read the text and answer the questions.

1. What was the first method to inspect pipelines?
2. What is the advantage gained from introducing pigging into pipeline industry?
3. What is pigging intended for?
4. Is it required to stop pipeline operation for pigging?
5. What is the main reason for using pigging in batching?
6. What are the basic advantages of up-to-date monitoring equipment over conventional aerial inspection?
7. What are the main types of pigs used in pipeline engineering?

PIPELINE INSPECTION AND MAINTENANCE

Today, various pipeline monitoring programs are used to keep track of the effects of corrosion or mechanical damage to insure that the pipeline continues to meet safety and operating requirements. Traditionally, pipelines were inspected visually by traversing the route on the ground or patrolling the pipeline route in aircraft. Aerial inspection is still done, but emphasis now is on developing instrumentation and monitoring equipment that will provide more rapid and precise location of leaks and potential leaks.

In modern pipeline engineering, pipeline operation and maintenance becomes more effective and efficient when essential operation and maintenance jobs are performed using pigs. Many procedures that are needed for increased pipeline longevity, improved pipeline efficiency, and risk reduction, such as reducing the effect of internal corrosion, cannot be done without having pigging capability.

Operators need to run cleaning pigs to dewax and descale the inside surface of the pipe and remove debris, which help improve pipeline performance, and they can do all this without significantly interrupting product flow to the customer. Other pigging tasks include dewatering or swabbing, drying of gas pipelines after hydrostatic testing, batching products to minimize mixing of two different products at the liquid interface, and internal in-

spection of the entire pipeline system. Pipeline internal inspection can be done by using gauging plates, caliper pigs, or smart pigs.
Abridged from: Pipeline planning and construction field manual / E. Shashi Menon, 2011.

VOCABULARY AND TERMINOLOGY

IV. Read the texts given above in detail and match the words in column A with the words in column B to form word-combinations. Then give Russian equivalents to these word-groups.

Example: 1d – скорость распространения коррозии

	A		**B**
1)	corrosion	a)	current
2)	sacrificial	b)	monitoring programs
3)	pipe wall	c)	inspection
4)	electrical	d)	rate
5)	pipeline	e)	current method
6)	smart	f)	thickness
7)	internal	g)	pig
8)	impressed	h)	anode
9)	monitoring	i)	prevention program
10)	pipeline corrosion	j)	equipment

V. For questions 1–5, choose one of the words (a–f) that best completes the gap in the text. There is one extra word.

a	**maintenance**	**c**	**essential**	**e**	**offshore**
b	**capability**	**d**	**efficiency**	**f**	**pigs**

Modern Pipeline Engineering

In modern pipeline engineering, pipeline operation and 1) _____ are a necessary part of the work of the construction. The more 2) _____ operation and maintenance jobs are performed using 3) ____. Many procedures are needed to increase pipeline longevity and improve pipeline 4) _____. Risk reduction, such as reducing the effect of internal corrosion, cannot be done without having pigging 5) _____.

VI. Fill in the gaps with the given derivatives.

transport (V) **transported** **transportability**
transporting **transportation** **transporters**

1. The latter is only suitable for pipelines _____ a gaseous medium, such as natural gas, where the throughput may be increased significantly (by approximately 10 %) by drag-reducing coating.

2. Bare or coated pipe _____ on flat-bed trucks or rail cars should be adequately secured and padded, and pipe on vessels must be secured against rolling.
3. Because of its high energy density, easy _____, and relative abundance, oil has been the world's most important source of energy since the mid-1950s.
4. The pipe, including end fittings, accessories and reels should be sufficiently secured and protected during storage and _____ to avoid damage of the pipe and to safeguard personnel.
5. But in the simplest terms, the revolution in gas pipeline regulation that began in the mid-1980s transformed pipeline companies from merchants to _____.
6. Producers can now sell directly to industrial customers, and pipeline companies must _____ that gas for a fee.

VII. Complete the summary of the text PIPELINE CORROSION PROTECTION. Use only one word in each sentence.

1. There are four methods which are used to prevent corrosion on pipelines: protective coatings and linings, cathodic protection, materials selection, and _____.
2. External coatings are applied on the _____ of the pipe to form a barrier between the pipe material and the environment.
3. Cathodic protection prevents corrosion by converting all of the anodic (active) sites on the metal surface to cathodic (passive) sites by supplying electrical _____ (or free electrons) from an alternate source.
4. The two main methods of achieving this goal are by either _____ anodes or the impressed current method.
5. Corrosion can be _____ by proper selection of materials for the specific application and inhibitors.
6. Corrosion-_____ materials include stainless steels, plastics, and special alloys used in conjunction with pipelines.
7. Corrosion inhibitors are used to decrease the _____of corrosion by adding them to the transported medium.
8. These inhibitors control corrosion of the metal by forming thin _____ at the metal surface.

VIII. Match the terms (1–10) with the definitions (a–j).

1)	cathode	a) electrode from which electric current flows to an electrolyte (water, soil). On the surface an oxidation process takes place, e.g. metal to metal ions or hydroxyl ions to oxygen and water.

2)	fittings	b)	substance added to a transported medium to reduce corrosion.
3)	pigging	c)	electrochemical method of corrosion protection of metal structures, achieved by forcing an electric current from an anode through the surrounding electrolyte into the metal, which becomes a cathode.
4)	pitting	d)	thermal insulation concept where insulation material is introduced in the annulus between the product pipe and a rigid sleeve pipe.
5)	anode	e)	an anode which connected to a structure can offer cathodic protection while it is consumed.
6)	sacrificial anode	f)	pipeline components that do not have operational functions.
7)	pipe-in-pipe	g)	passage of a pipeline by spherical or cylindrical devices (pigs), propelled by the transported medium.
8)	cathodic protection	h)	method of cathodic protection where the driving current is delivered from an external power source.
9)	inhibitor	i)	localised corrosion attack.
10)	impressed current	j)	electrode into which electric current flows from an electrolyte (water, soil). On the surface a reduction process takes place, e.g. water to hydrogen and hydroxyl ions.

GRAMMAR

IX. Find 10 sentences with Infinitive, Infinitive constructions and Gerund in the texts and translate them into Russian.

X. Match the uses of Infinitive (A–C) with the sentences.

A. Where there is infinitive of any function
B. Complex Subject
C. Complex Object

Example: *0. To make water or oil exert the correct amount of pressure, the operator adds weighting material. – The answer is 0.C (as* ***To make*** *is an adverbial modifier)*

1. In discussing underground storage, it is important to define several terms.
2. LNG is pumped into special insulated tanks of various designs to store before loading onto ships for transport to market.
3. There have been large and costly crude oil and product spills because one or more valves were not operated correctly but were reported to be positioned in accordance with the test plan.

4. In the tank battery, the oil volume is supposed to be measured and tested before pumping the oil into the pipeline system.
5. The need to curtail operations if the maximum allowable operating pressure must be reduced because of corrosion of the pipe wall should also be considered.
6. One way of significantly reducing the cost of hydrostatic testing crosscountry pipelines is to increase the test pressure range or design the pipeline using higher X-grade pipe and flanges.
7. To calculate hydraulic rates for a given segment of the system, the computer searches for the maximum flow rate that satisfies all minimum and maximum suction pressure and maximum discharge pressures.
8. Grading cannot begin or continue along a right-of-way until the designated right-of-way is cleared along the construction corridor.
9. The thermal insulation system is designed to provide adequate insulation for the operational flow conditions.
10. In recent years, emphasis on heat content of the gas has resulted in techniques to monitor the BTU content of a flowing gas stream.

XI. Put the verbs in brackets into the correct *infinitive form* or the *-ing* form.

1. They would like _____ (to start) pipeline construction in spring.
2. He is too excited _____ (to participate) in real pig launching procedure.
3. When hydrogen-induced cracking occurs close to the surface it may result in _____ (to blister).
4. It is no use _____ (to apply) lining if operating temperature requirements are neglected.
5. Welding crew is busy _____ (to weld) pipe sections laid along the intended route.
6. My supervisor suggests me _____ (to go) to the construction site.
7. Most finished petroleum products that end up in the marketplace are the result of _____ (to blend) a range of hydrocarbon molecules from a number of different processes at a refinery.
8. Other welder qualification rules depend on the operating conditions of the pipeline _____ (to weld).

TRANSLATION

XII. Translate the sentences from English into Russian.

1. Experiments were conducted that resulted in protecting copper against corrosion from seawater utilizing iron anodes.
2. Cathodic protection prevents corrosion by converting all of the anodic (active) sites on the metal surface to cathodic (passive) sites by supplying electrical current (or free electrons) from an alternate source.

3. The two main methods of achieving this goal are by either sacrificial anodes or the impressed current method.
4. Corrosion inhibitors are used to decrease the rate of corrosion by adding them to the transported medium.
5. These inhibitors control corrosion of the metal by forming thin films at the metal surface.
6. Traditionally, pipelines were inspected visually by traversing the route on the ground or patrolling the pipeline route in aircraft.
7. Aerial inspection is still done, but emphasis now is on developing instrumentation and monitoring equipment that will provide more rapid and precise location of leaks and potential leaks.
8. Many procedures that are needed for increased pipeline longevity, improved pipeline efficiency, and risk reduction, such as reducing the effect of internal corrosion, cannot be done without having pigging capability.
9. Other pigging tasks include dewatering or swabbing, drying of gas pipelines after hydrostatic testing, batching products to minimize mixing of two different products at the liquid interface, and internal inspection of the entire pipeline system.
10. Pipeline internal inspection can be done by using gauging plates, caliper pigs, or smart pigs.

WRITING

XIII. Write an abstract (100–120 words) to the following article. (For more details you may see Writing Reference p. 202)

PROBLEM PIPELINES

The problem is that most of our aging pipeline systems were not equipped or designed to accommodate pipeline pigging. This is especially true in the smaller diameter, hazardous liquid pipelines located in urban areas. Because of the high demand for pipeline systems capable of transporting crude oil from production to refineries and products from refineries to distribution terminals and marine terminals, during and after WWII, pipeline designer's made mistakes, and did not consider long-term maintenance as part of their pipeline design. As a result, many liquid pipelines were not designed for pigging of any kind.

These older pipelines evolved over time by connecting different pipelines together and by constructing new pipeline extensions or laterals between existing pipelines, to supply product and crude oil as necessary to meet market demand. These pipelines had changes in diameter size, and many were constructed with short (or tight) radius bends and unprotected branch connections (meaning pipe tee connections without bars which are needed to keep

pigs from catching and blocking the flow). Some pipelines were operated with reduced port valves or square port valves, and of course, all were without any pig launcher/receiver capability. Even worse, some of the old pipelines had mitered elbows and reduced port check valves. When corrosion leaks occurred, they were repaired by inserting a screw in the leaking corrosion pit and wrapping the pipe at that location with a steel band and rubber gasket.

Abridged from: Pipeline planning and construction field manual / E. Shashi Menon, 2011.

TEST 4

Variant 5

READING

I. Read the text and match each extract (A–D) to one of the headings (1–4).

1. Tank battery configuration and components ____
2. Reasons for crude processing ____
3. Final stage in crude processing before delivery ____
4. Parameters to be measured before crude deliver ____

PRELIMINARY CRUDE PROCESSING

A. A typical land-based oil field contains a number of wells. A network of gathering lines carries this oil from the wells to a location in or near the oil field for preliminary processing. Oil produced from almost any reservoir contains some gases (including natural gas, often in the form of associated gas) in addition to water vapor or liquid water. For this reason, a unit called a tank battery at a well site is used to remove both the natural gas and the water. Any solid materials (e.g., sand), as well as some dissolved salts, are removed from the raw crude.

B. A typical tank battery contains a separator (treater) to separate oil, gas, and water; a fired heater to break water/oil emulsions to promote complete removal of water from the oil; and tanks for storing the oil until it can be shipped from the lease by truck or pipeline. Metering equipment is also included to measure the volume of oil leaving the lease.

C. When a pipeline company is ready to accept the stored oil, a technician or an automated system checks oil volume to be transferred as well as oil quality. In manual operations, after climbing to the top of the storage tank and opening a small hatch, a technician takes three actions:

- measures the temperature of the oil;
- lowers a gauge tape into the tank to measure oil depth;
- takes a sample of the stored oil by dipping a small bottle into the tank or by opening a small valve on the tank's side

D. Then, by calculation and analysis, the technician will convert the measured oil depth to oil volume, using a gauge table or computer algorithm; separate basic sediment and water (BS&W) from the oil sample, using a centrifuge; determine how much BS&W is contained in the measured oil volume.
Abridged from: The oil and gas industry: a nontechnical guide / Joseph F. Hilyard, 2012.

II. Read about the methods of pipeline corrosion protection. Write whether the following statements are true (T) or false (F).

Statement	True/False (T/F)	
1. LNG has become a breakthrough over the past decades in the gas transportation industry.		
2. LNG transportation would soon replace pipeline transportation.		
3. The liquefaction process includes refrigeration, shipment, and regasification.		
4. LNG can be delivered without being pressurized.		
5. Not all produced natural gas should be processed before cooling.		
6. There is no need for an extra cooling system to maintain the required temperature of LNG.		

TRANSPORTING NATURAL GAS AS LNG

An increasingly important development in the movement of natural gas – particularly between nations – has been the evolution, over the past several decades, of the LNG industry. Transforming natural gas into a cryogenic (ultracold) liquid increases its energy density dramatically, permitting movement by ship, barge, or tank truck instead of by pipeline. The same cryogenic technique is also used to expedite shipment of industrial gases such as nitrogen, oxygen, and hydrogen.

The three major steps in the LNG value chain are the liquefaction process, the shipment of the LNG (most often by ships of special design) to an import terminal, and the transformation of the LNG back into gaseous form (regasification) for introduction into a pipeline that will carry it to market. Interim storage of the LNG is also part of industry operations at both liquefaction plants and regasification plants. When natural gas (at atmospheric pressure and 60 °F) is cooled below its boiling point (–263 °F), its volume can be reduced by a factor of more than 600, and it can be stored and shipped without pressurization in liquid form. Before cooling gas is cleaned from carbon dioxide or hydrogen sulfide (sweetening), water or water vapor (dehydration).

LNG will remain an ultracold liquid with no need for a cooling system because of the naturally occurring process called boil-off. In this process, some natural gas vapors evaporate from the LNG, and this evaporation draws heat away from the liquid, keeping it cold. Effective thermal insulation will maintain the low temperature of the LNG as long as the boil-off gas is removed from the storage vessel.

Abridged from: The oil and gas industry: a nontechnical guide / Joseph F. Hilyard, 2012.

III. Read the text and answer the questions.

1. Where is oil often stored?
2. What can be made in order to minimize evaporation from an oil tank?
3. What are floating roofs designed for?
4. What are the main two types of oil storage tanks?
5. Where is gas often stored?
6. What does the term “cushion gas” stand for?
7. What can influence the type of oil storage facility?

OIL AND GAS STORAGE

Crude oil is typically stored in aboveground tanks or in underground caverns. Depending on market conditions and supply/demand dynamics, it is also occasionally stored in tanker ships.

Crude oil storage tanks are typically large cylindrical structures built of carbon steel. They are usually painted a light color to reflect the rays of the sun, thereby minimizing evaporation. Generally, storage tanks are divided into pressurized storage tanks and atmospheric storage tanks. Pressurized storage tanks are usually used for storing liquids that evaporate. For this reason, atmospheric storage tanks are the ones that are best suited for storing crude oil. They include fixed roof tanks and floating roof storage tanks. Fixed roof storage tanks are used when the quantities of crude oil are not that much. The floating roof prevents evaporation and reduces oil contact with oxygen and moisture.

Gas can be stored in a variety of ways; the following are the most common:

- under pressure in depleted oil or natural gas reservoirs;
- in aquifers (water-bearing sedimentary rock formations);
- in underground salt caverns.

In discussing underground storage, it is important to define three terms:

- Total gas storage capacity: the maximum volume of gas that can be stored in an underground storage facility based on its design.
- Base gas (or cushion gas): the volume of gas that must stay in a storage reservoir to maintain adequate pressure and deliverability rates throughout the withdrawal season.
- Working gas: the volume of gas in the reservoir above the level of base gas (in other words, the amount available to the marketplace).

Abridged from: The oil and gas industry: a nontechnical guide / Joseph F. Hilyard, 2012.

VOCABULARY AND TERMINOLOGY

IV. Read the texts given above in detail and match the words in column A with the words in column B to form word-combinations. Then give Russian equivalents to these word-groups.

Example: 1c – deliverability rate (скорость подачи газа)

	A		B
1)	deliverability	a)	site
2)	associated	b)	season
3)	tank	c)	rate
4)	well	d)	equipment
5)	dissolved	e)	tape
6)	metering	f)	battery
7)	withdrawal	g)	salt
8)	gauge	h)	gas
9)	underground	i)	formation
10)	water-bearing	j)	cavern

V. For questions 1–5, choose one or word combination (a–f) that best completes a gap in the text. You can use each word only once. There is one extra word that is not needed.

a	**destination**	**c**	**tanks**	**e**	**transportation**
b	**ready supply**	**d**	**be stored**	**f**	**underground storage facilities**

Gas Storage Facilities

Natural gas, like most other commodities, can 1) _____ for an indefinite period of time. The exploration, production, and 2) _____of natural gas takes time, and the natural gas that reaches its 3) _____ is not always needed right away, so it is injected into 4) _____. These storage facilities can be located near market centers that do not have a 5) _____ of locally produced natural gas.

VI. Fill in the gaps with the given derivatives.

storage stored store storing restored

1. Systematic and routine testing involves periodic sampling and testing of gas in storage to determine the dew point of vapors contained in the _____ gas.
2. After a pipeline has been constructed and put into operation, the right of way is cleaned up and _____.
3. In gravity flow systems, liquid may flow from a _____ tank located at a higher elevation through a pipeline down to a terminus at lower elevation.

4. In addition to the pipe storage areas close to the construction corridor, other construction yards, not used for pipe storage are utilized to _____ equipment.
5. A typical tank battery also contains tanks for _____ the oil until it can be shipped from the lease by truck or pipeline

VII. Complete the summary of the text OIL AND GAS STORAGE. Use only one word in each sentence.

1. Crude oil is typically stored in tanks, underground caverns or _____.
2. Storage tanks are commonly mage of carbon _____.
3. To minimize evaporation the colour is _____.
4. For storing liquids that evaporate there are _____ storage tanks.
5. Gas can be stored in natural reservoirs, _____ and underground salt caverns.
6. There are ____ important terms used to discuss underground storage.
7. Total gas storage capacity is ____ volume of gas stored in underground facility.
8. Working gas is the _____ of gas available to the marketplace.

VIII. Read the texts given above in detail and match the English word or word-combinations (1–9) with its definitions (a–j).

1)	regasification	a)	removing acid gases (f.e. carbon dioxide and hydrogen sulfide) from natural gas.
2)	liquefaction process	b)	a volume of natural gas in the storage reservoir that can be extracted during the normal operation of the storage facility.
3)	boiling point	c)	a tape on a reel used to measure the quantity of oil in a stock tank.
4)	sweetening	d)	a process when some natural gas vapors evaporate from the LNG, and this evaporation draws heat away from the liquid, keeping it cold.
5)	dehydration	e)	the temperature at which a liquid boils and turns to vapor.
6)	boil-off	f)	removing liquid or water vapor from a gas.
7)	base gas	g)	this process converts gas to liquid by lowering the temperature of the gas to approximately –260 degrees Fahrenheit (–160 degrees Celsius).
8)	working gas	h)	transformation of the LNG back into gaseous form.
9)	gauge tape	i)	the volume of gas that must stay in a storage reservoir to maintain adequate pressure and deliverability rates throughout the withdrawal season.

10) cushion gas — j) a volume of gas that must remain in the storage facility to provide the required pressurization to extract the remaining gas.

GRAMMAR

IX. Find 10 sentences with infinitive, Infinitive constructions and Gerund in the texts and translate them into Russian.

X. Match the uses of Infinitive and Gerund (A–C) with the sentences.

A. Where there is infinitive of any function
B. Complex Subject
C. Complex Object

Example: *0. To make water or oil exert the correct amount of pressure, the operator adds weighting material. – The answer is 0.C (as To make is an adverbial modifier).*

1. Use of the drag reducer in the trans-Alaska crude pipeline throughout 1980 is reported to have provided additional capacity of up to 170,000 b/d over that which would have been available without the additive.
2. Offshore regasification systems such as these will need to prove their safety, reliability, and economic feasibility in the coming years before being widely adopted.
3. Compressor stations are supposed to push natural gas through a pipeline by compressing the gas at intervals along the system.
4. To determine the most effective tradeoff options experts conduct dependability analyses.
5. To limit gas temperature to recommended values, it is often necessary to cool the gas between compression stages.
6. This heave has been found to be greater than that which would occur due solely to the freezing of the water in the soil.
7. Another approach is to use a computer model to predict heave and the resulting stresses on the pipe.
8. Laying pipe with a reel barge is reported to offer advantages in Arctic waters.
9. Gas price regulation is considered by most energy analysts to have had a negative influence on the search for new gas supplies.
10. The most common way to mitigate upheaval buckling is to provide the pipeline with sufficient overburden.

XI. Put the verbs in brackets into the correct *infinitive form or the –ing form*.

1. The decision to postpone _____ (test) a newly-built pipeline was made by Technical Pipeline Safety Standard Committee.
2. The Commission suggested _____ (commission) the pipeline in spring.
3. Pipeline owners could not afford _____ (own) and _____ (maintain) the required equipment and use a construction staff for only intermittent construction work on their own systems.
4. They suggest _____ (compensating) these dangers by careful selection of pipe material.
5. It has been decided for this particular project _____(introduce) a more rigid requirement than could be deduced from the DNV standard.
6. To avoid _____ (damage) the pipe it is important to manage the installation operation in a safe and controlled manner.
7. The 45° ells, rather than 90° ells, are recommended _____ (avoid) sharp changes in the direction of gas flow that could cause turbulence.
8. If the pipeline is buried, a further contribution to the insulation is obtained from the seabed soil, which may be assumed _____ (have) a thermal conductivity of the order of 1–2 W/m/°C.

TRANSLATION

XII. Translate the sentences from English into Russian.

1. In manual operations, after climbing to the top of the storage tank and opening a small hatch, a technician takes three actions.
2. Transforming natural gas into a cryogenic (ultracold) liquid increases its energy density dramatically, permitting movement by ship, barge, or tank truck instead of by pipeline.
3. Before cooling gas is cleaned from carbon dioxide or hydrogen sulfide (sweetening), water or water vapor (dehydration).
4. Pressurized storage tanks are usually used for storing liquids that evaporate.
5. For this reason, atmospheric storage tanks are the ones that are best suited for storing crude oil.
6. All three elements of the above definition are relevant in determining appropriate facility reporting in general, and in clarifying reporting obligations to the oil and gas production areas in particular.
7. Pipeline transportation has the advantages of being well established, efficient, cost-effective, and readily expandable.
8. Pipeline pumps are used for boosting pressures and for transferring product in both gathering and mainline transmission systems.

9. Gas flows by expanding in the pipe from the discharge side (high pressure point) from one station to the suction side (low pressure point) of the next.
10. It is also worth mentioning two final modes of oil transportation, i.e. the tank truck and the railcar.

WRITING

XIII. Write an abstract (100-120 words) to the following article. (For more details you may see Writing Reference p. 202)

Offshore Regasification Process

In the mid-2000s, other approaches to regasification were moving from concept to commercial application: the conversion of LNG to gaseous form aboard converted or specially designed vessels moored offshore.

One approach involves use of a tanker that contains both LNG tanks and a regasification system. After arrival on station, the vessel connects to a special buoy that is in turn connected to a pipeline on the seabed. The tanker's LNG is regasified onboard and sent down to the pipeline that carries it to shore.

Another is the floating storage and regasification unit (FSRU) – either a custom-built ship or a converted LNG tanker – typically moored permanently at an offshore site. Other loaded LNG tankers tie up to the FSRU and pump their LNG into the FSRU's insulated tanks. Later, the LNG is regasified and sent to shore in the manner described above.

In a third concept, a specially built system is attached to a conventional LNG tanker offshore. This pulls LNG from the tanker and vaporizes it. Then the LNG is sent through a subsea line to an onshore pipeline.

Offshore regasification systems such as these will need to prove their safety, reliability, and economic feasibility in the coming years before being widely adopted.

VOCABULARY REFERENCE

Unit 5–6 (TEST 3)

abandon	– закрывать, консервировать, ликвидировать (скважину)
abound	– изобиловать
absorb	– поглощать
accept	– принимать
access	– доступ
accident	– аврия, несчастный случай
account for	– приводить, вызывать
actuate	– приводить в действие, активироваться
advanced recovery technique	– метод увеличения нефтеотдачи
advancement	– содействие развитию
advertisement	– объявление
aerial	– аэро, снятый с воздуха
affiliated company	– дочерняя компания
aim	– цель, задача
amount	– количество
application	– применение
application form	– анкета (поступающего на работу)
apply for	– устраиваться на (работу, должность)
appraise	– производить оценку, оценивать
appraisal	– оценка, определение стоимости
apprentice	– новичок, стажер
approach	– подход
approve	– одобрять
ascertain	– выяснять
asset	– актив, статья дохода
assign	– присваивать
associated gas	– попутный газ
assume	– предполагать
atmospheric temperature	– среднее значение температуры воздуха
available	– доступный, имеющийся в распоряжении
background	– данные
background subsurface physical characteristics	– исходные физические характеристики подземных пластов
balance sheet	– отчет о финансовом положении, отчетная ведомость
bay	– залив

be closely linked to – быть тесно связанным с
be concerned with – иметь дело (заниматься) с
be responsible for – отвечать за
bear a relationship to – иметь отношение к …..
bell-shaped curve – колоковидная кривая
benefit – преимущество
bid for – делать конкурсное предложение
bitumen – битум
blacksmith – кузнец
blow-down drum – емкость для спуска жидкости
body – корпус
body of water – водный объект
boiling point – температура кипения
book – оформлять, ставить на баланс
boreholes – скважина
bottom – дно, нижняя часть
branch – отрасль, раздел (науки)
brine wells – скважина для разработки соляного источника
burn – сжигать
by no means – ни в коей мере не
by-product – попутный продукт
cable tool – бурильный инструмент для канатно-ударного бурения
carbon – углерод
carbon black – черно-серый пигмент, получаемый из продуктов сжигания различных углеводородов
carbon dioxide – углекислый газ
carry out – проводить
casing – обсадка, колонна обсадных труб
cause – причина; вызывать, приводить
certain – нечто несомненное
certainty – определенность, обоснованность, достоверность
challenging – представляющий сложность, затруднительный
charge – заряд
chemical flooding – химическое заводнение
chromatograph – хроматограф
circumstance – обстоятельство

civil engineering	– гражданское строительство
claim	– заявлять, объявлять
clean up	– очищать
cloth	– ткань
clue	– ключ (подсказка), сведение
collaborate	– сотрудничать
collection tank	– сборный резервуар
colouring	– красящее вещество
commercial production	– промышленная добыча
commodity	– товар, продукт, предмет потребления
community	– сообщество, община
complex reservoir	– пласт сложной структуры
complicated	– сложный
composition	– состав, соединение
concern	– озабоченность, беспокойство, проблема
condition	– условие
conduct	– поведение
confirm	– подтверждать
consequence	– последствие
consumption	– потребление
contain	– содержать
contaminate	– загрязнять
continuous electric logging	– непрерывный электрический каротаж
contractor	– подрядчик
controversial	– спорный, дискуссионный
conventional well	– традиционная скважина
convert	– преобразовывать
core sample	– образец керна
coring technique	– технология колонкового бурения
cover energy requirements	– удовлетворить потребности в энергии
covering letter	– мотивационное письмо
creek	– ручей
crew	– бригада
cross-section	– разрез
customer relations	– работа с клиентами
CV	– резюме
dam	– строить плотину на реке, запрудить
damage	– наносить урон, вред
debris	– обломок, фрагмент, осколок
decide	– решать
decline	– падать, снижаться

decommissioning – снятие с эксплуатации
degree – учебная (ученая) степень
deliver – доставлять, поставлять
demand – спрос, потребность
density – плотность
deposit – залежь, месторождение
design – проектировать
despite – несмотря на
detect – обнаруживать, улавливать
determine – определять, устанавливать
develop – разрабатывать, развивать
development – разработка, развитие
device – устройство
dig – копать
digital – цифровой
direction – направление
discharge – утечка, слив
discover – обнаруживать, открывать
display – изображение
dissolve – расствориться
distillation tower – перегонная колонна
distribute – распределять
distribution – распределение
diverse – разноплановый
double-hulled tanker – двухкорпусный танкер
drain – осушать
dramatically – резко, сильно, чрезвычайно
draw up contract – составлять контракт
drill – бурить, разбуривать
drilling operator – нефтедобывающая компания, ведущая буровые работы
drilling tool – буровое оборудование
drop – падать; падение
earn – заработать
easy-to-reach – легкодоступный
economic return – экономическая прибыль, доход
electric current – элекрический ток
electricity – электричество
embayment – бухта, залив
embed – встраивать, вмонтировать
embrace – охватывать, включать

employ	– занять, давать работу
endangered species	– вымирающие, редкие виды
engine	– двигатель
engineering	– технология, техника; инженерно-техническая деятельность, инженерно-технические работы
enhanced recovery technique	– метод искусственного поддержания энергии пласта
enquiry	– дознание, расследование
ensure	– гарантировать, обеспечивать
enticing	– занимательный, привлекательный
environment	– окружающая среда
environment officer	– испектор по защите и охране окружающей среды
environmental restrictions	– ограничения, налагаемые требованиями охраны окружающей среды
environmentally sensitive areas	– природоохраняемая зона
equipment	– оборудование
equipment failure	– неисправность оборудования
establish	– установить
estate	– поместье
estimate	– оценка; оценивать
evolve	– возникнуть в ходе эволюции
examine	– рассматривать, изучать, исследовать
excess	– превышение
excess pressure	– избыточное давление
executive	– управляющий директор
exist	– существовать
expand	– расширяться, развиваться
experience	– опыт
explode	– взрывать
exploitation	– эксплуатация, разработка месторождения
exploratory well	– разведочная скважина
explosion	– взрыв
explosives	– взрывчатые вещества
expose	– выходить (на поверхность), обнажаться
extract	– извлекать (нефть, газ или инструмент из скважины); добывать
facility	– объект
familiar	– хорошо знакомый
fault	– разлом

favourable – благоприятный
feasibility – целесообразность, рентабельность
feather – перо
field – поле
fill in – заполнить
finite – ограниченный, исчерпаемый
flare – сжигать на факеле
flare stack – факельный ствол
flare system – система сжигания неиспользованного газа на факеле
floating boom – плавучее боновое заграждение
flood – затапливать
flow – приток
flowing well – фонтанная скважина
fluid content – содержание флюида
focus – сосредоточить внимание
force – оказывать давление, вытеснять
forecast – прогнозировать
formation – продуктивный пласт
formation-evaluation – оценка параметров продуктивности пласта
fossil fuels – ископаемые виды топлива
fraction – компонент нефти
fractional distillation – фракционная перегонка
fractured shales – трещиноватые глины
fuel cell – электрохимический генератор
fuel-cell-powered vehicle – автомобиль с силовой установкой на водородных топливных элементах
furnace – печь
gain – прибыль, выручка
gas cap – газовая шапка, купол (в коллекторе нефти)
geological reasoning – геологическое обоснование
geophone – сейсмоприемник
geoscience – науки о земле
giant – гигант
Global Gas Flaring Reduction Public-Private Partnership – глобальное партнерство по борьбе с факельным сжиганием газа
global warming – глобальное потепление
go over – превосходить
gravity survey – гравиразведка

greenhouse gases – парниковые газы
growth – рост
gush out – бить, вырываться
gusher – фонтанирующая скважина
habitat – естественная среда обитания
hand-operated lever pump – насос с ручным рычагом
haul away – вывозить
heavy oil – тяжелая нефть, нефть с низким удельным весом
hire – нанимать
hole – скважина
hydrocarbon – углеводород
hydrogen – водород
immediate – непосредственный
immiscible – несмешиваемый
imply – подразумевать
improvement – улучшение, усовершенствование
in order of importance – по степени важности
in this way – подобным образом
increase – увеличивать, повышать, усиливать; увеличение
indicate – показывать
indirect – косвенный
influence – влияние
inject – нагнетать, закачивать
install – устанавливать
instead of – вместо
insulating – изолирующий
intensify – усиливать
internship – практика
interpret – интерпретировать; объяснять, толковать
interpretation – интерпретация; объяснение, толкование
intersecting grid – сеть частично-пересекающихся профилей
introduce – вводить, представлять
involve – включать
job scope – объем работ
keep track – отслеживать
land owners – собственник земельного участка
large-scale – широкий, масштабный; крупномасштабный
law of supply and demand – закон спроса и предложения

lay out – расположение, схема
leak – протечка
leakage – утечка, просачивание
lifespan – продолжительность эксплуатации
limit – ограничивать
liquefied natural gas – сжиженный природный газ
liquid – жидкость
list – перечислять
local residents – местные жители
locate – определять местонахождение, расположить в определенном месте
look for – искать
lower – снижать
magnetic qualities – магнитные свойства
magnetic survey – магниторазведка
magnitude – величина
maintenance work – текущий или профилактический ремонт
make sense – иметь смысл
mammal – млекопитающее
management skills – административные навыки
manufacturer – производитель, промышленник
marine – морской
matter – проблема, вопрос
maximum point – максимальная точка, значение
maze – лабиринт, путаница
measure – мерить, измерять; мера
medieval – средневековый
meet demand – удовлетворять спрос
mine – производить выработки, добывать разрывая
mineral deposit – местрождение полезных искпаемых
mineral exploration – разведка месторождений твердых полезных ископаемых
mineral right – право на разработку минеральных ресурсов
mining engineering – горная техника, горное дело
minor – мелкий
misleading – обманчивый, вводящий в заблуждение
molasses – патока
mosquito repellent – средство от комаров
mountain building – горообразование

native community – местное сообщество
negotiation skills – навыки ведения переговоров
nevertheless – тем не менее
nonconventional – нетрадиционный
notice – заметить
occasionally – изредка, временами
occupy – занимать
occur – залегать, встречаться
odour – неприятный запах
official body – официальный орган
oil supply – ресурсы нефти
oil-bearing – нефтеносный
oil-coated – покрытый нефтью
oil-gas pool – нефтегазовая залежь, месторождение
oil-producing – нефтедобывающий
oil-shale deposit – залежь горючих сланцев
on-demand – по требованию
ooze – медленно вытекать
operate – осуществлять деятельность (о предприятии)
opportunity – возможность
ore deposit – рудная залежь
outcrop – обнажение, выход (пород) на дневную поверхность
output – отдача
overproduction – чрезмерная выработка
overtime – сверхурочная работа
oxygen – кислород
peninsula – полуостров
percentage – процентная норма, содержание
permeability – проницаемость
permit – разрешение
petroleum engineering – нефтегазовое дело
physics of oil and gas distribution – физические процессы распределения нефти и газа в пласте
pick up – приниматься
picture of sub-surface – изображение подземных пластов, недр; геологический разрез
pipe out – выкачивать, откачивать
pipeline – трубопровод
pipes – трубопровод

pit – выработка, яма
place – помещать, размещать
placement – трудоустройство; зачисление на программы и предметы
plentiful – в избытке
poisonous – ядовитый, отравляющий
pollute – загрязнять
pollution – загрязнение
pond – пруд
porosity – пористость
porous rock – пористая порода
possible reserves – предполагаемые запасы полезного ископаемого
pound – сильно бить, колотить, ударять
power cut – отключение электропитания
precursor – предшественник
predict – предсказывать
preliminary resource evaluation program – проект предварительной оценки ресурсов
pressure release valve – клапан сброса избыточного давления
prevent – предотвращать
primary recovery – первичная добыча
probability – вероятность наличия
probable reserves – прогнозные запасы полезного ископаемого
procedure – методика
process – обрабатывать
processing capacity – производительность обработки
produce – добывать
production – добыча
producer – нефтедобывающая фирма, компания
producible – добываемый, перспективно рентабельный
producing intervals – продуктивный, нефтеносный интервал
production capacity – промышленная продуктивность, уровень добычи
production engineer – инженер-эксплутационник, инженер по добыче нефти и газа
production facilities – сооружения для ведения добычи
production rig – экслуатационная установка
production tower – ректификационная колонна

profit – доход
promote – стимулировать, активизировать
promotion – продвижение по службе
prospect – перспективная площадь, разведуемый участок
prospector – рудоискатель, разведчик
proven reserves – доказанные запасы
provide – предоставлять
publicity – огласка, известность
pull along – протягивать, протаскивать
pump – добывать нефть глубокими насосами, качать; нагнетать, закачивать в пласт
purge – слабительное
purpose – цель
push – выталкивать
quantity – количество
quarter – четверь
rail tanker – вагон-цистерна
rapid – быстрый
rare – редкий
rate – уровень
raw (products) – сырье
reach – достигать
realize – понимать, осознавать
receive – получать
reclaim – мелиорировать, осушать
recognize – признавать
recording truck – самоходная регистрирующая станция
recover – получать (керн), добывать (нефть, газ); – восстанавливать
recovery factor – коэффициент нефтеотдачи
recruit – набирать, принять на работу, нанимать
refer – относиться, рассматриваться
referee – рекомедательное лицо, рекомендатель
refinery – нефтеперерабатывающий завод
reflect – отражать
reformer – преобразователь
reintroduce – вернуть
relate to – быть связанным, иметь отношение
release – выпускать, выделять
reliable – надежный

rely on – опираться
remelt – переплавлять
remove – удалять, устранять
renewable – восполняемый, неисчерпаемый
reply – ответить
reproductive rate – темп размножения
require – требовать
rescue – спасать
rescue worker – спасатель
resemble – напоминать
reserve – запас
reservoir – пласт-коллектор; пластовый резервуар (нефти, газа)
reservoir engineer – инженер-разработчик
reservoir performance – поведение, отдача, производительность пласта
reservoir rock – порода-коллектор
reservoir sandstone – нефтеносный песчаник
resistance – сопротивление
resistivity – удельное электрическое сопротивление; электрический каротаж
resource – ресурс
resource number – объем ресурса
responsibility – обязанность
responsible – ответственный
result in – приводить
rock formation – образования горных пород
rock layer – слой, пласт породы
rock-fluid system – система «порода-флюид»
rot – гнить, разлагаться
roughneck – рабочий буровой бригады
ruin – нарушать
run out of – истощить запас, израсходовать, исчерпать
safety device – предохранительное устройство
safety equipment – оборудование, обеспечивающее безопасность работ
salary – ежемесячная зарплата
salve – целебная мазь
sample – образец
satellite – спутник

satellite image – спутниковый снимок, космоснимок
satisfactory – удовлетворительный
satisfy the needs – удовлетворить потребности
schedule – график, расписание работ
scrape up – выскребать
secondary recovery – вторичная добыча
seem – казаться
seep – высачивание (нефти), выход на поверхность
seismic exploration – сейсморазведка
seismic line – сейсмический профиль
seismic reflection – метод отраженных волн
select – отбирать
selection – отбор
senior manager – руководитель высшего звена
sense – смысл
separate – отделять
service company – сервисная компания
set off – побуждать, положить начало, взрывать
settler – поселенец
shaft – скважина
shallow hole – неглубокая скважина
share – доля
shipping regulation – регламентация морский перевозок
shock wave – ударная волна
shortage – нехватка
shorten – укорачивать
shutdown – остановка, неполадка
sink – оседать, опускаться на дно
site – участок, место выполнения работ
size – размер
skim – снимать пленку с поверхности
slice – делить на части
slick – пленка
sluggish – медленно текущий, вязкий
soar – взлетать
software – программное обеспечение
soil – почва
solve problem – решать проблему
sophisticated – сложный, высокой сложности
sorbent – сорбирующее вещество, химический

поглотитель
source – источник
spark – искра
spark discussion – вызывать обсуждение
sparsely – частично, скудно
spectacular – эффектный, захватывающий
spill – разлив, пролив, утечка
splitter – колонна разделения бензиновых фракций
sprawl – растянуться
spread – распространяться
staff – штатные сотрудники
steam – пар
steam reforming – реакция конверсии метана водяным паром
steam-powered – на паровой тяге
store – хранить
streamer – морская буксируемая коса
strict – строгий
subject matter expert – специалист узкого профиля
substance – вещество, материя
subsurface rock – горная порода
sufficient – достаточный; обоснованный
suggest – предполагать
supervision – технический контроль
supplier – поставщик, снабженец
supply – поставлять
supply chain – канал поставок
supply domestic customer – снабжать потребителя газа в бытовом секторе экономики
supply gap – брешь в снабжении
support – поддержать
surface – поверхность; поверхностный
surface water – вода наземных водоемов
survey – изыскание
tackle issue – решать проблему
take sample – брать образцы
tank – резервуар, емкость для хранения нефти и нефтепродуктов
tanker lorry – автоцистерна
tar-sand – нефтеносный песчаник
team effort – коллективная работа

technique – техника (методика), метод; оборудование
thermal recovery – тепловое воздействие на пласт
thick – густой
three D seismic volume – трехмерный массив данных
throughout – по всему
toolpusher – мастер буровой установки
tower – колонна
train – подготавливать
transmit – передавать
trap (pocket) – нефтяная ловушка; улавливаться в ловушке
treacle – вязкая жидкость, жидкая смола
tribe – племя
turn to – обращаться
two-dimensional – двухмерный
ultimate – неоспоримый, безусловный
underdeveloped area – малоосвоенный район
underwater gun – подводный источник сейсмических сигналов
upgrade – улучшать, усовершенствовать
upstream petroleum industry – поиски, разведка добыча нефти и газа
use up – истощить, опустошить
valve – клапан
variation – колебание, изменение
vehicle – транспортное средство
vent – выпускное отверстие; выпускать
venting – выброс в атмосферу
vessel – судно
viable – целесообразный, рентабельный, пригодный
vibration – колебание
vibrator truck – вибратор на шасси грузовика
view – точка зрения
viscosity – вязкость
volumes – объемы
wages – еженедельная зарплата
waste – трата, потеря
waste heat – сбрасываемое тепло
waste oil – отработанные углеводороды
waterproof – придавать водонепроницаемость
well completion – заканчивание скважины

well log – каротажная диаграмма; каротаж скважины
wholesale price – оптовая цена
wildcat well – поисково-разведочная скважина; первая скважина, заложенная наугад
wire-drawn electrode – электрод опускаемый на проводе
wreck – потерпеть крушение
yield – давать, выдавать;
– дебит, нефтеотдача
zone of weakness – область наименьшего сопротивления

Unit 7 (TEST 4)

acidizing – кислотная обработка пласта
annular space – затрубное пространство
benefit – преимущество, достоинство, прибыль
blow-out preventer – противовыбросный превентор
borehole – ствол скважины
casing – обсадная колонна
charge – заряд
cementing – цементирование
coiled tubing – гибкая насосно-компрессорная труба (НКТ)
contractor – подрядчик
control console – пульт управления
cuttings – буровой шлам
debris – обломки породы
derrick – вышка
derrickman – верховой рабочий
deviated – горизонтальный, отклоненный
disadvantage – недостаток
downhole motor – погружной электродвигатель
drill a hole – бурить скважину
drill pipe – буровая труба, бурильная колонна
driller – бурильщик, буровик
drilling crew – буровая бригада
drilling mud – буровой раствор
drilling rig – буровая вышка, буровая
floater – плавучая буровая установка
formation – продуктивный пласт
fracturing – разрыв пласта

headquarter – размещаться
hinder – препятствовать, затруднять
hire – нанимать, устраивать на работу
hole completion – заканчивание скважины
jack-up platform – самоподъемная платформа
kelly – ведущая труба
land rig – наземная буровая установка
liner – потайная обсадная колонна, потайная колонна
maintain – поддерживать в рабочем состоянии
marine riser – морская водоотделительная колонна
mast – подъемная вышка
mitigate – смягчать, уменьшать
moon pool – буровая шахта в корпусе бурового судна или платформы
mount – устанавливать
mud pit – амбар для бурового раствора
offshore drilling – шельфовое бурение, оффшорное бурение
open hole completion – заканчивание скважины с необсаженным забоем
perforation – перфорация, простреливание скважины
perforating gun – пулевой перфоратор, скважинный перфоратор
pipe-handling equipment – оборудование для спуска-подъема труб
production – добыча
repaire – чинить, налаживать
reservoir – пласт-коллектор; пластовый резервуар
reservoir fluid – пластовая жидкость
rig floor – рабочая площадка буровой, буровая площадка
rig superintendant – мастер буровой установки
rotary helper – помошник бурильщика
rotary table – ротор буровой установки
roughneck – разнорабочий, подсобный рабочий
sandscreen – песочный фильтр
screw – завинчивать, закручивать
seal off – закупоривать, изолировать
skin damage – повреждение поверхности ствола скважины;
slickline – канат

stimulation	– интенсификация, стимуляция;
straddling	– изоляция
surge of fluid	– пульсация пластовой жидкости, колебание
supervise	– осуществлять технический контроль
take over	– принимать, брать на себя
tongs	– щипцы, ключ для труб
toolpusher	– буровой мастер, мастер буровой установки
trip in	– спускать бурильную колонну
trip out	– поднимать бурильную колон
truck-mounted unit	– буровая установка, смонтированная на – автомобиле
viscosity	– вязкость
well bore	– буровая скважина, шурф
work shift	– рабочая смена
wrench	– гаечный ключ

Unit 8 (TEST 4)

above-ground pipeline (elevated line)	– надземный трубопровод
associated gas	– попутный газ
atmospheric storage tank	– резервуар низкого давления
backfilling	– обратная засыпка траншеи
batch	– партия перекачиваемого продукта
bedding	– постель, подсыпка
block valves (shut-down system)	– запорная арматура
branch (pipeline lateral, spur line)	– ответвление трубопровода
breathing loss	– потери от испарения при «дыханиях»
burial depth	– глубина заложение трубопровода
buried pipeline (underground pipeline)	– подземный трубопровод
capacity	– пропускная способность; емкость, объем; производительность
cathodic protection	– электрохимическая защита от коррозии
coating	– изоляционное покрытие (защитное покрытие); обшивка.
compressor station	– компрессорная станция

concrete-coating (concrete-weight coating)	– бетонное покрытие (утяжеляющее бетонное покрытие)
continuous supply	– бесперебойная перекачка
corrosion (corrosion attack)	– коррозийное разрушение
corrosion mechanism	– механизм протекания процесса коррозии
corrosion rate	– скорость коррозии
corrosion resistance	– стойкость к коррозии
cover (minimum cover)	– глубина залегания
crevice corrosion	– щелевая коррозия
cross-sectional area of the pipe (free bore)	– сечение трубопровода
crossing	– переход
crude oil	– сырая нефть
desalting	– удаление солей (обессоливание)
dewatering	– удаление воды (обезвоживание)
dewaxing	– депарафинизация
differential pressure	– перепад давлений
distillation	– перегонка (нефти)
distribution pipeline (line)	– распределительный трубопровод
dusty gas	– неочищенный газ
elevation profile	– высотное положение трубопровода
encircling sleeve	– полноокружная ремонтная конструкция; муфта
environmental cracking	– растрескивание под воздействием окружающей среды
export line	– магистральный трубопровод
export oil	– товарная нефть
export product	– готовая продукция
field-joint coating	– изоляция сварных соединений
feasibility study	– технико-экономическое обоснование проекта
fixed roof tank	– резервуар со стационарной крышей без понтона
fixed roof tank with pontoon	– резервуар со стационарной крышей с понтоном
floating roof tank	– резервуар с плавающей крышей
flow pattern (flow regime)	– режим перекачки
flowline	– выкидная линия, подводящие трубы
flow rate	– расход
free span	– участки трубы с провисанием

gas compression	– компримирование газа
gas cooling	– осушка газа на основе процесса охлаждения
gas dewatering (gas dehydration)	– осушка газа
gas distribution station	– газораспределительная станция
gas gathering line	– газосборный коллектор
gas processing unit	– установка очистки технологического газа
gas processing plant	– установка комплексной подготовки газа; газоперерабатывающий завод
gas supply	– система газоснабжения
gate valves	– задвижка
gathering line (in-field line, field line)	– промысловый трубопровод
ground pipeline	– наземный трубопровод
head	– напор
head loss	– потеря напора
hydrostatic testing	– гидравлические испытания
impressed current method	– катодная защита от коррозии
inline inspection	– внутритрубная диагностика
in-service pipeline	– находящийся в эксплуатации трубопровод
insulation	– теплоизоляция
j-lay method	– монтаж в вертикальном положении, J-метод
leak	– утечка
lease	– промысел (наиболее общий термин); участок, сдаваемый в аренду для добычи природных ресурсов; договор аренды земельного участка.
liquefied natural gas	– сжиженный природный газ
loops (looping, looped line)	– лупинг
non-destructive testing	– неразрушающий контроль
oil gathering system	– система нефтесбора
oil loading facilities	– нефтеналивной пункт, пункт налива нефти
oil metering station	– узел учета нефти
oil sampling	– отбор проб нефти
oil settling	– отстой нефти
oil spill	– разлив нефти

oil stripping	– дегазация нефти
oil treatment facilities	– пункт подготовки нефти
oil treatment	– подготовка нефти
originating (major) station	– головная станция
operating pressure	– рабочее давление
padding	– присыпка
pig launcher	– камера пуска скребков
pig receiver	– камера приема скребков
pig	– скребок, очистное устройство; внутритрубный инспекционный снаряд, внутритрубное диагностическое устройство; разделитель потока, механический разделитель
pig trap	– камера пуска и приема очистных устройств
pipe joint	– секция трубопровода, отдельная труба; сварной шов, сварной стык, стык труб
pipeline maintenance	– техническое обслуживание
pipeline monitoring program	– дефектоскопия
pipe wall thickness	– толщина стенки трубы
pipeline construction	– строительство трубопровода
pipeline	– трубопровод
pipeline laying	– укладка трубопровода
pipeline layout	– план трубопровода
pipeline operation	– эксплуатация трубопроводов
pipeline route	– трасса трубопровода
pipeline specificaions	– характеристики трубопровода
pipeline string	– плеть трубопровода
pipeline system (linepipe)	– линейная часть трубопровода
pipeline valves	– трубопроводная арматура
piping system	– технологические трубопроводы
pitting corrosion	– точечная коррозия; язвенная коррозия; коррозия пятнами
pressure drop	– падение давления
pressure line	– напорный трубопровод
pressurized storage tank	– резервуар высокого давления
product line	– продуктопровод
production (recovery, extraction)	– добыча
pump station	– нефтеперекачивающая станция (НПС)

reel-laying (reeling)	– укладка трубопровода с барабана, G-метод
refined oil	– товарная нефть
refinery	– нефтеперерабатывающий завод (НПЗ)
roughness	– шероховатость (стенки трубы)
row (right-of-way)	– охранная зона; технический коридор; полоса отвода
sacrificial protection	– протекторная защита от коррозии
s-lay method (conventional lay-barge method)	– монтаж в слабонаклонном положении, S-метод
scraper (pig)	– скребок, внутритрубный инспекционный снаряд, механический разделитель потока, очистное устройство
sideboom	– трубоукладчик
straightening device	– выпрямляющее устройство
storage (and terminal) facilities	– сооружения для хранения
storage tank	– резервуар
stringing	– укладка плетей трубопровода вдоль траншеи
submerged pipeline (trenched pipeline)	– заглубленный трубопровод
survey	– инженерные изыскания
suspended pipe (pipeline)	– воздушный переход; свободноподвешенная труба (плеть), свободно провисающий участок.
tank battery	– пункт сбора и подготовки нефти и газа к транспорту
tank farm	– резервуарный парк
telemetry	– средства телемеханики
tension machine (tensioner)	– натяжной механизм (натяжное устройство)
throughput	– пропускная способность
tie-in	– соединение участков трубопровода; врезка в трубопровод; точка подключения (присоединения)
tightness	– герметичность
trenching (ditching)	– разработка траншеи
trunk pipeline (line), transmission line, main line	– магистральный трубопровод
ultrasonic testing	– ультразвуковая дефектоскопия

underground gas storage	– подземное хранилище газа
underwater buried pipeline	– заглубленный трубопровод
water removal (dehydration)	– осушка газа
weld joint (weld seam, seam, seam weld)	– сварной шов
wellhead	– устье скважины
wrapping	– ленточное покрытие; бандажирование

Appendix 1

GRAMMAR REFERENCE

Unit 5

Причастие прошедшего времени (Past Participle или Participle II)

Причастие прошедшего времени образуется путем добавления суффикса **–ed** к основе правильного глагола или путем чередования звуков в корне неправильного глагола (3 форма неправильных глаголов). Причастие прошедшего времени имеет пассивное значение.
to use – us**ed** (*использованный*)
to invite – invit**ed** (*приглашенный*)
to see – **seen** (*увиденный)*

Функции и способы перевода на русский язык

Часть сказуемого		
1) выраженного глаголом во временах группы *Perfect* 2) выраженного глаголом во всех временах страдательного залога	It has not **rained** yet. The mine was **built** many years ago.	А) личной формой сказуемого в соответствующей форме времени и залога. *Дождя еще **не было**.* *Шахта **была построена** много лет тому назад.*
Определение		
1) Левое определение (стоит перед определяемым словом) **2) Правое определение** (стоит после определяемого слова, образуя определительный причастный оборот)	The **stolen** picture was very soon found. The engineers **invited** to the mine are good specialists.	А)причастием прош.вр. страдательного залога с суффиксами: -н-; -м- ***Украденная** картина была вскоре найдена*. *Инженеры, **приглашенные** на шахту, хорошие специалисты.*
Обстоятельство		
(с союзами **when, while, if, unless, as** и др.)	When **burnt**, coal produced heat. Metals do not melt until **heated** to a definite temperature.	А) придаточным обстоятельственным предложением В)при+ существительное *При **сгорании** уголь выделяет тепло. (Когда уголь сгорает, он ……..)* *Металлы не плавятся, пока не **нагреваются** до определенной температуры*

Причастие прошедшего времени входит в состав перфектных форм причастия настоящего времени.

Appendix 2

Unit 6

Причастие настоящего времени (Present Participle или Participle I)
Причастие настоящего времени образуется прибавлением к основе глагола окончания **–ing:** to use – us**ing** *(использующий),* to build – build-**ing** *(работающий).*

Функции и способы перевода на русский язык

Часть сказуемого		
Входит в состав всех временных форм *Continuous*	They are **working** in the laboratory.	А) личной формой сказуемого в соответствующей форме времени и залога. *Они **работают** в лаборатории (сейчас).*
Определение		
1)Левое определение (стоит перед определяемым словом)	The car moved down the street at an **increasing** speed.	А) причастием с суффиксом *-ущ, -ющ, -ащ, -ящ.* *Машина неслась вниз по улице с **увеличивающейся** скоростью.* В) определительным придаточным предложением *Процессы, **ведущие** (которые **ведут**) к образованию пород, известны.*
2)Правое определение (стоит после определяемого слова, образуя определительный причастный оборот)	Processes **leading** to the formation of rocks are known.	
Обстоятельство		
стоит перед подлежащим или после дополнения и образует обстоятельственный причастный оборот (часто с **when** и **while**).	When **designing** new machines, engineers pay attention to geological conditions.	А) деепричастным оборотом В) придаточным предложением ***Проектируя** новые машины, инженеры обращают внимание на геологические условия.* Или: *Когда инженеры **проектируют** новые машины, они обращают внимание на геологические условия.*

В функции обстоятельства могут употребляться все формы причастия настоящего времени.

	Active	**Passive**	
Non-Perfect	reading *читая*	being read *«будучи прочитан» (т. е. когда (так как) его прочитали)*	Одновременность (выражает действие одновременное с действием глагола-сказуемого)
Perfect	having read *прочитав*	having been read *«будучи (быв) прочитан» (после того как его прочитали)*	Предшествование (выражает действие предшествующее действию глагола-сказуемого)

Сравните:

Going home I met an old friend. (Active, Non-Perfect)– ***Идя (Когда я шел)*** *домой, я встретил старого друга.*

Being asked in French I could not understand the man. (Passive, Non-Perfect) – ***Будучи спрошенным (Когда меня спросили)*** *по-французски, я не смог понять человека.*

Having finished work I went home. (Active, Perfect)– ***Закончив (После того, как я закончил)*** *работу, я пошел домой.*

Having been rejected by everybody, he became a monk. (Passive, Perfect) – ***Будичи отвергнутым всеми (После того, как все его отвергли)****, он ушел в монастырь.*

Appendix 3

Независимый/Обособленный причастный оборот
(Absolute Participle Construction)

В состав независимого причастного оборота, также называемого абсолютным причастным оборотом, может входить как причастие настоящего времени, так и причастие прошедшего времени.

В независимом причастном обороте имеется существительное без предлога (реже местоимение в именительном падеже), которое стоит перед причастием и по смыслу является субъектом действия, выраженного причастием.

От основной части предложения независимый причастный оборот всегда отделяется **запятой**.

Существительное в общем падеже\ (местоимение в именительном падеже)	+	Причастие (PARTICIPLE)

Перевод

1) Если независимый причастный оборот стоит в начале предложения, то он переводится на русский язык обстоятельственным придаточным предложением причины, времени или условия.

The weather permitting, we shall go to the country. – ***Если погода позволит****, мы поедем за город. (обстоятельство условия)*

It being very cold, we could not go for a walk. – ***Так как было холодно****, мы не смогли пойти на прогулку. (обстоятельство причины)*

His work finished, he went home. – ***Когда его работа была закончена****, он пошёл домой.* (*обстоятельство времени*)

2) Если независимый причастный оборот стоит в конце предложения, то он переводится на русский язык предложением, вводимым союзами *причем, а, и*. The car started moving along the highway, **its speed** gradually accelerating. – *Автомобиль начал двигаться по шоссе,* ***и*** *(причем) скорость его постепенно увеличивалась.*

3) Субъект независимого причастного оборота может также вводиться предлогом **with**, который на русский язык обычно не переводится.

With **Peter working** in London, the house seemed empty. – *Так как* ***Питер работал*** *в Лондоне, дом совсем опустел.*

Unit 7

Функции и способы перевода инфинитива (Functions and means of translation of the infinitive)

INFINITIVE

В начале предложения	В начале / В конце предложения	После существительного в P.Voice (to be + Part II)	После существительного в A. Voice	После порядковых числительных (the I[st], 2[nd]...-the last)	После вспомогат. глаголов, модальных глаголов, после глаголов	После переходных глаголов
Функция подлежащего	**функция обстоятельства**	**функция определения**	**функция определения**	**функция определения**	**функция часть сказуемого**	**функция прямого дополнения**
перевод: а)существительн б)неопред. ф. гл. (что делать?)	*перевод:* а) для того, чтобы + н.ф.гл. б) «для» +существит	*перевод:* а) прид. определ, предложением (который) в буд. времени б) прид. определ. предложением с модальным глаголом	*перевод:* а) придат. опред. предложением б) существит. с предлогом в) причастием	*перевод:* а) придат. опред$_1$ предложением в)личной формой глаг.-сказуемого	*перевод:* а) неопред. ф. гл.. б)существительн.	*перевод:* неопред. ф. глаг.
To solve this problem is very important. *Решить (решение) эту проблему очень важно.*	To solve this problem they made many experiments. — They made experiments to solve this problem.	The problem to be solved is very important.	Methods to solve this problem are very important.	He was the first to solve this problem.	1. He began to solve this problem. *Он начал решать эту проблему.*	Thev help to solve this problem. *Они помогают решить эту проблему*
После: It's important -*важно* It's necessary- *необходимо* It's possible- *возможно* It's impossible - *невозможно* и *др.* It's important to solve this problem.	а) *Для того, чтобы решить эту проблему, они делали много экспериментов.* б) *Для решения...*	а) *Проблема, которую будут решать...* б) *Проблема, которую должны (надо, следует) решить...*	а) *Методы, которые решают...* б) *Методы для решения...* в) *Методы, решающие...*	а) *Он был первым, кто решил эту проблему.* б) *Он первым решил эту проблему.*	2. He is to solve this problem. *Он должен решить...* 3. Our task is to solve this problem. *Наша задача это решить...*	

Appendix 5

Инфинитивные конструкции
Сложное дополнение (Complex Object)

СОЧЕТАНИЕ	**существительное в общ. падеже** **местоимение в объект, падеже** (me, you, him, her, it, us, them)	**+ Инфинитив**

То есть предложения типа сочетания существительного в общ. падеже (или местоимения в объект, падеже) с инфинитивом, выступающие как единый член предложения – ***сложное дополнение.***

Представим формулу:

Подлежащее + сказуемое | Сложное дополнение / Complex object

We know **him (Newton) to have solved** this problem.

Перевод: Придаточным дополнительным предложением с союзами *«ЧТО», «ЧТОБЫ», «КАК»,* подлежащее которого соответствует существительному в общ. падеже (или местоимению в объектном падеже), а сказуемое соответствует инфинитиву.

Мы знаем, что он (Ньютон) решил эту проблему.

!!! Исключение: После глаголов чувственного восприятия, инфинитив употребляется без частицы «to».

1. *to hear – слышать*
2. *to watch – наблюдать (to observe)*
3. *to see – видеть*
4. *to feel – чувствовать*
5. *to make – заставлять*
6. *to let – позволять*

*I heard **him (Newton) have solved** this problem.*

Appendix 6

Сложное дополнение (Complex Subject)

I. **Подлежащее** Сказуемое **Инфинитив**

Местоимение в Им. п. **в Passive Voice**
Сущ-ое в общ. падеже To know – знать
To say – говорить
To find – находить
To suppose – полагать
To believe – полагать
To consider -считать
To think – думать и др.

То есть предложения типа сочетания **«подлежащее» + «инфинитив»** при сказуемом в пассивной форме выступает как единый член предложения – сложное подлежащее.

He (Newton) is known **to have solved** this problem.
2 1 3

Перевод: Перевод следует начинать со сказуемого в пассивной форме, которое переводится неопределенно-личным предложением, затем существительного в общ. падеже (местоимение в им. падеже), а затем - инфинитива.

«Известно, что он (Ньютон) решил эту проблему».

II. Complex Subject может употребляться со следующими глаголами в действительном залоге:

To seem, to appear – казаться
To prove, to turn out – оказаться
To happen, to chance – случайно оказаться

He proved **to have solved** this problem.

Перевод: Оказалось, что он решил эту проблему.
Он, оказалось, решил эту проблему.

III. to be likely – вероятно
to be unlikely – маловероятно
to be sure – несомненно
to be certain – обязательно

He is not likely **to have solved** this problem.

Перевод: Вероятно, что он не решил эту проблему.
Он, вероятно, не решил эту проблему.

Appendix 7

Unit 8

Герундий (Gerund)

Герундий образуется прибавлением к инфинитиву без частицы *to* окончания *–ing*: to *read – reading*; *to write – writing*. В отличие от причастия, которое образуется аналогичным образом, герундий обладает признаками двух частей:

1) Глагола: может иметь прямое дополнение (без предлога), определяться наречием, иметь простую и сложную формы.

2) Существительного: перед герундием может стоять притяжательное местоимение, предлог и определение. При этом герундий никогда не употребляется с артиклем и не имеет форму множественного числа.

Функции и способы перевода на русский язык

В связи с тем, что герундий имеет признаки существительного, он может выполнять роль любого члена предложения.

В роли подлежащего герундий может переводиться как существительным, так и инфинитивом.

Defining problems precisely requires patience. – Точное определение задач требует терпения.

Getting several opinions is vital. – Очень важно иметь несколько точек зрения.

В роли определения герундий переводится существительным или прилагательным (редко).

Life is one long process of getting tired. – Жизнь – это один долгий процесс утомления.

В роли обстоятельства герундий иногда может переводиться деепричастием.

In an interview a person can learn only by listening, not by talking. – Во время интервью человек может что-то узнать, только слушая, но не говоря.

Особое внимание следует уделять предлогам, используемым перед герундием в простой форме. Некоторые из них в сочетании с герундием приобретают характерные значения:

on – после, по
in – при, в процессе
by – путем, с помощью, посредством
while – одновременно (+деепричастие)
without – не (+ деепричастие), без (+ существительное)
through – посредством, благодаря, из-за

В роли дополнения герундий может переводиться существительным, инфинитивом или сказуемым в придаточном предложении.

The turbulent flow of gases produces cooling. – Турбулентное течение газов вызывает охлаждение.

We thought of starting another series of experiments. – Мы думали о том, чтобы начать еще одну серию экспериментов.

Наиболее часто употребляемые в научных текстах переходные глаголы, после которых в качестве дополнения без предлога следует использовать герундий:

to avoid – избегать
to deserve – заслуживать
to prefer – предпочитать
to require – требовать
to resist – сопротивляться
to try – пытаться

Герундий может употребляться и после глаголов, требующих дополнения с предлогом:

to account for – объяснять
to aim at – стремиться к
to depend on (upon) – зависеть от, полагаться на
to differ in – различаться
to object to – возражать против
to prevent from – предотвращать, препятствовать
to rely on (upon) – полагаться на
to result from – приводить к
to think of – думать о

Особое внимание следует обратить на перевод следующих словосочетаний, за которыми используется герундий:

cannot help – нельзя (не можем) + не + неопределенная форма глагола.

They could not help using this information. – Они не могли не использовать эту информацию.

(it is) worth/ (it is) worthwhile – стоит + неопределенная форма глагола или существительное.

It is worth (worthwhile) discussing this phenomenon. – Стоит обсудить это явление.

no use – нет смысла (бесполезно) + неопределенна форма глагола.

There is no use considering these data. – Нет смысла учитывать эти данные.

Функции и перевод форм герундия на русский язык (Functions of Gerund)

1. В начале предложения (без предлога)	После глаголов (без предлога): to avoid, to fancy to deny, to delay to excuse, to mind to mention, to propose, to require, to need to suggest, give up и другие	После глаголов и выражений с предлогами to succeed in *удаваться* to hear of, to object to to result in *приводить к* to result from *происходить в результате* to rely on, to think (of, for) to be fond of, to be sure of, to be interested in и другие	После глаголов to start = to begin to continue = to go on to stop = to finish	После существительного с предлогами «of». «for»	В конце (начале) предложения с предлогами in, on, upon, by, without, before, after, on account of, in spite of, due to, because of
функция подлежащего (subject)	**функция прямого дополнения (direct object)**	**функция предложного дополнения (prepositional object)**	**функция составного глагольного сказуемого (part of predicate)**	**функция определения (attribute)**	**функция обстоятельства** (adverbial modifier)
перевод: а) сущест.; б) неопр. ф. глагола;	*перевод:* а) существительным; в) неопр. ф. глагола; с) сказуемым в составе придаточного предложения;	*перевод:* а) существительным; в) неопр. ф. глагола; с) сказуемым в составе придаточного предложения;	*перевод:* а) существ.; б) неопр. ф. глагола;	*перевод:* а) существ. с предлогом; б) существ, в Р.П.; в) неопр. ф. глаг;	*перевод:* see Table Translation of Gerund in a function of dverbial modifier».
Using this method helped him in his work.	**This test requires using new method.**	**Scientists succeeded in using this method.**	**The students began using this method.**	**The method for using these data is very complex.**	
2. В предложениях типа: **no use** **It is (was) useless doing no good**					
There is (was) no use doing **It is no use crying.** *Бесполезно плакать.* **It was no good objecting.** *Возражать не имело смысла.* **There is no going back.** *Назад пути нет.*					

Перевод форм герундия в функции обстоятельства (Translation of Gerund in a function of adverbial modifier)

Предлог	Примеры и способы перевода
in	*He made many mistakes in using this method.* Перевод: a) деепричастием настоящего времени b) сочетанием «при» + существ.
by	*By using this method he made many mistakes.* Перевод: a) дееприч. наст, времени («а», «я») b) путем (с помощью) + существительное
without	*He could do nothing without using this method.* Перевод: a) «не» + деепричастие b) сочет. «без» + сущ.
before (after)	*After (before) using this method he started the experiment.* Перевод: перед (после) + сущ.
on, upon	*On (upon) using this method, he stopped the experiment.* Перевод: a) дееприч. прош. времени b) сочет. «после», «при» + сущ.

Appendix 8

Зависимые герундиальные обороты (Geraundial Constructions)

В зависимых герундиальных оборотах перед герундием нет слова, обозначающего действующее лицо или предмет. При переводе таких оборотов придаточными предложениями обычно повторяется подлежащее английского предложения, а герундий становится сказуемым.

This metal differs from that one by having a higher melting point. – Этот метал отличается от того более высокой точкой плавления.

In addition to being very interesting this book is of great use. – Кроме того, что эта книга интересная, она еще и очень полезная.

Независимые герундиальные обороты (Absolute Gerundial Constructions)

В таких оборотах между предлогом и герундием имеется слово, выражающее лицо (или предмет), которое совершает или принимает на себя действие, передаваемое герундием. При переводе такого оборота это местоимение или существительное становится подлежащим, а герундий сказуемым придаточного предложения.

There is unmistakable proof of Pauling's having been wrong. – Имеется несомненное доказательство того, что Полинг ошибался.

Appendix 9

WRITING REFERENCE

Writing Abstract
Аннотация (Abstract)

Рекомендации по написанию аннотации английского текста

Рекомендуемый объем аннотации – 100–120 слов. Аннотация к тексту включает только самые основные положения и выводы, которые даются в сжатой форме. Аннотация выполняет следующие функции: – позволяет определить основное содержание текста (или статьи), его релевантность и решить, следует ли обращаться к полному тексту; – предоставляет информацию о тексте (статье) и устраняет необходимость чтения его полного текста в случае, если он представляет для читателя второстепенный интерес; В аннотации не должны повторяться предложения из текста (нельзя брать предложения из текста и переносить их в аннотацию), а также ее название.

В аннотации должны излагаться существенные факты, приведенные в тексте, и не должен содержаться материал, который отсутствует в самом тексте. В тексте аннотации следует избегать слишком длинных предложений, а также сложных грамматических конструкций. Текст должен быть лаконичен и четок.

Аннотация (abstract) состоит из:

1. **Вводная часть** – главная идея текста и основная информация (Кто? Что? Где? Когда?).
2. **Основная часть** – перечень затронутых в тексте проблем.
3. **Заключительная часть**, в которой пишущий высказывает свое мнение.

При написании аннотации следует использовать клишированные вводные слова.

Вводная часть:

The text deals with ____

As the title implies the text describes ____

The text is concerned with____

Основная часть:

It is known that ____

It should be noted about/that ____

It is spoken in detail about ____

It is reported that ____

The text gives valuable information on/about ____
Much attention is given to ____
It is shown that ____
The main idea of the text is ____
It gives a detailed analysis of ____
It draws our attention to ____
It is stressed that ____

Заключительная часть

Оценка:
The following conclusions are drawn ____
The text gives valuable information about ____

Рекомендация:
The main idea of the text is ____
The text is of great help to ____
The text is of interest to ____

Можно следовать следующей краткой схеме:

1. The text tells about _____ .
2. The author points out _____ .
3. He believes _____ .
4. In the second part of the text he continues _____ .
5. The author also gives the information about _____ .
6. In conclusion _____ .

Appendix 10

Writing Summary on Graphic Information

Описание картинки, слайда, схемы, процесса (Description of figure, slide, chart, diagram)

Рекомендуемый объем – 120–150 слов. Качественное описание картинки или процесса включает:

- выступление, в котором необходимо написать, что, собственно, иллюстрирует слайд, картинка, диаграмма.
- основную часть, в которой необходимо описать изображенные процессы, стадии, использованное оборудование. Обычно состоит из 2–3 абзацев.
- заключение, которое представляет собой описание всего процесса без деталей и подробностей.

Для описания процесса или определенной последовательности необходимо использовать слова-связки:

Listing
(слова-связки, используемые для перечисления, организации логической последовательности).

first, second, third	*Первое, второе, третье*
firstly, secondly, thirdly	*Во-первых, во-вторых, в-третьих*
first, furthermore, finally	*Во-первых, кроме того, наконец-то*
to begin, to conclude, in conclusion	*Для начала, чтобы сделать вывод, в завершение*
next, last, finally	*следующий, последний, наконец*
In addition, moreover	*Кроме того, кроме того*
Further, furthermore	*Далее / кроме того,*

Result/consequence
(слова-связки для выражения результата / следствия)

so	*так*
therefore	*поэтому*
as a result/consequence	*в результате/вследствие*
accordingly	*соответственно*
consequently	*следовательно*
because of this/that	*из-за этого/ того*
thus	*таким образом*
hence	*Отсюда*
for this/that reason	*По этой / той причине*
so that	*так что*
in that case	*в том случае*

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