Документ подписан простой электронной подписью
Информация о владельце:
ФИО: Локтионова Оксана Геннадьевна
Должность: проректор по учебной работе
Дата подписания: 06.10.2026 17:20:32
Уникальный программный ключ:
0b817ca911e6668abb13a5d426d39e5f1c11eabbf73e943df4a4851fda56d089

МИНОБРНАУКИ РОССИИ

Федеральное государственное бюджетное образовательное учреждения высшего образования
«Юго-Западный государственный университет»
(ЮЗГУ)

Кафедра иностранных языков

УТВЕРЖДАЮ
Проректор по учебной работе
_____ О.Г. Локтионова
«____» _____ 2026 г.

Technical English (Part 3)

Методические указания для практических занятий и самостоятельной работы
по дисциплине «Иностранный язык» для студентов направлений подготовки 02.03.03, 04.03.01, 09.03.01, 09.03.03, 09.03.04, 10.03.01, 10.05.02, 11.03.02, 11.03.03, 12.03.04, 15.03.06, 18.03.01, 28.03.01, 30.05.03

Курск 2026

УДК 811.111 (075.8)

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Technical English (Part 3) : методические указания для практических занятий и самостоятельной работы по дисциплине «Иностранный язык» для студентов направлений подготовки 02.03.03, 04.03.01, 09.03.01, 09.03.03, 09.03.04, 10.03.01, 10.05.02, 11.03.02, 11.03.03, 12.03.04, 15.03.06, 18.03.01, 28.03.01, 30.05.03 / Минобрнауки России, Юго-Зап. гос. ун-т; сост.: Е.А. Таныгина, А.Б. Ставинская.– Курск, 2026. – 43 с. – Библиогр.: с. 43.

Методические указания предназначены для усвоения необходимого минимума словарного состава текстов по техническим специальностям, включая общенаучную, терминологическую, служебную лексику, и включают в себя тексты для чтения, лексико-грамматические упражнения и тесты. Данное пособие также способствует формированию навыков перевода текста.

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Текст печатается в авторской редакции

Подписано в печать 17.09. .Формат 60x84 1/16.
Усл.печ. л. 2,5. Уч.-изд. л. 2,3.
Тираж 100 экз. Заказ. Бесплатно. 614
Юго-Западный государственный университет.
305040, г. Курск, ул. 50 лет Октября, 94.

Module 11. MOTOR CAR COMPONENTS

KEY VOCABULARY

Exercise 1. Read and guess the meanings of the new words.

1) *engine, chassis, body.* The main structural components of a motor car are engine, chassis, and body.

2) *petrol (gasoline) engine.* A petrol (gasoline) engine is the most popular for light passenger vehicles.

3) *capacity.* The engine in heavy vehicles is usually a large capacity diesel.

4) *pulling power, reliability, low fuel consumption.* The main requirements for a diesel are high levels of pulling power, reliability, and low fuel consumption.

5) *transmission, drive lines, steering systems.* Chassis embraces transmission, drive lines, and steering systems.

6) *clutch, gearbox, propeller shaft, drive shafts, half-shafts.* Transmission includes clutch, gearbox, propeller shaft, main shaft, differentials, fi nal drive shafts or halfshafts.

7) *front and rear axles, suspension.* Drive lines consist of frame, front and rear axles, suspension, and wheels.

8) *layout.* Motor cars may have three types of drive layout.

9) *rear-wheel drive, front-wheel drive, four-wheel drive.* Vehicles may contain rear-wheel drive, front-wheel drive, and four-wheel drive layout.

10) *accessible.* When the rear wheels act as the driving wheels, spacing out the main components makes each unit accessible.

11) *to intrude.* When the rear wheels act as the driving wheels, the transmission components intrude into the passenger compartment.

12) *to distribute.* Four-wheel drive arrangement distributes the drive to all four wheels.

13) *to reduce wheel spin.* It reduces the risks of wheel spin.

14) *springs, shock absorbers, linkages.* The suspension system involves springs, shock absorbers, and linkages.

15) *wheel steering, brake steering.* The steering systems involve wheel steering and brake steering.

16) *vehicle's handling.* The suspension system contributes to the vehicle's handling for good safety and driving pleasure.

17) *to isolate.* The suspension system keeps vehicle occupants comfortable and well isolated from road bumps, vibration, etc.

18) *integral chassis frame and body.* Most modern cars are built with integral chassis frame and body.

19) *stiff.* The frameless or integral arrangement provides a stiff light construction of the motor car.

20) *suitable.* This frameless or integral arrangement is suitable for massproduced vehicles.

21) *to withstand.* A suitable body shell can withstand various frame stresses.

22) *unitary*. A small passenger vehicle uses a lightweight unitary construction.

23) *to locate.* A light unitary construction contains relatively light vehicle systems and components.

24) *sufficient.* A light unitary construction provides sufficient space for a driver and passengers.

Exercise 2. Try to enrich your vocabulary:

a) analyse the following words with different suffixes and divide them into two groups – nouns and adjectives:

structure, requirement, location, necessary, unitary, construction, suffi- cient, driver, structural, transmission, propeller, suspension, usual, internal, combustion, traditional, usual, ability, reliability, accessible, intrusion, compactness, arrangement, acceleration, absorber, linkage, safety, pleasure, comfortable, vibration, integral, suitable, various;

b) make up as many words as you can by combining different parts of the words:

in-	require	-ment
un-	construct	-er
	drive	-ty
	access	-able
	comfort	-ion
	arrange	-ible
	absorb	-ness
	suit	-age
	compact	-ly
	usual	
	traditional	
	link	

Exercise 3. Divide the following words or phrases into five groups, those which describe or belong to a) engine; b) transmission; c) drive lines; d) steering system; e) body.

Rear axle, capacity, clutch, pulling power, propeller shaft, wheels, springs, suspension, shock absorber, half-shafts, integral arrangement, gearbox, differentials, linkages, stiff light construction, main shaft, frame, front axles, wheel steering, diesel, brake steering, internal combustion, petrol, fuel consumption, gasoline, rear-wheel drive.

Exercise 4. Think over the definitions of the words which appear in the texts and dialogues and then:

a) agree or disagree with the following definitions

1. *Accessible* means easy for anyone to obtain and use.
2. *Unitary* means relating to or existing as a single thing.
3. *Sufficient* means as much as is needed.
4. *Capacity* is the amount of something that can be put in a container.
5. *Brake* is the equipment in a car or other vehicle that you use for slowing down or stopping.

b) match each word with its correct definition

clutch, gearbox, axle, suspension, transmission

1. The part of the vehicle that takes power from the engine to the wheels.

2. A metal box that contains the gears of the vehicle.

3. A piece of equipment in a vehicle that you press with your foot when you change gear.

4. The equipment that makes a vehicle move smoothly when it goes over bumps on the ground.

5. A metal bar that connects a pair of wheels on a car or other vehicle.

EXPLORING GRAMMAR

Exercise 1. Read the sentences, point out the Subjunctive Mood, the modal verbs and their equivalents. Give the Russian equivalents.

6. They have to provide the necessary tools. 2. This structure should fulfil a number of requirements. 3. The structure must contain all the systems and components. 4. They are able to arrange all the components. 5. The suspension system is to keep the vehicle occupants comfortable. 6. Being rather stiff the frameless or integral arrangement can withstand various frame stresses. 7. The front-wheel drive is designed to be rather compact. 8. The four-wheel drive is to reduce the risks of wheel spin. 9. It would be desirable to install a diesel in this vehicle. 10. I wish we were isolated from road bumps.

Exercise 2. Make up your own sentences according to the models.

Model A: *He can drive this motor car. He must drive this motor car. He is able to drive this motor car. He has to drive this motor car.*

1. He can arrange these components. 2. He can provide the proper model design. 3. He must provide the proper model design. 4. The four-wheel drive arrangement must distribute the drive to all four wheels. 5. She must handle the vehicle very carefully.

Model B: *This motor car hasn't a petrol engine.*

I wish this car had a petrol engine.

1. This vehicle hasn't a diesel. 2. This car hasn't sufficient space for a driver and passengers. 3. This motor car hasn't a four-wheel drive layout. 4. This automobile hasn't a good suspension system. 5. This vehicle hasn't a stiff light construction.

Exercise 3. Fill in the blanks to streamline the use of the Present Simple and Present Perfect. The words in brackets are given to help you.

1. The operations … usually … by this structure (to fulfil). 2. The engineer … already … the components (to arrange). 3. As a rule, the engine … high levels of pulling power (to produce). 4. This suspension system always … vehicles occupants comfortable (to keep). 5. Lately, most cars … with integral chassis frame and body (to build).

Exercise 4. Make up sentences according to the models to practise the use of tenses.

Model A: *Как правило, они работают в офисе.*

As a rule, they work in the office.

1. Как правило, мы выполняем много заданий. 2. Назначение транс- портного средства обычно определяет его размер и вес. 3. Небольшое пассажирское транспортное средство обычно использует легкий несущий

кузов. 4. Шасси включает трансмиссию, ходовую часть и системы управ- ления. 5. Устройство полного привода снижает риск буксования колес.

Model B: *Легкие несущие кузова используются в небольших автомобилях. Lightweight unitary constructions are used in small passenger vehicles.*

1. Все системы и компоненты автомобиля размещаются в несущем кузове. 2. Пружины, амортизаторы и направляющий аппарат входят в систему подвески. 3. Большинство современных автомобилей проектируются с несущим кузовом. 4. Риск буксования колес уменьшается при наличии устройства полного привода. 5. Высокие тяговые показатели обеспечиваются мощными дизельными двигателями.

READING

Exercise 1. Read the text, try to focus on its essential facts and choose the most suitable heading given below for each paragraph.

1) Engine
2) Suspension System

3) Integral Chassis Frame and Body
4) Motor Car Components
5) Transmission and Drive Lines

MOTOR CAR STRUCTURE

A structure of a vehicle has to fulfil a number of requirements. The prime purpose of the vehicle structure is to provide a location for all the necessary ve- hicle systems and components. The purpose of the vehicle will also dictate the size and weight of the vehicle systems and components and therefore the structure will be designed accordingly. The main structural components of a motor car are engine, chassis and body. Chassis embraces transmission (clutch, gear- box, propeller shaft, main shaft, differentials, final drive shafts or half-shafts), drive lines (frame, front and rear axles, suspension and wheels) and steering systems (wheel steering and brake steering).

MOTOR CAR COMPONENTS

The usual source of power for a motor car is an internal combustion engine. A petrol (gasoline) engine has traditionally been the most popular for light passenger vehicles. The engine in heavy vehicles is usually a large capacity diesel, the main requirements for which are an ability to produce high levels of pulling power, reliability, and low fuel consumption.

The power of the engine is transmitted through the transmission and drive lines to the drive wheels. For the rear-wheel drive (RWD) layout, the rear wheels act as the driving wheels. Spacing out the main components in this layout makes each unit accessible but a drawback is the intrusion of the transmission components into the passenger compartment. The compactness of the front-wheel drive (FWD) layout has made it very popular on modern cars, especially on small cars. The arrangement of four-wheel drive (4WD) is safer because it distributes the drive to all four wheels and during acceleration it reduces the risks of wheel spin.

The suspension system involving springs, shock absorbers and linkages serves a dual purpose: contributing to the vehicle’s handling for good active safety and driving pleasure, and keeping vehicles occupants comfortable and reasonably well isolated from road bumps, vibrations, etc.

Most modern cars are built with an integral chassis frame and body. This frameless or integral arrangement provides a stiff light construction to the motor car, which is particularly suitable for mass-produced vehicles. A suitable designed body shell can withstand various frame stresses. A lightweight unitary construction contains relatively light vehicle systems and components and provides sufficient space for a driver and passengers.

Exercise 2. Agree or disagree with the following statements.

1. To provide a location for all the necessary vehicle systems and com- ponents is the prime purpose of the vehicle structure. 2. The usual source of power for a motor car is a diesel. 3. The front-wheel drive layout is rather compact. 4. Most of the modern cars are designed with an integral chassis frame and body. 5. A small passenger vehicle with a light unitary construction doesn't provide sufficient space for a driver and passengers.

KEY VOCABULARY DEVELOPMENT

Exercise 1. Match the adjectives in column A with the nouns in column B to form meaningful phrases and then identify them at the sentence level in the text. It will help you understand the text in detail.

A	B	
1)	dual	a) space
2)	necessary	b) source
3)	unitary	c) systems
4)	sufficient	d) vehicles
5)	structural	e) components
6)	usual	f) purpose
7)	heavy	g) wheels
8)	high	h) arrangement
9)	rear	i) levels
10)	integral	j) construction

Exercise 2. Decide which of the verbs on the left collocate with the nouns on the right and then identify the word combinations at

the sentence level in the text. It will help you understand the text precisely.

1)	to fulfil	a) drive
2)	to provide	b) risks
3)	to transmit	c) requirements
4)	to distribute	d) structure
5)	to reduce	e) systems and components
6)	to withstand	f) location
7)	to design	g) vehicle
8)	to locate	h) power
9)	to serve	i) stresses
10)	to handle	j) purpose

Exercise 3. Try to enrich your vocabulary:

a) find words in the text which have the same meanings as the following words:

to perform, some, most important, aim, to construct, integral, enough, major, parts, motor, big, disadvantage, embrace, different;

b) find words in the text whose meanings are opposite to the meanings of the following words:

external, heavy, low, big, passive, old, frameless, unsuitable, unusual;

c) replace the words in italics with the words with similar meanings:

1. A structure of a vehicle should *perform some* requirements. 2. This vehicle provides *enough* space for a driver and passengers. 3. The *major* structural *parts* of *a motor car* are engine, chassis, and body. 4. The rear-wheel drive has *a disadvantage.* 5. The integral chassis frame and body can withstand *different* frame stresses.

Exercise 4. Complete the sentences: change the word in capitals at the end of each sentence to form a word that fits suitably in the blank space.

1. The frameless arrangement is … for mass-produced vehicles SUIT.
2. This unitary structure has sufficient space for a … and passengers DRIVE.

3. In the rear-wheel drive layout each unit is … ACCESS.
4. The suspension system involves shock … ABSORB.
5. This integral … provides a stiff light construction to the motor car ARRANGE.

Exercise 5. Insert the words at the sentence level: fill in the blanks with the missing words (the first letter of each word is given).

1. This car provides s… space for vehicle's occupants. 2. Besides p… shaft, transmission embraces m… shaft and half-shafts. 3. S… is a component of the drive lines. 4. Steering system embraces w… steering and b… steering. 5. One of the requirements for the engine is low f… c… . 6. The most popular engine for light passenger vehicles is a p… engine. 7. The s… system involves springs, shock absorbers, etc. 8. The passengers are isolated from road b… . 9. This body shell can w… frame stresses. 10. This frameless arrangement is rather s… .

TEST 11

1. Choose the proper words and fill in the blanks.

1. A structure of a vehicle provides a ... for all necessary vehicle systems.

A. location B. number C. requirement D. purpose

2. A. motor car includes engine, chassis, and ... .

A. suspension B. body C. diesel D. clutch

3. Transmission embraces ..., gearbox, propeller shaft, etc.

A. frame B. brakes C. clutch D. rear axle

4. ... systems are wheel steering and brake steering.

A. Main B. Major C. Sufficient D. Steering

5. D.rive lines include ..., front and rear axles, etc.

A. frame B. gearbox C. clutch D. space

6. Suspension involves ..., shock absorbers, and linkage.

A. propeller shaft C. capacity
B. springs D. handling

7. For the RWD. ..., the rear wheels act as the driving wheels.

A. space B. linkage C. spacing out D. layout

8. In the ... layout each unit is accessible.

A. RWD. B. FWD. C. 4WD.

9. Relatively light vehicle systems and components are located in a light- weight ... construction.

A. sufficient B. unitary C. usual D. main

10. The frameless arrangement provides a ... light construction to the motor car.

A. isolated B. driving C. front D. stiff

2. The text contains different mistakes: 4 – in spelling, 3 – in grammar. Correct the mistakes and rewrite the text.

In British English, the term 'transmission' refer to the whole drive train, including klutch, gearbox, propeller shaft (for rear-wheel drive), diferential, and final drive shafts. In American English, a gearbox are any device which convert speed and torque, whereas a transmision is a type of gearbox that can be "shifted" to change the speed-torque ratio dynamicaly.

Module 12. ENGINES

KEY VOCABULARY

Exercise 1. Read and guess the meanings of the new words.

1) *confined space.* An internal combustion engine is an engine in which combustion of the fuel takes place in a confined space.

2) *profound impact.* The invention and development of the internal com- bustion engine had a profound impact on human life.

3) *ignition.* The first internal combustion engines did not include com- pression of gas before ignition.

4) *fossil fuel.* Generally using fossil fuel (mainly petroleum), these engines appeared in transport in almost all vehicles.

5) *significant distinction.* The most important significant distinction be- tween modern internal combustion engines and the early designs is the use of compression.

6) *spark ignition.* According to the type of ignition, engines can be divided into spark-ignition and compression-ignition engines.

7) *four-stroke cycle, piston*. A four-stroke cycle engine has four piston movements over two engine revolutions for each cycle.

8) *valve, I-head engine, L-head engine.* In accordance with valve location, engines are called I-head and L-head engines.

9) *reciprocating engine*. A reciprocating engine has one or more cylinders in which pistons reciprocate back and forth.

10) *combustion chamber*. The combustion chamber is located in the closed end of each cylinder.

11) *crankshaft.* Power is delivered to a rotating output crankshaft by me- chanical linkage with the pistons.

12) *single-cylinder engine, in-line engine, V-type engine, opposed-cylinder engine, W-type engine, opposed-piston engine, radial engine.* Reciprocating engines are classified on the base of position and number of cylinders into single-cylinder engines, in-line engines, V-type engines, opposed-cylinder engines, W-type engines, opposed-piston engines, and radial engines.

13) *straight line.* In-line engine, cylinders are positioned in a straight line.

14) *at an angle.* In V-type engine, two banks of cylinders are at an angle to each other.

15) *opposite to each other.* An opposed-cylinder engine has two banks of cylinders opposite to each other on a single crankshaft.

16) *fiat.* These engines are often called flat engines.

17) *connecting rod*. The connecting rods of the pistons are connected to a master rod.

18) *in turn*. The connecting rods of the pistons are connected to a master rod, which in turn, is connected to the crankshaft.

19) *rotary engine.* A rotary engine is made of a block (stator) built around a large non-concentric rotor and crankshaft.

20) *to slide against the inner surface.* The moving combustion chambers are formed by the corners of the rotor sliding against the inner surface of the non-rotating block

21) *carburetted engine, multipoint port fuel injection engine, throttle body fuel injection engine, gasoline direct injection engine.* By method of fuel input, spark ignition engines are divided into carburetted engines, multipoint port fuel injection engines, throttle body fuel injection en- gines, and gasoline direct injection engines.

22) *to facilitate.* Air and fuel are mixed to facilitate the combustion process in carburetted engines.

23) *intake.* A multipoint port fuel injection engine has one or more injec- tors at each cylinder intake.

24) *intake manifold.* In throttle body fuel injection engines, injectors up- stream in intake manifold.

25) *to be mounted.* In gasoline direct injection engines, injectors are mounted in combustion chambers with injection directly into cylinders.

26) *homogeneous.* Well-mixed fuel and oxidizer are compressed to the point of auto-ignition in homogeneous charge compression-ignition engines.

27) *to identify*. Several or all of these classifications can be used at the same time to identify a given engine.

Exercise 2. Try to enrich your vocabulary:

a) analyse the following words with different suffixes and divide them into two groups – nouns and adjectives:

internal, combustion, development, successful, efficient, commercial, mixture, different, ignition, distinction, mechanical, injector, classification, motion, invention, operation, compression, production, application, significant, different;

b) make up as many words as you can by combining different parts of the words:

re-	inject	-ment
dis-	intern	-al
multi-	compress	-age
	link	-or
	point	-ion
	place	

Exercise 3. Divide the following terms into two groups, those which belong to

a) spark-ignition engines; b) compression-ignition engines.

Gasoline direct injection engines, homogeneous charge compression-ignition engines, multipoint port fuel injection engines, throttle body fuel injection engines, indirect injection engines, carburetted engines, direct injection engines.

Exercise 4. Think over the definitions of the terms which appear in the texts and dialogues and then:

a) agree or disagree with the following definitions

1. *An internal combustion engine* **is an engine** in which combustion of the fuel takes place in a confined space, producing expanding gases that are used directly to provide mechanical power.
2. *A four-stroke cycle engine* is an engine which has two piston movements over two engine revolutions for each cycle.
3. *A two-stroke cycle engine* is an engine which has four piston movements over one revolution for each cycle.
4. *A single-cylinder engine* is an engine which has some cylinders and pis- tons connected to the crankshaft.
5. *A reciprocating engine* is an engine which has one or more cylinders in which pistons reciprocate back and forth.

b) match each word with its correct definition

rotary engine, radial engine, in-line engine, W-type engine, carburetted engine

1. This engine is made of a block (stator) built around a large non-concen- tric rotor and crankshaft.
2. Cylinders are positioned in a straight line, one behind the other along the length of the crankshaft in this engine.
3. Pistons are positioned in a circular plane around a circular crankshaft in this engine.
4. Air and fuel are mixed to facilitate the combustion process in this engine.
5. This is an engine of two different cylinder arrangements.

EXPLORING GRAMMAR

Exercise 1. Read the sentences, point out the Passive Voice. Give the Russian equivalents.

1. Different internal-combustion engines are created by engineers.
2. A petrol engine has traditionally been used in light passenger vehicles.
3. The power of the engine is being transmitted through transmission and drive lines to the drive wheels.

4. Most modern cars are built with the integral chassis frame and body.

5. The internal-combustion engines are used in automobiles, locomotives, marines, aircrafts, and others.

Exercise 2. Make up your own sentences with the Passive Voice according to the model.

Model: *In the 19th century engineers developed various forms of internal combustion engines. In the 19th century various forms of internal combustion engines were developed by engineers.*

1. Étienne Lenoir created the first internal combustion engine in 1860.
2. Designers use engines in automobiles, locomotives, submarines, aircrafts, and others.
3. We usually use gasoline, diesel oil or fuel oil in automobiles.
4. A single combustion process causes two power strokes at the same time.
5. The scientists have classified engines of two different cylinder arrangements as W-type engines.

Exercise 3. Fill in the blanks to streamline the use of the Passive Voice. The words in brackets are given to help you.

1. Yesterday this letter … to our British partners (to send). 2. The engines of a new type … at Russian automobile plants next year (to produce). 3. This type of engine … for the new model of the car recently (to test). 4. Every year the modern designs of the automobiles … by the engineers and scientists at the international conferences (to discuss). 5. Such common fuel as gasohol consisting of 90% gasoline and 10% alcohol also … in IC engines (use).

Exercise 4. Make up sentences according to the model to practise the use of the Passive Voice.

Model: *Современные двигатели внутреннего сгорания классифицируются по различным параметрам.*

Modern internal combustion engines are classified in a number of different ways.

1. В двигателе карбюраторного типа сжатая топливовоздушная смесь поступает в цилиндры и поджигается системой зажигания. 2. В технической литературе современный двигатель называют бензиновым двигателем, четырехтактным двигателем, поршневым двигателем, двигателем с турбонагнетателем, двигателем с искровым зажиганием, двигателем с V-образным расположением цилиндров, двигателем с верхним расположением клапанов, двигателем с водяным охлаждением, двигателем с распределённым впрыском топлива. 3. В двигателях с непрямым впрыском топливо впрыскивается в отдельную дополни- тельную камеру сгорания. 4. В бензиновых двигателях с прямым впрыском топлива форсунки расположены в камерах сгорания, и топливо впрыскивается непосредственно в цилиндры. 5. В двигателях с распределённым впрыском топлива топливо попадает в каждый цилиндр через впускные клапаны.

READING

Exercise 10. Read the text.

AN INTERNAL COMBUSTION ENGINE

An internal combustion (IC) engine is an engine in which combustion of the fuel takes place in a confined space, so that expanding gases provide mechanical power and produce motion. The invention and development of the internal combustion engine in the 19th century had a profound impact on human life. The first commercially successful internal combustion engine was created by a Frenchman, Étienne Lenoir in 1860. It ran on coal gas, but worked on a cycle of operations, which did not include compression of the gas before ignition: as a result, it was not very efficient. Although various forms of internal combustion engines had been developed before the 19th century, their widespread adoption in a variety of applications began with the commercial drilling and production of petroleum. Generally using fossil fuel (mainly petroleum), these engines appeared in almost all vehicles in the late 19th century. The most significant distinction between modern internal combustion engines and the early designs is the use of compression and, in particular, in-cylinder compression.

Modern internal combustion engines can be classified in a number of different ways. According to the type of ignition, they can be divided

into spark-ignition (SI) and compression-ignition (CI) engines. Depending on the engine cycle, they are four-stroke cycle and two-stroke cycle ones. A four-stroke cycle engine has four piston movements over two engine revolutions for each cycle. A two-stroke cycle engine has two piston movements over one revolution for each cycle. In accordance with the valve location, the internal combustion engines are called I-head engines if valves are in head (overhead valve), and L-head engines if valves are in block (flat head). According to the type of cooling, engines can be classified as air-cooled engines and liquid-cooled engines (water-cooled engines).

Basic design divides engines into reciprocating and rotary ones. A reciprocating engine has one or more cylinders in which pistons reciprocate back and forth. The combustion chamber is located in the closed end of each cylinder. Power is delivered to a rotating output crankshaft by mechanical linkage with the pistons. Reciprocating engines are classified on the base of position and number of cylinders. These are single-cylinder engine, in-line engine, V-type engine, opposed-cylinder engine, W-type engine, opposed-piston engine, and radial engine. A single-cylinder engine has one cylinder and piston connected to the crankshaft. In-Line engine cylinders are positioned in a straight line, one behind the other along the length of the crankshaft. In V-type engine, two banks of cylinders are at an angle with each other along a single crankshaft, allowing for a shorter engine block. Opposed-cylinder engine has two banks of cylinders opposite to each other on a single crankshaft. These engines are often called flat engines. Engines of two different cylinder arrangements have been classified as W-type engines in the technical literature. An opposed-piston engine has two pistons in each cylinder with the combustion chamber in the centre between the pistons. Radial engines are engines with pistons positioned in a circular plane around a circular crankshaft. The connecting rods of the pistons are connected to a master rod, which in turn, is connected to the crankshaft.

A rotary engine is made of a large non-concentric rotor with a built-in gearwheel, moving around a stationary block (stator). The moving combus- tion chambers are formed by the corners of the rotor sliding against the inner surface of the non-rotating block (housing). A number of experimental engines have been tested using this concept, but

the only design that has ever become common in an automobile is the Wankel engine which has one, two, and three rotors.

By method of fuel input, spark-ignition engines are divided into four types: carburetted engines in which air and fuel are mixed to facilitate the combustion process; multipoint port fuel injection engines in which one or more injectors at each cylinder intake; throttle body fuel injection engines in which injectors upstream in intake manifold; gasoline direct injection engines in which injectors are mounted in combustion chambers with injection directly into cylinders. By method of fuel input, compression-ignition engines are divided into three types: direct injection engines in which fuel is injected into the main combustion chamber; indirect injection engines in which fuel is injected into the secondary combustion chamber; homogeneous charge compression ignition engines in which well-mixed fuel and oxidizer (typically, air) are compressed to the point of auto-ignition.

Besides, different kinds of fuel are used in engines: diesel oil, motor oil, naphta; kerosene or benzol-oil mixtures; gas, natural gas methane; alcoholethyl, methyl; dual fuel. There are several engines that use a combination of two or more fuels.

Several or all of these classifications can be used at the same time to identify a given engine. Thus, a modern engine might be called a reciprocating, spark-ignition, four-stroke cycle, I-head, water-cooled, gasoline, multipoint port fuel injection automobile engine.

Exercise 2. Agree or disagree with the following statements.

1. The first commercially successful internal combustion engine was very efficient. 2. The most significant distinction between modern internal combustion engines and the early designs is the use of compression and, in particular, in-cylinder compression. 3. Depending on the engine cycle, engines are four-stroke cycle and five-stroke cycle ones. 4. In accordance with the valve location, the internal combustion engines are called I-head engines if valves are in head (overhead valve), and L-head engines if valves are in block (flat head). 5. Radial engines are often called flat engines.

KEY VOCABULARY DEVELOPMENT

Exercise 1. Match the words in column A with the words in column B to form meaningful phrases and then identify them at the

sentence level in the text. It will help you understand the text in detail.

A		B
1)	mechanical	a) designs
2)	fossil	b) power
3)	profound	c) result
4)	significant	d) impact
5)	in-cylinder	e) space
6)	combustion	f) chamber
7)	expanding	g) gases
8)	efficient	h) compression
9)	early	i) fuel
10)	confined	j) distinction

Exercise 2. Decide which of the verbs on the left collocate with the nouns on the right and then identify the word combinations at the sentence level in the text. It will help you understand the text precisely.

1)	to run on	a) coal gas
2)	to deliver	b) cylinders
3)	to push	c) air (fuel) mixture
4)	to inject	d) power
5)	to slide against	e) process
6)	to identify	f) surface
7)	to facilitate	g) engines
8)	to mix	h) air and fuel
9)	to position	i) piston
10)	to produce	j) motion

Exercise 3. Try to enrich your vocabulary:

a) find words in the text which have the same meanings as the following words:

limited, to construct, plane, important, to join, car, energy, to throw out, different, forward, application, to place;

b) find words in the text whose meanings are opposite to the meanings of the following words:

unusual, inefficient, small, to disjoin, to end, ancient, mobile, solid, for- ward, external, after, the last, outer, in front of, longer;

c) replace the words in italics with the words with similar meanings:

1. The most *important* distinction between modern internal combustion engines and the early designs is the *application* of compression and, in particular, in-cylinder compression. 2. *Power* is delivered to a rotating output crank- shaft by mechanical linkage with the pistons. 3. The connecting rods of the pistons are *joined* to a master rod. 4. Opposed-cylinder engines are common on some *automobiles* with an even number of cylinders from two to eight or more. 5. He *constructed* the internal combustion engine.

Exercise 4. Complete the sentences: change the word in capitals at the end of each sentence to form a word that fits suitably in the blank space.

1. The first internal combustion engines did not have in-cylinder… COMPRESS.
2. In accordance with valve …, the internal combustion engines are called I-head engines and L-head engines LOCATE.
3. Basic design divides engines into … and rotary ones RECIPROCATE.
4. The … chambers are built into the non-rotating block in rotary engines COMBUST.
5. The … of the internal combustion engine had a profound impact on human life INVENT.

Exercise 5. Insert the words at the sentence level: fill in the blanks with the missing words (the first letter of each word is given).

1. The invention and development of the internal combustion engine in the nineteenth century has had a p… impact on human life. 2. The first internal combustion engines did not have c… before i… . 3. Opposed-cylinder engines are often called f… engines. 4. A two-stroke cycle engine has two p… move- ments over one revolution for each cycle. 5. Radial engines are engines with pistons positioned in a circular plane around a circular c… 6. According to the basic design, engines are divided into r… and rotary engines. 7. In h… charge compression

ignition engines, well-mixed fuel and oxidizer are compressed to the point of auto-ignition. 8. According to the type of c…, engines can be clas- sified as air-cooled engines and liquid-cooled engines (water-cooled engines).

10. Engines of two different c… arrangements have been classified as W-type engines in the technical literature. 10. In-line engine cylinders are positioned in a s… line.

TEST 12

1. Choose the proper words and fill in the blanks.

1. An internal combustion (IC) engine is an engine in which ... of the fuel takes place in a confined space.

A. melting B. combustion C. forging D. cutting

2. The first internal combustion engine ran on…, but worked on a cycle of operations, which did not include compression of the gas before ignition.

A. natural gas B. petrol C. coal gasD. diesel oil

3. The most significant distinction between modern internal combustion en- gines and the early designs is the use of … .

A. pressure B. damping C. ignition D. compression

4. A reciprocating engine has one or more cylinders in which pistons reciprocate … .

A. up and down C. left and right

B. back and forth D. round the cylinder

5. Basic design divides engines into reciprocating and … ones.

A. royal B. round C. rotary D. rolling

6. *Reciprocating engines are classified on the base of position and number* of … .

A. pistons B. cylinders C. crankshafts D. valves

7. A. single-cylinder engine has one cylinder and piston connected to the … .

A. crankshaft C. rotor

B. combustion chamber D. stator

8. Opposed-cylinder engine has… banks of cylinders opposite to each other on a single crankshaft.

A. two B. three C. four D. five

9. An opposed-piston engine has ... pistons in each cylinder with the combustion chamber in the centre between the pistons.

A. two B. three C. four D. five

10. A. rotary engine is made of a large non-concentric rotor with a built-in…, moving around a stationary block (stator).

A. cylinder B. crankshaft C. piston D. gearwheel

2. The text contains different mistakes: 4 – in spelling, 3 – in grammar. Correct the mistakes and rewrite the text.

Modern internal combustion engines can to be clasified in a number of different ways. Several or all of these classifications can be use at the same time to identify a given engine. Thus, a modern engine might be calles a reciprocating, spark-ignition, four-stroke cycle, I-head, woter-cooled, gasoline, multipoint port fuel injection avtomobile engine.

Module 13 OIL & GAS AND PETROCHEMICAL INDUSTRIES

KEY VOCABULARY

Exercise 1. Read and guess the meanings of the new words.

1) *primary products.* Natural gas and natural gas liquids are the primary products of oil and gas industry.

2) *crude oil.* Crude oil was used for fuel and medicine many years ago.

3) *oil and gas extraction industry.* The oil and gas extraction industry can be classified into four major processes.

4) *exploration.* Exploration is the first step in oil production.

5) *oil or natural gas deposits.* Exploration involves the search for oil and gas deposits.

6) *well development*. Well development means the construction of wells.

7) *site abandonment.* Site abandonment occurs when a well does not have economic quantities of oil or gas.

8) *to plug the well.* Site abandonment involves plugging the wells.

9) *to lack.* Site abandonment involves plugging the wells and restoring the site when a recently-drilled well lacks the potential to produce economic quantities of oil and gas.

10) *casing.* Casing is mounted in the well at the initial stage of the well development.

11) *drilling rig, production rig.* When the drilling rig is removed, then the production rig is installed.

12) *tubing.* Tubing carries the liquids and gas to the surface.

13) *fiow of fiuid.* A series of valves is installed to control the flow of fluid from the well.

14) *pump, rod pump*. The most common pump is the rod pump.

15) *formation pressure.* The pumping is required if the formation pressure is low.

16) *artificial lift.* If pumps are added, then such kind of production is called 'an artificial lift'.

17) *to suspend.* The rod pump is suspended on a string of rods from a pumping unit.

18) *to remove impurities.* Equipment is needed to remove impurities.

19) *pipeline, to facilitate.* A pipeline is connected to the well to facilitate transportation.

20) *storage container, to store.* A storage container is connected to the well to store the product.

21) *pores, fractures.* Sometimes hydrocarbons can hardly move easily through the pores or fractures into the reservoir.

22) *acidizing, fracturing.* There are some forms of stimulation such as acidizing and fracturing.

23) *light and heavy fraction.* Lighter fractions are collected at the top of the tower, and heavier fractions are collected at its bottom.

24) *fractioning column.* The separation of the mix of hydrocarbons is per- formed in a fractioning column, also known as an atmospheric distil- lation tower.

25) *refinery.* Crude oil is turned into usable products at refineries.

26) *perforated trays.* An atmospheric distillation tower is a tall steel tower with perforated trays.

27) *residual products, waxes, greases.* The residual products of the distillation are further processed to produce refinery fuels, waxes, greases, etc.

28) *cracking, coking.* The most widely used conversion methods are cracking and coking.

29) *derrick.* Wooden derricks were constructed long ago.

30) *domain.* The business of oil refining was John D. Rockefeller's domain.

Exercise 2. Try to enrich your vocabulary:

a) analyse the following words with different suffixes and divide them into two groups — nouns and adjectives:

important, connection, production, petrochemical, scientific, primary, development, chemical, significant, importance, abandonment, pressure, physical, economic, stimulation, exploration, geophysical, construction, equipment, appearance, different, available;

b) make up as many words as you can by combining different parts of the words:

re-	search	-er/or	-ly
non-	experiment	-al	
	store	-tion	
	move	-ment	
	equip	-able	
	sale		
	construct		

Exercise 3. Divide the following words into two groups, those which describe

a) oil & gas industry; b) petrochemical industry.

Polymers, distillation, organic components, waxes, cracking, lubricants, refinery, well development, detergents, liquid hydrocarbons, synthetic rubbers, wellbore, crude oil, derrick, exploration, acidizing.

Exercise 4. Think over the definitions of the words which appear in the texts and dialogues and then:

a) agree or disagree with the following definitions

1. *Distillation tower* is a long vertical cylinder used in fractional distillation where the separation of high and low boiling fractions takes place.
2. *Derrick* is a tall tower built over an oil well that is used for raising and lowering the drill.
3. *Lubricants* are such substances as grease or oil that reduce friction when applied as a surface coating to moving parts.
4. *A well* is a deep hole in the earth to obtain oil, gas.
5. *A drilling rig* is a special apparatus used for drilling oil wells.

b) match each word with its correct definition

to process, to distill, to store, to lack, to prospect

1. To be without or not to have enough.
2. To explore for oil.
3. To separate or extract the essential elements.
4. To prepare, to treat or convert by subjecting to a special process.
5. To keep or accumulate for future use.

EXPLORING GRAMMAR

Exercise 1. Read the sentences, point out the complex sentences. Give the Russian equivalents.

1. Hydrogen and carbon making up petroleum came from plants and animals which were living on land and in sea long ago. 2. This explanation that you managed to listen to is generally accepted by scientists. 3. I believe you know, that carbon and hydrogen are the primary constituents of organic materials, both plant and animal. 4. Moreover, according to the material that you read before, carbon, hydrogen, and hydrocarbons are constantly produced by life processes of plants and animals. 5. Gas accumulates on the top of the reservoir as a "gas cap" over the oil in a typical trap, which one can be aware of. 7. Most of the world's petroleum was found trapped in rocks, which are porous by nature. 7. It occurs because natural gas is lighter than oil, which in its turn is lighter than water. 8. Porosity is the ability of the rock which is characterized by holding oil and gas like water in a sponge. 9. Geophysicists can identify the structure, configuration, thickness, and depth of new basins if they apply measuring. 10. It is a

well-known fact that heat and pressure transformed the organic materials into solid, liquid or gaseous hydrocarbons.

Exercise 2. Make up your own sentences according to the models.

Model A: *Main products are crude oil and natural gas. They have been used throughout the history.*

Main products are crude oil and natural gas which have been used throughout the history.

1. The oil industry has four processes. They are of great importance 2. The four processes are exploration, well development, production, and site abandonment. They make up entire cycle. 3. Well development is the first phase. It means the construction of wells. 4. Production is the second stage. It implies extracting of hydrocarbons and separating them. 5. Site abandonment is the final stage. It involves plugging the well.

Model B: *Drilling, casing, and testing are completed. The drilling rig is removed. When drilling, casing, and testing are completed, the drilling rig is re- moved.*

1. Drilling rig is removed. The production rig is installed. 2. Formation pressure is not sufficient. Pumps are added. 3. Natural gas cannot be stored easily. A pipeline connection is connected to the well. 4. The stimulation of the formation is required. The hydrocarbons can hardly move more easily to the wellbore through the pores and fractures into the reservoir. 5. The stimulation is done in some cases. The pump is removed for maintenance.

Exercise 3. Fill in the blanks to streamline the use of the complex sentences.

1. A fractioning column, … is also known as an distillation tower, plays a very important role. 2. It is a tall steel tower, … has perforated trays. 3. Sever- al trays are required … each fraction has a different boiling range. 4. There are light and heavy distillates … people produce at refineries. 5. Residual products are further processed … waxes, greases, and asphalt are produced. 6. … some oil wells contain enough pressure to push oil to the surface, pumping is not necessary. 7. … testing operations are completed, the drilling rig is removed. 8. … a well

fails to produce required quality of oil or gas, then the decision about abandonment of the site is made.

Exercise 4. Make up sentences according to the models to practise the use of the complex sentences.

Model A: *Мы знаем, что эта проблема требует особого внимания.*

We know that this problem requires special attention.

1. Они знают, что буровая установка неисправна. 2. Мы информированы о том, когда нефтеразведка закончится. 3. Они полагают, что найденный пласт породы содержит залежи нефти и газа. 4. Мы знаем, что установка этого оборудования очень важна. 5. Они уверены, что насосы необходимы.

Model B: *Когда вы проведете испытание скважины, мы сможем оценить дебит скважины.*

When you make the well test, we'll be able to determine its fiow rates.

1. Когда они установят обсадную колонну, мы будем готовы обсуждать мощность скважины. 2. Когда они уберут буровую установку, мы будем монтировать установку по добыче. 3. Если они начнут опе- рации по обсадке скважины трубами на этой неделе, то мы закончим все работы в срок. 4. Если это будет необходимо, мы сможем применить гидравлический разрыв пласта залежи нефти.

READING

Exercise 1. Read the text.

OIL AND GAS INDUSTRY

The oil and gas industry is an important link in the energy supply of the countries. The primary products of the industry are crude oil, natural gas liquids, and natural gas. The oil and gas extraction industry can be classified into four major processes: exploration, well development, production, and site abandonment. Exploration involves the search for rock formations associated with oil or natural gas deposits, and involves geophysical prospecting and/or exploratory drilling. Well development means the construction of one or more wells. Production is

the process of extracting the hydrocarbons and separating the mixture of liquid hydrocarbons, gas, water, and solids; removing the constituents that are non-saleable; and selling the liquid hydrocarbons and gas. Finally, site abandonment involves plugging the well and restoring the site when a recently-drilled well lacks the potential to produce economic quantities of oil or gas.

Production equipment installation is of great importance. When drilling, casing, and testing operations are completed, the drilling rig is removed and the production rig is installed. In most cases, tubing is installed in the well which carries the liquids and gas to the surface. At the surface, a series of valves collectively called the Christmas tree because of its appearance is installed to control the flow of fluid from the well.

Pumps are added if the formation pressure is not sufficient to force the formation fluid to the surface. While some oil wells contain enough pressure to push oil to the surface, most oil wells drilled today require pumping. This is also known as artificial lift. Different types of pumps are available; the most common is the rod pump. The rod pump is suspended on a string of rods from a pumping unit, and the prime mover for pumping units can be an electric motor, or a gas engine. Equipment is usually installed on site to separate natural gas and liquid phases of the production and remove impurities. Finally, a pipe-line connection or storage container (tank) is connected to the well to facilitate transportation or store the product. In the case of natural gas, which cannot be stored easily, a pipeline connection is necessary before the well can be placed on production.

Christmas tree

In many oil and gas wells, one additional step is required - stimulating the formation by physical or chemical means so that the hydrocarbons can move more easily to the wellbore through the pores or fractures into the reservoir. This is usually done before installing a pump or when the pump is removed for maintenance. Some forms of stimulation such as acidizing and fracturing are commonly employed if required.

Exercise 2. Agree or disagree with the following statements.

1. The primary products of the industry are crude oil, natural gas liquids, and natural gas. 2. The main process characterizing oil and gas industry are the following: exploration, production, site abandonment. 3. Production equip- ment is of great importance. 4. If the formation pressure is not enough for the formation to flow by gravity, pumps are added. 5. The formation can be stimulated by physical or chemical means.

KEY VOCABULARY DEVELOPMENT

Exercise 12. Match the adjectives in column A with the nouns in column B to form meaningful phrases and then identify them at the sentence level in the text. It will help you understand the text in detail.

A

1) primary
2) artificial
3) non-saleable
4) geophysical
5) liquid
6) economic
7) sufficient
8) different
9) prime
10) electric

B

a) hydrocarbons
b) constituents
c) prospecting
d) pressure
e) mover
f) motor
g) pumps
h) lift
i) products
j) quantities

Exercise 2. Decide which of the verbs on the left collocate with the nouns on the right and then identify the word combinations at the sentence level in the text. It will help you understand the text precisely.

1) to plug
2) to lack
3) to store
4) to suspend
5) to employ
6) to remove
7) to facilitate
8) to restore
9) to complete
10) to install

Exercise 3. Try to enrich your vocabulary:

a) equipment
b) stimulation
c) products
d) site
e) transport
f) drilling
g) potential
h) impurities
i) pumps
j) wells

a) find words in the text which have the same meanings as the following words:

significant, connection, main, to embrace, to manufacture, to finish, various;

b) find words in the text whose meanings are opposite to the meanings of the following words:

artificial, to join, solid, to buy, long ago, to star;

c) replace the words in italics with the words with similar meanings:

1. The oil and gas industry is a *significant link* in the energy supply of the countries. 2. The operations are *finished.* 3. There are *various* types of pumps. 4. The oil and gas extraction industry can be classified into four *main* processes. 5. Exploration *embraces* the search for oil and gas deposits**.**

Exercise 4. Complete the sentences: change the word in capitals at the end of each sentence to form a word that fits suitably in the blank space.

1. Some constituents are … SALE.
2. Production is a process of … the hydrocarbons EXTRACT.
3. They lack the potential to produce … quantities of oil and gas ECONOMY.
4. Production … installation is of great importance EQUIP.
5. A distillation tower can separate … fractions VARY.

Exercise 5. Insert the words at the sentence level: fill in the blanks with the missing words (the first letter of each word is given).

1. W… development means the construction of one or more wells. 2. The drilling r… is removed. 3. C… is an important phase as well as testing operations. 4. Site a… involves plugging the w… . 5. Exploration involves the search for oil or natural gas d… . 6. T… is installed in the well which carries the liquids and gas to the surface. 7. P… are added if the formation pressure is not sufficient. 8. The r… pump is … on a string of rods from a pumping unit. 9. Equipment is installed to remove i. 10. The hydrocarbons can move easily through the pores or f… into the reservoir.

TEST 13

1. Choose the proper words and fill in the blanks.

1. The primary products of the oil & gas industry are… .

A. crude oil, natural gas liquids C. mazute

B. jet fuel D. crude oil, natural gas liquids, natural gas

2. **The major processes are…** .

A. Exploration C. exploration, production, well development, site abandonment

B. production D. production, exploration, site abandonment

3. Crude oil is the mixture of… .

A. hydrocarbons B. hydrogen C. oxygen D. carbon

4. Most of the world's petroleum was found trapped in … rocks.

A. porous B. deep C. sedimentary basins D. high

5. … transformed the organic materials into solid, liquid or gaseous hydro- carbons.

A. Distillation B. Coking C. Heating D. Cooling

6. Porosity is the ability of rock to hold oil and gas like water in … .

A. a sponge B. a pipe C. a tanker D. a reservoir

7. The products of light distillates are… .

A. jet fuel and stove oil B. asphalt C. grease D. butane

8. The products of middle distillation are… .

A. jet, diesel, fuel oil B. methane C. propane D. jet and stove oil

9. Residual products are… .

A. heavy fuel oils B. wax C. grease D. diesel oil

10. The most common type of pumps is … pump.

A. rod B. pipe C. production D. deep

3. The text contains different mistakes: 2 – in spelling, 5 – in grammar. Correct the mistakes and rewrite the text.

When crude oil is first bring to the surface, it may to contain a mikture of natural gas and produced fluids such as salt water and both dissolved and suspended solids. Natural gas is separated at the well site and is process for sale if natural gas pipelines is nearby. Metane is the predominant component of natural gas, but ethane, propane and butane are also significant component.

Module 14 INDUSTRIAL AND ENVIRONMENTAL BIOTECHNOLOGY

KEY VOCABULARY

Exercise 1. Read and guess the meanings of the new words.

1) *to alter.* Biotechnology is application of science and technology to living organisms, products, and models to alter living and non-living materials for the production of knowledge, goods, and services.

2) *to derive from.* Biotechnology is derived from biological knowledge.

3) *detergents.* Industrial enzymes are used in detergents.

4) *fine chemicals.* They manufacture some antibiotics, vitamins, and other fine chemicals.

5) *ubiquitous applications.* The term 'bio-based products' comprises a great variety of innovative products in ubiquitous applications.

6) *perceptible characteristics.* No external, perceptible characteristics differentiate bio-based products from traditional products.

7) *to recognize.* Most bioproducts cannot be easily recognized by consumers.

8) *to play a vital role.* Healthcare biotechnology plays a vital role in ad- dressing unmet medical needs.

9) *fungi, yeast.* Industrial biotechnology uses fungi, yeast, bacteria to make sustainable energy.

10) *gene, genomics, genetic engineering.* One of the main biotechnical tech- niques is DNA/RNA that deals with genomics, gene probes, and genetic engineering.

11) *engineering, synthesis engineering, cell and tissue engineering*. Synthesis engineering as well as cell and tissue engineering are well known biotechnological techniques.

12) *biobleaching, bioleaching, biopulping.* A biomodel is represented in biobleaching, bioleaching, and biopulping.

13) *feedstock.* Crude oil is used as feedstock in the production of chemicals and fuels.

14) *greenhouse effect.* Global warming is the result of the 'greenhouse ef- fect', which is caused by carbon dioxide and other gases.

15) *carbon dioxide.* Carbon dioxide is a result of the combustion of hydrocarbons and coal.

Exercise 2. Try to enrich your vocabulary:

a) analyse the following words with different suffixes and divide them into two groups - nouns and adjectives:

biogradable, external, sustainable, scientific, biotechnological, biofiltration, natural, industrial, incredible, consumer, initial, organic, treatment, bioremediation, application, evolution, biological, medical, pharmaceutical, innovative;

b) make up as many words as you can by combining different parts of the words:

nano-	visible	-al	-ly
petro-	experiment	-or	
bio-	technology		
in-	chemical		
	react		

Exercise 3. Divide the following words into two groups, those which describe

a) white biotechnology; b) bioremediation.

Antibiotics, biogradable plastics, fine chemicals, enzyme, genomics, cell engineering, bioreactor, bioprocessing, biosystem, corn, wheat, bioethanol, biodiesel, substitute, biofuel.

Exercise 4. Think over the definitions of the words which appear in the texts and dialogues and then:

a) agree or disagree with the following definitions

1. *Biotechnology* is derived from biological knowledge.
2. *White biotechnology* is a broad field using new enzymes for a variety of industrial needs.
3. *Biofuel production* is a part of white biotechnology.
4. *DNA (deoxyribonucleic acid)* is a chemical substance that contains ge- neric information and is found in all living cells and some viruses.
5. *RNA (ribonucleic acid)* is an acid in all living cells that uses information from DNA to make protein.

b) match each word with its correct definition

enzyme, detergent, genome, protein, cell

1. The total amount of generic information in the chromosomes of a living thing, including its genes and DNA.
2. A liquid or powder used for washing clothes or dishes.

3. A natural chemical produced by animal and plant cells that helps reactions and other processes to start.

4. A substance in food such as meat, eggs, and milk that people need in order to grow and be healthy.

5. The smallest part of a living structure that can operate as an independent unit or an individual unit inside a structure consisting of many similar units.

EXPLORING GRAMMAR

Exercise 1. Read the sentences, point out the finite forms of the verbs. Give the Russian equivalents.

1.The main task is to reduce the environmental impact of manufacturing. 2. Although bio-based polymers and plastics are still in their infancy, this industry has been characterized by great potential. 3. Today we also see the results of recent developments of new processes combining biotechnology and chemical synthesis. 4. Biosensors can be used for real-time monitoring of environmental pollutants. 5. Enzymes and other biological organisms can perform industrial processes in such traditional industries as food industry, leather and textile industries, etc. 7. Biotechnology techniques are adapted and adopted for biofuel production. 8. Biorefineries are able to reuse waste materials as feedstock for energy and materials. 9. Some current biotechnological applications reduce emissions but also lead to a high degree of carbon feedstock. 10. The production of biofuel will create the technological foundation for replacing oil-based materials with bio-based materials.

Exercise 2. Make up your own sentences according to the models.

Model A: *Red biotechnology plays a vital role in addressing unmet medical needs.*

Red biotechnology has recently played a vital role in addressing unmet medical needs.

1. Biodiesel provides alternatives to fossil fuels. 2. Industrial biotechnology encompasses many waste treatments. 3. It produces biofuel from renewable raw materials. 4. It produces ethanol as a substitute for gasoline. 5. The term “bio-based products” comprises a great variety of innovative products.

Model B: *We use bio-based products in construction. Bio-based products are used in construction.*

1. We add industrial enzymes in detergents. 2. We use bacteria in food processing. 3. They transform feedstock into organic chemicals. 4. We use biogradable plastics in household application. 5. We transform sugar-cane, sugar beet and wheat into main feedstocks.

Exercise 3 Fill in the blanks to streamline the use of the verbals. The words are given to help you.

1. … features of the bioproducts are not visible at once (to distinguish). 2. Many countries think of … an alternative fuel … their emission reduction targets (to use, to meet). 3. Natural gas when … emits 50-70% less carbon di- oxide (to burn). 4. Biofuels are extremely useful, at least in the short term, for … the energy challenge (to address). 5. A new biomodel is … (to represent). 6. … the technological and business potential of biotechnologies takes time (to understand). 7. Multiple product biorefinery models include a complex net- work of individual process chains … from biorenewable feedstocks to different intermediates and … in diverse bio- and chemical end products (to start, to end). 8. In order to turn research into products, a crucial step is … a proof of the concept and … it under industrial conditions (to establish, to test). 9. The biotechnological techniques can … a key role in … knowledge to commercial success stories (to play, to convert).

Exercise 4. Make up sentences according to the models to practise the use of the verbals.

Model A: *Мы разработали ряд мер по улучшению работы завода посредством привлечения новых инвесторов.*

We developed a set of measures of improving the plant's performance by attracting new investors.

a. Они сконцентрировались на некоторых шагах по внедрению биотехнологий посредством поставки возобновляемого сырья. 2. Он проанализировал слабые стороны производства биопродуктов, используя данные о поставке сырьевого материала. 3. Они нашли эффективные пути повышения производства биотоплива посредством преодоления проблем первого поколения биотоплива. 4. Промышленная биотехнология реализовала

поставленные цели посредством неуклонного следования выбранной стратегии. 5. Они решили усовершенствовать производство за счет строительства бионефтеперерабатывающего завода, использующего сельскохозяйственные отходы как ценное сырье.

Model B: *Они решили увеличить применение энзимов для большего количества химических продуктов.*

They decided to increase enzyme application for a growing range of chemical products.

1. Они планируют применять биосенсоры для мониторинга в ре- жиме реального времени за загрязнением окружающей среды. 2. Они начали производить биоразлагаемые пластмассы. 3. Завод планирует внедрить технологию биовосстановления, следуя за другими производителями. 4. Ожидается, что они разработают модули с применением микротехнологий для диагностики биосистем.

READING

Exercise 1. Read the text.

BIOTECHNOLOGY: THE SCIENCE BEHIND

Biotechnology is defined as the application of science and technology to living organisms as well as parts, products, and models to alter living or non- living materials for the production of knowledge, goods, and services. In other words, biotechnology is derived from biological knowledge and finally is associated with the evolution of the biological science.

Traditionally, biotechnology has been associated with the medical and pharmaceutical sectors. However, its domain is far wider. Bio-based products already existing on the market include biopolymer fibers used both in con- struction and household applications, biogradable plastics, biofuels, lubricants, and industrial enzymes such as those used in detergents or in paper and food processing. Biotechnological processes also constitute a key element in the manufacturing of some antibiotics, vitamins, amino acids, and other fine chemicals.

The term ‘bio-based products’ comprises a great variety of innovative products in ubiquitous applications. However, due to the fact that no external, perceptible characteristics differentiate bio-based

products from traditional products that are made with petrochemicals, most bioproducts cannot be easily recognized as such by consumers. The specific features of the bioproducts are mostly invisible for people.

Due to different historical reasons, biotechnology can fall within three areas: healthcare/red biotechnology that plays a vital role in addressing un- met medical needs; agricultural/green biotechnology provides farmers with the technology to grow food; industrial/white biotechnology that uses fungi, yeast, bacteria, and/or enzymes as 'cell factories' to make sustainable energy, chemicals, and a lot of other everyday things. Although the application and objectives of the three biotechnological areas are clearly differentiated, they have the same scientific and technological basis.

The main biotechnological techniques can be summarized as: DNA/RNA (genomics, gene probes, genetic engineering); proteins and other molecules (synthesis engineering of proteins and peptides); cell and tissue culture and en- gineering; processing biotechnological techniques (fermentation using bioreactors, bioprocessing, biobleaching, biopulping, bioleaching, bioremediation, biofiltration and phytoremediation); gene and RNA vectors (gene therapy); bioinformatics (construction of databases of genomes, modeling complex biological processes); nanobiotechnology (application of nano/microfabrication to build devices for studying and diagnostics of biosystems).

Exercise 2. Agree or disagree with the following statements.

1. Biotechnology has been associated with the medical and pharmaceuti- cal sectors. 2. The specific features of the bioproducts are mostly invisible to people. 3. There are three areas within biotechnology: red, green and white. 4. These areas have the same scientific and technological basis. 5. The main biotechnical techniques are DNA/RNA, proteins, cell engineering, processing, bioinformatics, nanobiotechnology.

KEY VOCABULARY DEVELOPMENT

Exercise 1. Match the adjectives in column A with the nouns in column B to form meaningful phrases and then identify them at the

sentence level in the text. It will help you understand the text in detail.

A		B	
1)	white	a)	oil
2)	pharmaceutical	b)	features
3)	specific	c)	science
4)	biological	d)	biotechnology
5)	biogradable	e)	sector
6)	ubiquitous	f)	applications
7)	perceptible	g)	chemicals
8)	vital	h)	plastics
9)	fine	i)	role
10)	crude	j)	characteristics

Exercise 2. Decide which of the verbs on the left collocate with the nouns on the right and then identify the word combinations at the sentence level in the text. It will help you understand the text precisely.

1)	to alter	a)	evolution
2)	to derive from	b)	detergents
3)	to associate with	c)	needs
4)	to exist on	d)	variety
5)	to be used in	e)	materials
6)	to comprise	f)	knowledge
7)	to recognize	g)	market
8)	to play	h)	food
9)	to address	i)	role
10)	to grow	j)	bioproducts

Exercise 3. Try to enrich your vocabulary:

a) find words in the text which have the same meanings as the following words:

use, field, broad, to embrace, main, various, aim, foundation, major, method, gadget;

b) find words in the text whose meanings are opposite to the meanings of the following words:

living, internal, visible, beyond, narrow, minor, common;

c) replace the words in italics with the words with similar meanings:

1. The 'white biotechnology' is a *wide* field. 2. The term 'bio-based product' *embraces* a great variety of innovative products. 3. The *aims* of the three biotechnological areas are clearly differentiated. 4. They have the same scientific and technological *foundation.* 5. There are some biotechnological *methods.*

Exercise 4. Complete the sentences: change the word in capitals at the end of each sentence to form a word that fits suitably in the blank space.

1. Biotechnology is derived from … knowledge BIOLOGY.
2. Biopolymer fibers are used in construction and household … APPLY.
3. Bioproducts comprise a great variety of … products INNOVATE.
4. They have the same scientific and … basis TECHNOLOGY.
5. Biotechnology is … associated with the evolution of biological science FINAL.

Exercise 16. Insert the words at the sentence level: fill in the blanks with the missing words (the first letter of each word is given).

1. Biotechnology has been traditionally associated with the medical and p… sectors. 2. Industrial enzymes are used in d… . 3. There is no e… p… characteristics of a 'bio-based product'. 4. It is difficult for a consumer to r… a 'bio-based product'. 5. Red biotechnology plays a v… role in addressing un- met medical needs. 6. The term 'bio-based product' comprises a wide variety of i… products in u… applications. 7. White biotechnology uses f…, y…, bacteria, and e… to make sustainable energy. 8. Cell and t… culture and engineering is one of the main biotechnical techniques.

TEST 14

1. Choose the proper words and fill in the blanks.

1. The so-called 'white biotechnology' makes use of ... for industrial purposes.

A. new enzymes B. genomes C. tissue D. proteins

2. *Biotechnology falls within … areas.*

A. two B. three C. four D. many

3. *There are … main biotechnological techniques.*

A. two B. three C. four D. seven

4. *Sugar cane, corn, sugar beet and wheat are… .*

A. foodstuffs B. dishes C. feedstock D. stock

5. *Acids, lipids, organic acids, vitamins are… .*

A. fine chemicals B. chemicals C. fibers D. biomass

6. *Bioethanol, biodiesel, biobutanol provide … to fossil fuels.*

A. field C. alternative

B. fine chemicals D. commitment

7. *Bioproducts have … external characteristics to differentiate them from traditional ones.*

A. no B. some C. many D. much

8. *Biobleaching, biopulping, bioleaching, bioremediation belong to … bio- technology.*

A. red B. green C. white D. green and white

9. *Three areas of biotechnologies have … scientific and technological basis.*

A. the same B. different C. similar D. external

10. *Abatement of pollution using microorganisms and plants is known as … .*

A. fine chemicals C. bioremediation

B. forestation D. bio-feedstocks

2. The text contains different mistakes: 2 — in spelling, 5 — in grammar. Correct the mistakes and rewrite the text.

Bioremediation a key area of ‘white biotechnology’, because the elimination of wide range of pollutants from water and soils are an absolute requirement for sustainable development. There numerous processes of clean water and solid wastes, using microorganisms aerobically and anaerobically. Some of them are quit sophisticated, while others is simple and are adapted to the conditions of countries.

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