В. В. Кириллова
К. А. Сечина
Е. В. Семчук

ИНОСТРАННЫЙ ЯЗЫК
АНГЛИЙСКИЙ ЯЗЫК

Часть II

Учебное пособие

Санкт-Петербург
2021

Министерство науки и высшего образования Российской Федерации

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ БЮДЖЕТНОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ

«Санкт-Петербургский государственный университет промышленных технологий и дизайна»
Высшая школа технологии и энергетики

В. В. Кириллова
К. А. Сечина
Е. В. Семчук

ИНОСТРАННЫЙ ЯЗЫК
АНГЛИЙСКИЙ ЯЗЫК

Часть II

Учебное пособие

Утверждено Редакционно-издательским советом ВШТЭ СПбГУПТД

Санкт-Петербург
2021

УДК 81.2 Англ. (075)
ББК 802.0я7
К431

Рецензенты:
кандидат филологических наук, доцент, заведующая кафедрой английского языка №2 Санкт-Петербургского государственного экономического университета
К. Н. Антонова;
доктор филологических наук, профессор кафедры иностранных языков Высшей школы технологии и энергетики Санкт-Петербургского государственного университета промышленных технологий и дизайна
Н. И. Полторацкая

Кириллова, В. В., Сечина, К. А., Семчук, Е. В.
К431 Иностранный язык. Английский язык: учеб. пособие / В. В. Кириллова, К. А. Сечина, Е. В. Семчук. Часть II. – СПб.: ВШТЭ СПбГУПТД, 2021. – 105 с.
ISBN 978-5-91646-276-0

Учебное пособие соответствует программам и учебным планам дисциплины «Иностранный язык» для студентов, обучающихся по направлениям подготовки 13.03.01 «Теплоэнергетика и теплотехника». Содержит оригинальные тексты по специальности для чтения и перевода, а также послетекстовые лексико-грамматические упражнения. Включен теоретико-грамматический раздел, в котором рассматриваются с примерами наиболее трудные грамматические темы английского языка: неличные формы глагола и пассивный залог. Для развития коммуникативных навыков приведены разговорные темы, кейс-задания, алгоритм создания презентации.

Пособие предназначено для подготовки бакалавров второго курса очной формы обучения. Отдельные разделы пособия могут быт полезны для других направлений подготовки студентов бакалавриата и магистратуры.

УДК 81.2 Англ. (075)
ББК 802.0я7

ISBN 978-5-91646-276-0

Оглавление

INTRODUCTION

ВВЕДЕНИЕ

Настоящее учебное пособие на английском языке предназначено для студентов II курса очной формы обучения по направлению 13.03.01 «Теплоэнергетика и теплотехника» и написано в соответствии с рабочей программой и учебным планом дисциплины «Иностранный язык» для неязыковых вузов.

Тематика разделов отражает рекомендованную для неязыковых вузов программу обучения иностранному языку и соответствует требованиям государственного стандарта третьего поколения.

Пособие состоит из 4 разделов, из которых первый раздел включает научно-технические тексты и терминологическую лексику, а также различные упражнения лексического характера, кейс-задания. Второй раздел содержит тексты для дополнительного чтения и перевода. Третий раздел включает устные темы, вопросы для обсуждения и развития разговорных навыков речи, этапы создания устной презентации. В четвертом теоретико-грамматическом разделе на примерах рассматриваются наиболее трудные конструкции английского языка с инфинитивом, герундием и причастием, а также содержатся разнообразные грамматические упражнения. Целью пособия является формирование навыка чтения и перевода оригинальной литературы по специальности на английском языке с извлечением полезной информации, изучение специальной и терминологической лексики, совершенствование грамматических и разговорных навыков.

В конце пособия есть словарный минимум с основными терминами, сокращениями и условными обозначениями.

Тематика текстов пособия носит общенаучный и профессиональный характер. Пособие предназначено для практических занятий; упражнения, содержащиеся в нем, помогают развить навыки самостоятельной работы над оригинальными научно-техническими текстами.

SECTION I
TEXTS AND EXERCISES ABOUT MODERN ENERGY INDUSTRY

Unit 1. Nuclear energy

Exercise 1

Distribute the following words and phrases into two groups: (1) types of energy (1) and equipment (2) to produce energy. Translate them into Russian.

Atomic energy plant, electrical energy fire, fossil fuels, gas power, gas station, gasworks, generating station, generator, geothermal energy, greenhouse effect, heat exchanger, hydraulic power, hydroelectric energy, hydroelectric scheme, kinetic energy, magnetic energy, motor nuclear energy, nuclear plant power station, powerhouse, solar cell, solar energy, solar panel, steam power, tidal barrage, tidal power, tide mill, turbine, water power, waterfall, waterworks, wave power, wind farm, wind power, windmill.

Exercise 2

Match the definitions with different types of energy: 1. Nuclear energy. 2. Mechanical energy. 3. Thermodynamics. 4. Electric power. 5. Magnetic. 6. Sonora. 7. Chemistry.

A. It is stored in the bonds of chemical compounds.
B. Sound energy is related to sound and its propagation by waves.
C. Magnetic energy is the energy that is generated in a magnetic field.
D. Related to the movement of electrons in a conductor.
E. This type refers to the internal energy of a thermodynamic system.
F. It includes two types of energy: potential and kinetic. It depends on the position and speed of a body.
G. It is obtained from the energy contained within the nuclei of the atoms.

Exercise 3

Translate the nouns into Russian, mind the suffixes of the noun "-ty", "tion", "-ion", "-ance/ence": utilization, transportation, electricity, innovation, emission, radiation, safety, permission, authority, contamination, activity.

Exercise 4

Work in small groups. Think of advantages and disadvantages of nuclear power production. Then compare your answers with these statements.

1. Nuclear power also has a lot fewer greenhouse emissions. It has been determined that the amounts of *greenhouse gases* have decreased by almost half because of the *prevalence* in the utilization of nuclear power. *Nuclear energy* has the least effect on nature since it doesn't *discharge* any gasses like *methane* and *carbon dioxide*, which are the primary "greenhouse gasses."

2. Nuclear power produces very inexpensive electricity. The cost of the uranium, which is utilized as a fuel in this process, is low. Also, even though the expense of

setting up nuclear power plants is moderately high, the expense of *running* them is quite low.

3. It is more compelling and more proficient than other energy sources. The amount of fuel required by nuclear power plant is comparatively less than what is required by other power plants as energy.

4. It *doesn't rely on* fossil fuels and isn't influenced by fluctuating oil and gas costs. Coal and natural gas power plants discharge carbon dioxide into the air, which causes a number of *environmental issues*. With nuclear power plants, carbon emissions are insignificant.

5. As a rule, a nuclear power plant creates 20 metric tons of nuclear fuel per year, and with that comes a lot of nuclear waste. When you consider each nuclear plant on Earth, you will find that that number jumps to *approximately* 2,000 metric tons a year.

6. The greater part of nuclear waste transmits radiation and high temperature, implying that it will inevitably consume any compartment that holds it. It can also cause damage to living things in and around the plants.

7. Nuclear power plants create a lot of low-level radioactive waste as transmitted parts and supplies. Over time, used nuclear fuel decays to safe radioactive levels, however this takes a countless number of years. Even low level radioactive waste takes hundreds of years to achieve adequate levels of safety.

8. Just like other sources of fuel, uranium is also finite and exists in few of the countries. It is pretty expensive to mine, refine and transport uranium. It produces considerable amount of waste during all these activities and can result in environmental contamination and serious health effects, if not handled properly.

9. Nuclear energy has immense power. Today, nuclear energy is used to make weapons. If these weapons go into the wrong hands, that could be the end of this world. Nuclear power plants are prime target for terrorism activities. Little lax in security can be brutal for humankind.

Exercise 5

Make up a table of advantages and disadvantages of nuclear power production.

Advantages	**Disadvantages**

Exercise 6

Answer the following questions:

A. What kind of energy is nuclear power?
B. What forms of energy do you know?
C. What do you know about the reasons of using energy of the nuclear?
D. What is the most important problem concerning the nuclear energy?
E. Can you differentiate fission from fusion?
F. Which actions do people have to do to control the appropriate using of the nuclear energy?

Exercise 7

Fill in the gaps into the sentences with the appropriate nouns (*waste, energy, power, accident, reactor, power plant (NPP), fuel, weapons*).

1. The normal life of nuclear … is anywhere from 40 – 60 years, depending on how often it is used and how it is being used.
2. Numerous nations are putting a lot of time and money into nuclear….
3. The Chernobyl … occurred on 26 April 1986 at the Chernobyl Nuclear Power Plant in Ukraine.
4. Nuclear … is produced when an atom is split (fission) or combined (fusion).
5. Nuclear … doesn't rely on fossil fuels and isn't influenced by fluctuating oil and gas costs.
6. Nuclear power plant creates tons of nuclear … every year.
7. Uranium was utilized as an energy source due to the vast production and development of nuclear … such as an atomic or hydrogen bomb.
8. One of the major concerns with nuclear energy is the … .

Exercise 8

Give the English equivalents to the words and word collocations. Remember them: ядерная энергетика; преобладание использования ядерной энергии; сооружение и эксплуатация АЭС; приблизительно; парниковые газы; метан и двуокись углерода; неблагоприятное воздействие; не зависеть от ископаемого топлива; при некорректной эксплуатации.

Exercise 9

Give the synonyms to the following words from the text: numerous, compelling, approximately, feasible, to discharge, to require, to achieve.

Exercise 10

Give the antonyms to the following words: insignificant, unfavorable, immense, finite, inexpensive.

Unit 2. Thermal energy

Exercise 1

Read the text and fill in the gaps with the appropriate words.

Water exists in … in three … : in the solid forms as … , in liquid state as … , and in the gaseous form as … .

At all … between 0° and 100 °C it exists in the liquid … and above 100 °C it assumes the … form under the natural atmospheric … .

The melting … of ice is always found to be a constant … , and it is taken as the zero of the centigrade … .

Water may be … below 0° without becoming solid, but ice can never … at a temperature above 0 °C. In passing from the solid to the … state water becomes reduced in volume, and on freezing an … takes place. *(See the key on page 74)*

Exercise 2

Read and translate the following text.

Text 1
Heat engines

Gasoline-powered engines, diesel engines, steam turbines, and gas turbines are examples of heat engines. All heat engines work on a cyclic principle of extracting thermal energy from some source, converting some of this energy to useful work, and rejecting the remaining energy to something at a lower temperature. In an automobile engine, the ignition of a gasoline vapor-air mixture produces a gas at a temperature several hundred degrees above room temperature. The pressure of the gas forces a piston downward, doing work. The gas cools and is ejected out the exhaust at a temperature significantly lower than at the time of ignition. A heat engine converting thermal energy to work cannot function unless there is a temperature difference between the source and exhaust. The larger the temperature difference, the greater the efficiency of the engine. Usually, the lower temperature is that of the engine's surroundings and the ignition temperature is significantly higher.

If it were it is practical to have a temperature lower than what exists naturally in our environment, a heat engine could be built in which this temperature was the exhaust temperature and the temperature of the environment was the higher temperature. Heat engines extracting thermal energy from the surface water of an ocean, and rejecting thermal energy to the cooler sub-surface water, have been proposed. They would not be very efficient because the temperature difference would be small and they would not be easy to construct. The attraction is related to the huge amount of thermal energy in the oceans, which cover roughly two-thirds of the earth's surface.

Exercise 3

Match the words on the left with their appropriate meanings on the right.

1.thermal energy	A. the part of a vehicle that converts some of thermal energy to useful work to make it move
2. pressure (n)	B. to suddenly send something out
3. efficiency (n)	C. the sum of all the random kinetic energies of the molecules in a substance, that is, the energy in their motions.
4. ignition temperature	D. the force produced by the quantity of gas or liquid
5. reject (v)	E. the lowest temperature at which a combustible substance when heated (as in a bath of molten metal) takes fire in air and continues to burn
6. heat engine	F. to throw away something that has just been made, because its quality is not good enough
7. eject (v)	G. the quality of working of an engine without wasting energy
8. exhaust (n)	H. a pipe on a car or machine that waste gases pass through

Exercise 4

Join the sentences below using *therefore, but, because.*

1. This energy is called internal energy … it is internal to the confines of the substance.

2. The sum of all the random kinetic energies of the molecules is called thermal energy, … , thermal energy is directly proportional to the Kelvin temperature.

3. No molecule has a definite speed or kinetic energy, … a molecule has a definite average kinetic energy that depends on the temperature.

Exercise 5

Read the sentences and correct any mistakes.

1. The high the temperature, the greater the thermal energy.
2. All matter composed of molecules or atoms.
3. Particle may interact with each other or their surroundings.
4. A molecule have a definite average kinetic energy that depends on the temperature.

Exercise 6

Read the sentences and tick the ones that are true according to the text or put a cross (X) next to the ones that are false.

1. A heat engine is a device able to transform work into heat.
2. Boiler, turbine, condenser and pump together constitute a heat engine.
3. The transfer of heat between two bodies in direct contact is called conduction.
4. When a body A is in thermal equilibrium with a body B, and also separately with a body C, then B and C will be in thermal equilibrium with each other.

See the key on page 84

Exercise 7

Use the dictionary to complete the table.

Noun	**adjective**	**verb**	**Person/technical device**
Benefit	beneficial		Beneficiary
		compose	
Rejection			
			mover

Exercise 8

Find the odd one out in the group of words. Explain why.

fossil fuel, geothermal energy, solar energy
liquids, molecules, atoms, particles
coal, fuel oil, gasoline, diesel
steam turbine, diesel, gas turbine, nuclear reactor
capacity, electricity, activity, efficiency

Exercise 9

Make a heat transfer quiz.

1. Every object emits …? (A. heat. B. infra red radiation. C. kinetic energy. D. Thermal energy).

2. When liquid evaporates the particles … . (A. slow down. B. speed up and escape. C. speed up and remain in the liquid. D. speed up).

3. Condensation is the change of … . (A. solid to liquid. B. solid to gas. C. liquid to gas. D. gas to liquid).

4. The types of heat transfer are … . (A. conduction, convection. B. conduction and radiation. C. convection and radiation. D. All mentioned).

5. You can increase evaporation by …? (A. increase the surface area of liquid. B. increase the temperature of liquid. C. creating a draught (тяга). D. All mentioned.

See the key on page 84

Unit 3. Thermal power plant

Exercise 1

Discuss the questions in pairs:

1. What is the largest thermal power plant in Russia? What type of fuel does it run on?
2. Of the coal-fired power plants what is the largest thermal power plant?
3. What capacity do the largest Russian TPPs have?
4. What is the main task of the development of thermal generation in our country today.
5. What problems do you think our energy industry faces with?

Exercise 2

Match the parts of these statements to make full sentences. Then read and translate them.

1. A steam power plant...	A. are non-renewable power stations.
2. Thermoelectric power plants are...	B. by the thermodynamic water/steam turbine cycle (Rankine cycle). In this case, the steam source is to generate the steam that drives the turbine.
3. Solar energy plant is...	C. converts the energy in nuclear reactions or in coal, oil or gas into mechanical or electric energy through the expansion of steam from a high pressure to a low pressure in a turbine or engine.
4. Coal-fired power plants ...	D. an example of a renewable power plant.
5. The conversion thermal energy into electrical energy is done...	E. thermal power stations whose objective is to transform thermal energy into electrical energy. Generally, they use their heat source to boil water and then generate electricity.

Exercise 3

Match the names of different types of thermal power plants with their descriptions: 1. Nuclear power plant. 2. Classic. 3. Biomass. 4. Solid waste combustion:

A. They obtain energy from the combustion of fossil fuels.

B. The energy is obtained from forest and agricultural residues' combustion or the famous energy crops.
C. They obtain energy through the combustion of treated garbage.
D. They generate energy thanks to the fission reactions of uranium atoms.

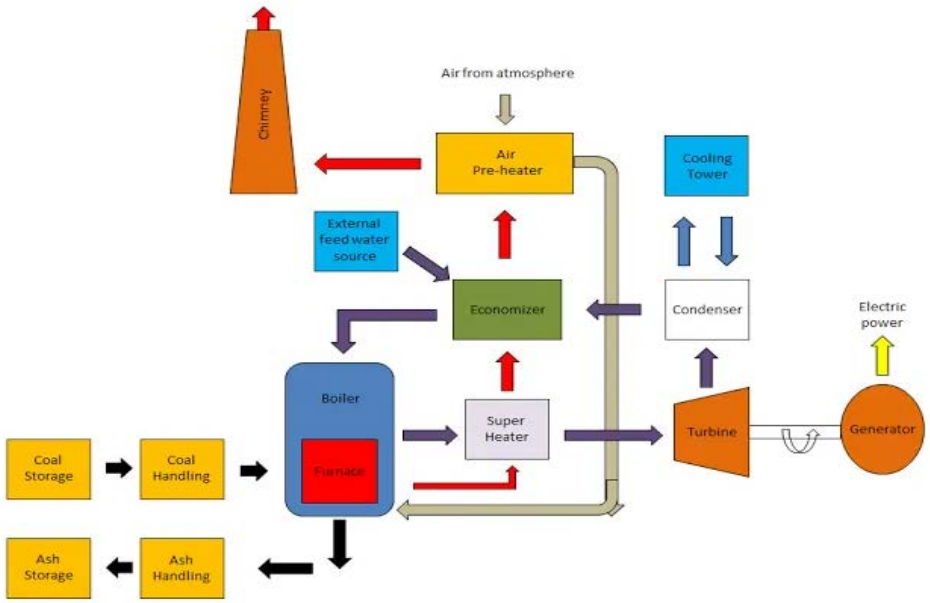

Fig. 1. Layout of Steam Power Plant

Exercise 4

Study the Fig. 1 which shows various components of the steam power plant andwatch a video about how it works https://www.youtube.com/ watch?v=IdPTuwKEfmA, then read the text about how a steam power plant works.

Text 1
How does a steam power plant work?

In the steam power plant the pulverised coal is fed into the boiler and it is burnt in the furnace. The water present in the boiler drum changes to high pressure steam. From the boiler the high pressure steam passed to the superheater where it is again heated up to its dryness. This superheated steam strikes the turbine blades with high speed and the turbine starts rotating at high speed. A generator is attached to the rotor of the turbine and as the turbine rotates it also rotates with the speed of the turbine. The generator converts the mechanical energy of the turbine into electrical energy. After striking on the turbine the steam leaves the turbine and enters into the condenser. The steam gets condensed with the help of cold water from the cooling tower. The condensed water with the feed water enters into the economiser. In the economiser the

feed water gets heated up before entering into the boiler. This heating of water increases the efficiency of the boiler. The exhaust gases from the furnace pass through the superheater, economiser and air pre-heater. The heat of this exhaust gases is utilised in the heating of steam in the superheater, feed water in the economiser and air in the air pre-heater. After burning of the coal into the furnace, it is transported to ash handling plant and finally to the ash storage.

Exercise 5

Match the names of the components of the steam power plant with their functions, translate them:

1. Coal Storage. 2. Coal Handling. 3. Boiler. 4. Air-preheater. 5. Economiser. 6. Turbine. 7. Generator. 8. Ash Storage. 9. Dust Collector. 10. Condenser. 11. Cooling Tower. 12. Chimney. 13. Feed Water Pump.

A. It is the mechanical device which converts the kinetic energy of the steam to the mechanical energy.
B. As its name indicates it economises the working of the boiler. It heats the feed water to a specified temperature before it enters into the boiler drum. It takes the heat from the burnt gases from the furnace to do so.
C. It is used to pre-heat the air before entering into the boiler furnace. The pre heating of air helps in the burning of fuel to a greater extent. It takes the heat from the burnt gases from the furnace to heat the air from the atmosphere.
D. It is coupled with the turbine rotor and converts the mechanical energy of the turbine to the electrical energy.
E. It converts the water into high pressure steam. It contains the furnace inside or outside the boiler shell. The combustion of coal takes place in the furnace.
F. Here the coal is converted into the pulverised form before feeding to the furnace. A proper system is designed to transport the pulverised coal to the boiler furnace.
G. It condensates the steam that leaves out turbine. It converts the low pressure steam to water. It is attached to the cooling tower.
H. It is the place where coal is stored which can be utilised when required.
I. It is used to store the ash after the burning of the coal.
J. It is a tower which contains cold water. Cold water is circulates to the condenser for the cooling of the residual steam from the turbine.
K. It is used to release the hot burnt gases or smoke from the furnace to the environment at appropriate height. The height of the tower is very high such that it

can easily throw the smoke and exhaust gases at the appropriate height. And it cannot affect the population living near the steam power plant.
L. It collects the dust particle from the burnt gases before it is released to the chimney.
M. It is used to transport the feed water to the boiler.

See the key on page 84

Exercise 6
Read and translate the text.

Text 2
Basics of steam generation

A boiler is a container, partially filled with water. Combustion of fuel produce heat, which is transferred to the container and makes the water evaporate. The vapor or steam can escape through a pipe that is connected to the container and be transported elsewhere. Another pipe brings water (called “feed water”) to the container to replace the water that has evaporated and escaped.

Since the pressure level in the boiler should be kept constant (in order to have stable process values), the mass of the steam that escapes has to be equal to the mass of the water that is added. If steam leaves the boiler faster than water is added, the pressure in the boiler falls. If water is added faster than it is evaporated, the pressure rises. If more fuel is combusted, more heat generated and transferred to the water. Thus, more steam is generated and pressure rises inside the boiler. If less fuel is combusted, less steam is generated and the pressure sinks.

The steam boiler provides steam to a heat consumer, usually to power an engine. In a steam power plant a *steam turbine* is used for extracting the heat from the steam and turning it into work. The turbine usually drives a generator that turns the work from the turbine into electricity. The steam, used by the turbine, can be recycled by cooling it until it condensates into water and then return it as *feedwater* to the boiler. The condenser, where the steam is condensed, is a *heat exchanger* that typically uses water from a nearby sea or a river to cool the steam. In a typical power plant the pressure, at which the steam is produced, is high. But when the steam has been used to drive the turbine, the *pressure* has dropped drastically. A *pump* is therefore needed to get the pressure back up. Since the work needed to compress a fluid is about a hundred times less than the work needed to compress a gas, the pump is located after the condenser. The cycle that the described process forms, is called a *Rankine cycle* and is the basis of most modern steam power processes.

Exercise 7

Read and translate another text about a steam boiler and make up the best title for it.

Text 4

In a traditional context, a boiler is an enclosed container that provides a means for heat from combustion to be transferred into the working media (usually water) until it becomes heated or a gas (steam). One could simply say that a boiler is as a heat exchanger between fire and water. The boiler is the part of a steam power plant process that produces the steam and thus provides the heat. The steam or hot water under pressure can then be used for transferring the heat to a process that consumes the heat in the steam and turns it into work. A steam boiler fulfils the following statements:

1. It is part of a type of heat engine or process
2. Heat is generated through combustion (burning)
3. It has a working fluid, a.k.a. heat carrier that transfers the generated heat away from the boiler
4. The heating media and working fluid are separated by walls. In an industrial / technical context, the concept “steam boiler” (also referred to as “steam generator”) includes the whole complex system for producing steam for use e.g. in a turbine or in industrial process. It includes all the different phases of heat transfer from flames to water/steam mixture (economizer, boiler, superheater, reheater and air preheater). It also includes different auxiliary systems (e.g. fuel feeding, water treatment, flue gas channels including stack).

The heat is generated in the furnace part of the boiler, where fuel is combusted. The fuel used in a boiler contains either chemically bonded energy (like coal, waste and biofuels) or nuclear energy. Nuclear energy will not be covered in this material. A boiler must be designed to absorb the maximum amount of heat released in the process of combustion. This heat is transferred to the boiler water through radiation, conduction and convection. The relative percentage of each is dependent upon the type of boiler, the designed heat transfer surface and the fuels that power the combustion.

Exercise 8

Now watch the video at https://youtu.be/GOCX_IrDP is about steam boiler fundamentals. Read the sentences and mark them as T (true) or F (false). Correct the false ones.

1. To generate the heat needed for steam production boilers burn fuel to provide the heat required.	
2. Fuel, air and heat are only these three basic requirements needed for the combustion process.	
3. According to the simplified design of the efficient boiler adding of an insulated casing as well as adding of a fan to supply air to a boiler and an outlet to remove combustion gases make the production of steam constant.	

4. The heat transfer occurs in two ways: radiation and conduction.	
5. Convection heat transfer also occurs when the warmer water mixes with cooler water.	
6. Scale is the only problem that can interfere with heat transfer.	
7. In this video they looked at one of main type of boilers: fire-tube boilers.	

Exercise 9

Read about the types of boilers in thermal power station and translate them into Russian. Use the dictionary.

1. Based on Tube Content

Fire Tube

Water Tube

2. Base on Operating Pressure

Ultra-supercritical boiler: Pressure > 27.0MPa or rated outlet temperature > 590 °C boiler

Supercritical boiler: 22.1 MPa < Pressure < 27.0 MPa

Subcritical boiler: 16.7 MPa < Pressure < 22.1 MPa

Ultra-high pressure boiler: 13.7 MPa < Pressure <16.7 MPa

High pressure boiler: 9.8 MPa < Pressure < 13.7 MPa

Sub-high pressure boiler: 5.4 MPa < Pressure < 9.8 MPa

Medium pressure boiler: 3.8 MPa < Pressures 5.4 MPa

3. Base on Fuel Used

Solid Fuel Fired

Stoker Fired Boilers

- Pulverized Fuel Boilers
- Fluidized Bed Combustion (FBC) Boilers

Oil Fired

Gas Fired Boilers

4. Based on Draught System

Natural Draught

Mechanical Draught

- Forced Draught System
- Induced Draught System
- Balanced Draught System

There are two types of boilers used in sub critical, super critical and ultra-super critical coal fired thermal power plant:

Pulverized coal-fired Boiler

Fluidized Bed combustion (FBC) boiler

Note: Both types of boiler are water tube boilers.

Unit 4. Alternative energy sources

Exercise 1

Discuss these questions in small groups.

1. Do you think global warming will continue?
2. What conditions or measures are necessary to make people use less energy and produce less carbon in the future?

Exercise 2

Energy prospects are based on the development of efficient alternative sources. The most studied areas in this field are *biofuels, wind energy, geothermal energy, solar energy, thermonuclear energy, hydrogen energy, tidal energy, hydro-electricity, geothermal power, nuclear power, tidal power, heat pumps*. Which of these types of energy is CLEANER ? Rank these with your partner. Put the best at the top. Change partners often and share your rankings.

Exercise 3

Discuss the questions:

1. What is biomass? What are a few examples of biomass?
2. What role does biomass have to play in our energy supply?
3. What are the advantages and disadvantages of creating energy through biomass?
4. How is biomass converted into energy?

Exercise 4

Read the text, divide it into the paragraphs and give a subtitle from the list:

a. COMBUSTION OF BIOFUEL; b. GASIFICATION; c. PYROLYSIS; d. BIOGAS PRODUCTION

Text 3

Most electricity from biofuels is generated by direct combustion. Wood fuels are burned in stoker boilers, and mill waste lignin is combusted in special burners. Plants are generally small, being less than 50 MW in capacity. There is considerable interest in combustion of biomass in a process called cofiring, when biomass is added to traditional fuels for electricity production. Cofiring is usually done by adding biomass to coal, but biomass also can be cofired with oil. Cofiring has the advantage of requiring very little capital cost since most boilers can accommodate approximately 5 to 10 per cent of biomass without modifications. Cofiring biomass has environmental benefits in addition to lowering greenhouse gases. Since biomass has little or no sulfur, sulfur dioxide (SO2) emissions are less when biomass fuels are used. Biomass also has lower levels of nitrogen than fossil fuels, leading to lower nitrogen oxide formation. The high water content in biomass also lowers the combustion temperature, decreasing the formation of thermal nitrogen oxides. In some cases this can lead to nonlinear

reductions; for example, in one study when 7 percent wood was cofired with coal, nitrogen oxides emissions decreased by 15 percent.

Gasification of biofuels, which is in the early developmental stage, has been the focus of much recent research, since it has the potential of providing high conversion. During gasification, biomass is converted to a combustible gas by heating with a substoichiometric amount of oxygen. The biomass can be heated either directly or with an inert material such as sand. In some cases steam is added. The product gas consists of carbon monoxide, methane and other hydrocarbons, hydrogen, and noncombustible species such as carbon dioxide, nitrogen, and water; the relative amount of each depends on the type of biomass and the operating conditions. Generally the product gas has an energy content about one-half to one-quarter that of natural gas. The gas is cleaned by removing tars, volatile alkali, ash, and other unwanted materials. The gas is then sent to a steam boiler or combustion turbine for electricity production by a Rankine cycle or a combined cycle (IGCC). Use of gasification technology with an IGCC can double the efficiency of average biomass electricity production using advanced turbine technology.

Another emerging area in biofuels is pyrolysis, which is the decomposition of biomass into other more usable fuels using a high-temperature anaerobic process. Pyrolysis converts biomass into charcoal and a liquid called biocrude. This liquid has a high energy density and is cheaper to transport and store than the unconverted biomass. Biocrude can be burned in boilers or used in a gas turbine. Biocrude also can be chemical by altered into other fuels or chemicals. Use of pyrolysis may make bioenergy more feasible in regions not near biomass sources. Biocrude is about two to four times more expensive than petroleum crude.

Biogas is composed primarily of methane (CH4) and carbon dioxide. Biogas is a by-product from anaerobic bacteria breaking down organic material. Large amounts of biogas can be released from areas such as livestock waste lagoons, sewage treatment plants, and landfills. Since biogas is primarily methane, it is similar to natural gas and can be used for energy generation, especially electricity using stationary engine-generators. The goals of capturing biogas are often to prevent these greenhouse gases from being released into the atmosphere, to control odor, and to produce fertilizer; energy production is secondary. Methane is a potent greenhouse gas, with twenty-one times the global warming potential of carbon dioxide. However, when methane is burned, it produces less carbon dioxide per Btu than any other hydrocarbon fuel.

Exercise 5

Look at the words given below. If necessary check their meaning in the dictionary. Put the words into groups as in example:

Cofiring, pyrolysis, carbon monoxide, combustion, sulfur dioxide, volatile alkali, ash, carbon dioxide, capture, combust, decrease, release, nitrogen, burner, accommodate, gasification, heating, store, gas turbine, prevent, global warming

Chemicals:….

Equipment and technology:…..

Process:….

Exercise 6

Match the words in column A with their definitions in column B.

1.	bacteria	a.	a smell is caused by one or more volatilized chemical compounds
2.	capital cost	b.	possible to work
3.	break down	c.	related to burning coal or gas and emissions of CO2 to the atmosphere
4.	odor	d.	very small organisms which can cause diseases
5.	feasible	e.	stop working
6.	fertilizer	f.	a substance that is put on the soil to make plants grow
7.	hydrocarbon fuel	g.	the amount of money that must be payed for something

Exercise 7

Put the following words into the gaps. Make appropriate changes if necessary: *release, emissions, capacity, biomass, focus, efficiency, benefits.*

1. Biomass fuels are used for the reduction of SO2_____.
2. Small plants are generally less than 50 MW in _____.
3. Cofiring can be done only by adding _____ to coal.
4. Livestock waste lagoon is the one of the main sources of _____ a methane and carbon dioxide.
5. Gasification of biofuels has been the _____ of much recent research.
6. This technology can double the _____ of average biomass electricity production.
7. It has environmental _____ in addition to lowering greenhouse gases.

Exercise 4

Read the sentences and say which ones are true or false according to the text.

1. Cofiring requires a lot of capital expense.
2. Most power from biofuels is created by burning.
3. There is no interest in ignition of biomass in a cycle called cofiring.
4. Cofiring is generally done by adding biomass to water.
5. Cofiring biomass has ecological advantages as well as decreases global warming.
6. Gasification of biofuels has been the main point of exploration since it can convert biomass to gas.
7. The biomass can be warmed either directly or indirectly through another material like sand.
8. Innovations in utilization of gasification cannot significantly increase the productivity of normal biomass power creation.

Exercise 5

The words in sentences are jumbled up. Put the words into the best order.

1) biogas/from/anaerobic/bacteria/by-product/breaking down/organic/is/material/a/

2) the/a/steam/gas/electricity/is/production/sent/to/boiler/for/

3) lower/levels/ has/biomass/fuels/than/also/of/nitrogen/fossil/

4) more/about/to/biocrude/than/is/two/four times/expensive/petroleum/crude

5) if/we/the/effects/change/combat/want/to/of/climate/we/have/find/to/ more/energy/sustainable/and/sources/gas/than/of/oil

6) we/will/out/of/supplies/unless/act/soon/we/run/energy

Exercise 6

Put the following words into 6 pairs of antonyms.

Decrease, small, unwanted, anaerobic, noncombustible, desirable, large, artificial, aerobic, double, organic, combustible.

Exercise 7

In pairs discuss the following information about innovations and less obvious energy sources.

1. In Livingston, near Edinburgh, the Mitsubishi Electric factory is making one alternative: air-source heat pumps, which draw warmth from the air to heat your home and water, without releasing any carbon in the process.

2. Vertical farming is a revolutionary, and arguably more sustainable, method of farming for several reasons. For example, it tends to require much less water than regular farming – by some estimates up to 95 % less. It also takes up less space (especially the ground footprint), and has little to no impact on local natural soils (apart from the ground surface right below).

4. Recently, scientists have been looking at the use of fast-growing grasses as an alternative to traditional fossil fuels. These grasses can be burnt in power stations to provide a renewable source of energy.

5. Many people in the UK are already taking steps to cut their carbon debt. Bands such as Coldplay, Pink Floyd and Atomic Kitten have produced carbon-neutral albums by planting enough trees to offset the CO2 generated by making the CDs.

***Case Study*.** It can be predicted that in the coming years there will be other technologies, the development of which will allow to abandon the use of hydrocarbons and, importantly, reduce the cost of energy. Or it is necessary to solve the main problems for the optimal development of the electric power industry.

Think of the main problems of the modern electric power industry and make a list of them. Suggest any ideas about using alternative energy sources which will help to produce clean energy in our country.

Unit 5. Environmental challenges

Exercise 1

Read some suggestions about irrational use of fuel and energy resources. In your opinion which of them are more effective in solving energy problems and energy resource saving?

1. “Logging waste is a technically feasible and cost effective fuel for replacing coal and fuel oil. The use of wood waste at wood processing enterprises for energy purposes will allow to reduce the purchase of heat and electricity; to dispose of waste, reduce the cost of their transportation and maintenance of dumps; to ensure independence from suppliers of heat and electricity”.

2. “The most significant components of heat losses in heat and power systems are losses at consumer facilities. The presence of such is not transparent and can be determined only after the appearance of a heat metering device in the heating station of the building, the so-called heat meter”.

3. “Natural gas is an important fuel and energy resource. Costs of extraction and transportation of natural gas are lower that for solid fuels. Being an excellent fuel, it also has a high heat output in different units. Gas is used in furnaces that require precise temperature control; it produces little waste and smoke that pollutes the air”.

4. Solar energy is one of the most efficient renewable sources of energy. The benefits of solar would be environmental, with the reduction of deforestation, as well as economical, as energy could be generated more cost-efficiently.

5. The “planetary health diet” can save million lives and reduce further damage to the environment. It is based on cutting red meat and sugar consumption in half and upping the intake of fruits, vegetables, whole grains and nuts. Everyday things like using more environmentally cooking methods, for example, using a micro than oven, water preheating with a kettle, using a cover not to allow heat to evaporate, regulation water consumption, eating local food instead of food transportation and packaging can save energy resources and reduce greenhouse gas emissions.

6. If we want to keep our environment as clean as possible, it is necessary to innovate technology and to try new ways to make the best out of the current situation.

7. Using combustion engine vehicles wastes most of the fuels energy. For example, one litre of gasoline releases about 2,3 kg carbon dioxide to the atmosphere. Imagine driving a full electric car that is reloaded by wind energy. That car would release zero emission to the atmosphere.

Exercise 2

Learn the following expressions of agreement and disagreement and use them with the previous statements.

Agreement	Disagreement
Yes, of course	Certainly, not
Yes, Certainly	Not at all
Quite so	On the contrary
That's right	I am afraid, not
I think (believe, suppose) so	I don't think so
I quite agree with the author	I don't agree with the author

Exercise 3

Read about the following negative impacts that should be considered on the territory of a nuclear power plant for generating electricity and beyond, translate:

- Withdrawal of land for construction and arrangement of sanitary zones.
- Terrain changes.
- Destruction of vegetation due to construction.
- Atmospheric pollution when blasting is necessary.
- Relocation of local residents to other territories.
- Harm to local animal populations.
- Thermal pollution affecting the microclimate of the territory.
- Changing the terms of use of land and natural resources in a particular territory.
- Chemical effects of nuclear power plants-emissions into water basins, the atmosphere and on the soil surface.
- Radionuclide contamination, which can cause irreversible changes in human and animal organisms. Radioactive substances can enter the body with air, water, and food. There are special preventive measures against this and other factors.
- Ionizing radiation when the station is decommissioned in violation of the rules for dismantling and decontamination
- One of the most significant polluting factors is the thermal impact of nuclear power plants, which occurs during the operation of cooling towers, cooling systems and spray pools. They affect the microclimate, the state of water, and the life of flora and fauna within a radius of several kilometers from the object.
- Modern nuclear power plants are created with high levels of security and safety. They must meet the highest regulatory requirements, including protection from contamination by radionuclides and other harmful substances.

Group discussion. An explosion at the Chernobyl nuclear power plant in 1986 blew up the reactor's containment shell, and tons of radioactive dust were released into the atmosphere. A huge number of people were injured and died, eliminating the consequences of the explosion. This incident and a number of others have shown that measures are needed to ensure safe energy production. Discuss in small groups what safety measures should be used.

SECTION II
TEXTS FOR SUPPLEMENTARY READING ABOUT BASIC EQUIPMENT OF THERMAL POWER STATION

Text 1. Pulverized coal fired (PCF) boilers

Coal-fired water tube boiler systems generate approximately 38 % of the electric power generation worldwide and will continue to be major contributors in the future. *Pulverized coal fired boilers*, which are the most popular utility boilers today, have a high efficiency but a costly SO_x and NO_x control. Almost any kind of coal can be reduced to powder and burned like a gas in a PCF-boiler, using burners. The PCF technology has enabled the increase of boiler unit size from 100 MW in the 1950's to far over 1000 MW. New pulverized coal-fired systems routinely installed today generate power at net thermal cycle efficiencies ranging from 40 to 47 % lower heating value, LHV, (corresponding to 34 to 37 % higher heating value, HHV) while removing up to 97 % of the combined, uncontrolled air pollution emissions (SO_x and NO_x).

Burners and layout

Another benefit from pulverizing coal before combustion is that the coal air mixture can be fed to the boiler through jet burners, as in oil and gas boilers. A finer particle is faster combusted and thus the combustion is more complete the finer the coal is pulverized and formation of soot and carbon monoxides in the flue gas is also reduced. The size of a coal grain after the coal grinder is less than 150 mm.

Two broadly different boiler layouts are used. One is the traditional two-pass layout where there is a furnace chamber, topped by some heat transfer tubing to reduce the FEGT. The flue gases then turn through 180º, and pass downwards through the main heat transfer and economizer sections. The other design is to use a tower boiler, where virtually all the heat transfer sections are mounted vertically above each other, over the combustion chamber.

Text 2. Fluidized bed boilers

Fluidized bed combustion was not used for energy production until the 1970's, although it had been used before in many other industrial applications. Fluidized bed combustion has become very common during the last decades. One of the reasons is that a boiler using this type of combustion allows many different types of fuels, also lower quality fuels, to be used in the same boiler with high combustion efficiency. Furthermore, the combustion temperature in a fluidized bed boiler is low, which directly induce lower NO_x emissions. Fluidized bed combustion also allows a cheap SO_x reduction method by allowing injection of lime directly into the furnace.

Principles. The principle of a fluidized bed boiler is based on a layer of sand or a sand-like media, where the fuel is introduced into and combusted. The combustion air blows through the sand layer from an opening in the bottom of the boiler. Depending on the velocity of the combustion air, the layer gets different types fluid-like behavior. This type of combustion has the following merits:

a) fuel flexibility; even low-grade coal such as sludge or refuse can be burned; b) high combustion efficiency; c) low NO_x emission; d) control of SO_x emission by desulfurization during combustion; this is achieved by employing limestone as a bed material or injecting limestone into the bed; e) wide range of acceptable fuel particle sizes; pulverizing the fuel is unnecessary; f) relatively

small installation, because flue gas desulfurization and pulverizing facilities are not required.

Main types: there are two main types of fluidized bed combustion boilers: Bubbling fluidized bed (BFB) and Circulating fluidized bed (CFB) boilers.

In the bubbling type, because the velocity of the air is low, the medium particles are not carried above the bed. The combustion of this type of boiler is generated in the bed.

The CFB mode of fluidization is characterized by a high slip velocity between the gas and solids and by intensive solid mixing.

In the circulating type, the velocity of air is high, so the medium sized particles are carried out of the combustor. The carried particles are captured by a cyclone installed in the outlet of combustor.

Combustion is generated in the whole combustor with intensive movement of particles. Particles are continuously captured by the cyclone and sent back to the bottom part of the combustor to combust unburned particles. This contributes to full combustion.

The CFB boiler has the following advantages over the BFB Boiler:

- High combustion efficiency;
- Lower consumption of limestone as a bed material;
- Lower NO_x emission;
- Quicker response to load changes

The main advantage of BFB boilers is a much larger flexibility in fuel quality than CFB boilers. BFB boilers have typically a power output lower than 100 MW and CFB boilers range from 100 MW to 500 MW. In recent years, many CFB boilers have been installed because of the need for highly efficient, environmental-friendly facilities (экологическое оборудование).

Text 3. Economizers and air heaters

The gases must be cooled from the boiler exit-gas temperature to the flue-gas temperature required for high efficiency by means of heat-exchangers supplied with fluids at temperatures less than the saturation temperature at the boiler pressure. This can be done in an air heater supplied with the air required for combustion at room temperature or in an economizer supplied with boiler feedwater at a temperature considerably below the saturation temperature, or both. In many installations, it is economical to install a small boiler and a large economizer and air heater and to deliver the gases to the economizer at temperatures as high as 900 °F rather than to cool the gases to lower temperatures by a larger boiler.

In a typical economizer feedwater is supplied to the inlet header from which it flows through a number of parallel circuits of 2-in. o.d. tubes of considerable length to

the discharge header. If the inlet header is at the bottom so that the water rises as it flows from tube to tube, the hot gas normally enters at the top and flows downward. Thus the coldest gas will be in contact with the coldest tubes, and it is possible to cool the gas to within 125° to 150 °F of the temperature of the inlet water if sufficient surface is installed.

Since the economizer has water in the tube and a dry gas around the tube, the major resistance to beat transfer is on the gas side. In order to increase the surface exposed to the gas per linear foot of tube and thus increase the effectiveness of the tubular surface, the economizer has fins welded to the top and bottom of each tube. This increases the surface available for heat transfer from the gas without substantially increasing the pressure drop of the gas as it flows across the surface. The gas flows at right angles to the tubes, and the 2-in. finned tubes are staggered to promote effective scrubbing of the outside surface by the gas so as to improve the overall heat-transfer coefficient.

Where scale-free feedwater is available or acid cleaning of heat transfer surfaces is used to remove scale, the flanged return bends may be eliminated. The flow circuits then consist of continuous welded tubing between inlet and outlet headers.

Text 4. Superheaters

Superheated steam is produced by causing saturated steam from a boiler to flow through a heated tube or superheater, thereby increasing the temperature, enthalpy, the specific volume of the steam.

Superheaters may be classified as convection or radiant superheaters. Convection superheaters are those that receive heat by direct contact with the hot products of combustion which flow around the tubes. Radiant superheaters are located in furnace walls where they “see” the flame and absorb heat by radiation with a minimum of contact with the hot gases.

In a typical superheater of the convection type saturated steam from the boiler is supplied to the upper or inlet header of the superheater by a single pipe or by a group of circulator tubes. Steam flows at high velocity from the inlet to the outlet header through a large number of parallel tubes or elements of small diameter. Nipples are welded to the headers at the factory, and the tube elements are welded to the nipples in the field, thus protecting the headers from temperature stresses due to uneven heating during final welding.

The amount of surface required in the superheater depends upon the final temperature to which the steam is to be superheated, the amount of steam to be superheated, the quantity of hot gas flowing around the superheater, and the temperature of the gas. In order to keep the surface to a minimum and thus reduce the cost of the superheater, it should be located where high-temperature gases will flow around the tubes. On the other hand, the products of combustion must be cooled sufficiently before they enter the superheater tubes so that any ash that may be present has been cooled to a temperature at which it is no longer sticky or plastic and will not adhere to the superheater tubes. In a modern two-drum steam generating unit fired by a continuous-ash-discharge spreader stoker, the superheater is located ahead of

the boiler convection surface and at the gas exit from the furnace. In installations burning coal having a high content of low-fusing-temperature ash, it may be necessary to place a few boiler tubes ahead of the superheater.

Text 5. Pump types

The conditions under which liquids are to be transported vary widely and require a careful analysis before the proper selection of a pump can be made.

The conditions that will influence the selection of the type of pump are: 1) the type of liquid to be handled, that is, its viscosity, cleanliness, temperature and so on, 2) the amount of liquid to be handled, 3) the total pressure against which the liquid is to be moved, 4) the type of power to be used to drive pumps.

Pumps may be divided into four major classifications:

1. Piston pumps or reciprocating pumps driven by engine or electric motors.
2. Centrifugal pumps driven by steam turbines or electric motors.
3. Rotary pumps driven by steam turbines or electric motors.
4. Fluid-impellent (жидкостный) pumps which are not mechanically operated but are fluid-pressure operated.

Text 6. Fans

Fans are used extensively in the heating and ventilating industry and in most power plants. Their basic design principles fall into two cases: axial-flow fans and centrifugal or radial fans. Axial flow fans are basically rotating air-foil fan similar to the propeller of an airplane.

The simplest axial flow fan is the small electric fan used for circulating air in rooms against very little resistance. Axial-flow fans for industrial purposes are the two blades or multiblade propeller type, and the multiblade airfoil type. Air enters the fan section from the left and flows over the rotor with a minimum of turbulence owing to the streamline form of the rotor and drive mechanism. The air stream is straightened by guide vane located on the discharge side, thus decreasing the rotational energy of the air by converting it to energy of translation.

The axial-flow fan operates best under conditions where the resistance of the system is low, as in the ventilating field. The axial-flow fan occupies a small space, is light in weight, is easy to install, and handles large volumes of air.

Centrifugal fan may be divided into two major classes: 1) the long-blade or plate type fan and 2) the short-blade multiblade fan. The blades of either type may be pitched towards the direction of motion of the fan, radially, or away from the direction of motion of the fan.

A plate-type radial blade rotor with double inlet is best suited for handling dirty gases since there are no pockets in the blades to catch and collect the dirt. The fan is designed for induced-draft service.

Text 7. Blowers

Blowers may be divided into 2 types: 1) rotary and 2) centrifugal.

A common type of rotary blower is the Roots (рутсевский) *two-lobe blower*. Two double lobe impellers mounted on parallel shaft connected by gears rotate in opposite directions and at the same speed. The impellers are machined to afford only a small clearance between them and between the casing and impellers. As the lobes revolve, air is drawn into the space between the impellers and the casing, where it is trapped and discharged in volumes equal to the space between the impellers and casing, and the operation is repeated four times for each rotation of the shaft.

In order to change the volume rate of flow, the blower speed is changed. The pressure developed by the blower can force the air through the piping system. The volume of air delivered by the blower will not change. Thus the blower is called a *positive-displacement blower*.

Care should be taken in operating any positive-displacement blower. A safety valve should be placed on the discharge line to prevent the discharge pressure becoming excessive. This valve will prevent overloading the discharge line and the driving motor. The advantages of the rotary blower are: 1) simple construction, 2) positive air movement, 3) economy of operation and low maintenance.

Centrifugal blowers and compressors operate on the same principle as centrifugal pumps and resemble the closed-impeller centrifugal pumps. The casing or housing is constructed of heavy steel plate, and the impeller is an aluminum-alloy casting. If care is taken in providing the proper drive motor, the overload characteristics of the centrifugal blowers will cause no trouble.

Text 8. Fuel combustion equipment

There are two general methods of firing fuel commonly employed: 1) on stationary grates, or 2) on stokers. Also coal may be pulverized to the consistency of 70 per cent through a 200-mesh screen and burned in suspension. The types of solid fuel encountered in various parts of the world and the general conditions under which they must be burned are so variable that it is impossible to design one type of grate or stoker that is exactly suited to all fuels. The problem becomes one rather of suiting the equipment to the type of fuel to be handled.

To a certain extent, the design of the furnace must be considered coincidentally with the selection of fuel-burning equipment, so that satisfactory ignition and heat release may be ensured. The choice of equipment for a given set of conditions is limited, and, although any stoker will burn any fuel only one design as a rule will give satisfactory results.

Text 9. Stokers

A stoker should not only be designed from the combustion point of view, but it must be mechanically strong to withstand all working stresses due to high temperature, etc. A simple design will ensure low first cost minimum maintenance

and operation for long periods without failure. Some of the factors to be aimed at in stoker design are: maximum rates of burning, highest continuous efficiency and the unlimited choice of fuels.

Any study of the use of stokers must begin with an analysis of the four principal constituents of coal, namely, moisture, volatiles, mixed carbon and ash, or, more generally, water, tar, coke and dirt. These determine the features which should be embodied in the stoker and furnace equipment so that the proper treatment of the coal at the correct time is effected on its passage through the furnace. Whichever of the two types be used the coal has to be taken from the bunkers to the feeding hoppers on the boilers. The coal falls by gravity from the bunkers through a valve into feeding chutes. In some installations automatic weighers are included in the downspouts between the cut-off valves and the boiler feed hoppers. The cut-off valves may be operated from the firing floor by means of chains. The chutes are one or two types namely, traversing and fixed.

There are usually two or three chutes for large boilers. The travelling chutes travel the full width of the feeding hopper, the motion being affected by means of a continuously rotating screwed shaft which engages with a special nut attached to the chute. The operating shaft has right- and left-hand helical grooves and the nut is designed so that at the end of its travel it reverses automatically.

The chutes are operated from the stoker drive, there being two or four chutes for large boiler units. Coal chutes are of welded mild steel plates, wearing plates also being included.

Text 10. Furnaces

A furnace is a fairly gas-tight and well-insulated space in which gas, oil, pulverized coal, or the combustible gases from solid-fuel beds may be burned with a minimum amount of excess air and with reasonably complete combustion. The furnace gases will consist of inert gases such as CO_2, N_2 and H_2O vapor, together with some O_2, and some combustible gases such as CO, H_2, hydrocarbons, and particles of free carbon (soot).

The design of a satisfactory furnace is based upon the “three T’s of combustion”: temperature, turbulence, and time.

For each particular fossil fuel, there is a minimum temperature, known as the ignition temperature. A furnace must therefore be large enough and be maintained at a high enough temperature to permit the combustible gases to burn before they are cooled below the ignition temperature.

Turbulence is essential if combustion is to be complete in a furnace of economical size. Violent mixing of oxygen with the combustible gases in a furnace increases the rate of combustion, shortens the flame, reduces the required furnace volume, and decreases the chance that combustible gases will escape from the furnace without coming into contact with the oxygen necessary for their combustion. Turbulence is obtained, in the case of oil, gas, and powdered coal, by using burners which introduce the fuel-air mixture into the furnace with a violent whirling action.

In burning fuels such as gas, oil, or pulverized coal, the incoming fuel-air mixture must be heated above the ignition temperature by radiation from the flame or hot walls of the furnace. Since gaseous fuels are composed of molecules, they burn very rapidly when thoroughly mixed with oxygen at a temperature above the ignition temperature. However, oil and pulverized coal burn with a longer flame than gaseous fuels.

The required furnace volume is dependent, therefore upon the kind of fuel burned, the method of burning the fuel, the quantity of excess air in the furnace, and the effectiveness of furnace turbulence. The shape of the furnace depends upon the kind of fuel burned, the equipment employed to burn the fuel, and the type of boiler used to absorb the energy if the fuel is burned for steam generation.

SECTION III
TOPICS FOR DISCUSSION

Unit 1. Studying at Higher School

Exercise 1
Discuss the following questions in groups.
1. Is student's life more about studying or having fun?
2. How has your life changed since entering the higher school?
3. What was your biggest fear before you began your first year?
4. Which do you prefer more, morning or afternoon classes? Why?
5. What do you know about our higher school? When it was established?
6. What traditions do you know? Why did you choose higher school?

Exercise 2
Read and translate the text.

The Higher School of Technology and Energy

The Higher School of Technology and Energy was founded in 1931. Its previous name was the Saint Petersburg State Technological University of Plant Polymers (SPbSTUPP). In the past it trained different specialists for the pulp and paper industry. Some years ago its structure was modernized. Since 2015 it has been merged with the Saint Petersburg State University of Technology and Design, and has become a unit of the Saint Petersburg State University of Industrial Technologies and Design.

Nowadays our Higher School includes 4 educational Institutes:

- Institute of Technology;
- Institute of Energy and Automation;
- Institute of Management and Economics;
- Institute of Continuous Part-Time Training.

At the moment the Higher School prepares specialists in many new educational programmes at the Bachelor's, Master's and PhD levels which allow comprehensive training of specialists for enterprises of a great number of industries such as chemical industry, mechanical engineering, heat power energy production, pulp and paper industry, printing industry, etc. Over than 3000 students majoring in process automation, energy, chemical and mechanical engineering, industrial design, etc. study at HSTE. Different forms of education are available: full-time, part-time, distance education.

The education is realized by different departments where qualified lecturers, associate professors and professors deliver lectures, direct classes and carry out laboratory works. Every theoretical course is followed by practical training. The Bachelor students study for 4 years according to full-time education programme and the Master students study for two years more. The Bachelor students study general engineering subjects. In the third year they begin to study specialized subjects. The

final year is devoted to the graduation project which is submitted to the State Examination Commission. The academic year begins on the 1st of September and is divided into two terms. The students take exams at the end of each term. At the end of their studies the students are granted Bachelor's and Master's diplomas.

The Higher School provides education on a fee-paying basis and education on a scholarship basis from the federal budget resources. The most successful students get extra scholarships such as the scholarship of the President of the Russian Federation, of the RF Government, the Saint Petersburg Government, of major employers. Winners of different competitions in the frames of some Russian and / or foreign special programmes are awarded grants.

The Higher School includes 2 students' dormitories, modern equipment, academic and research laboratories, a concert hall, experiment and test production workshops.

The Higher School organizes a lot of cultural, sports for students and creative competitions. The competitions "Miss HSTE", "Mister HSTE", "The best student of the year", different sports tournaments, quests are held among the students. There are sports sections, a vocal school, a dance studio, the Club of Cheerful and Quick-Witted Persons at our Higher School. Students are able to participate in the international conference student's conference "Dialogue of cultures" held by the Department of Foreign Languages. Students have the opportunity to acquire the necessary skills and deep their knowledge taking part in the conference with scientific presentations in the English language.

Exercise 3

Read the names of the fields of study at the Higher School and degree programmes it offers. Translate them into Russian.

Institute of Technology

Bachelor's Degree: Chemical Engineering; Printing and Packaging Technology; Energy- and Resource-Saving Processes in Applied Chemistry, Petrochemistry and Biotechnology; Technosphere Safety; Processing Machinery and Equipment.

Master's Degree: Chemical Engineering; Energy- and Resource-Saving Processes in Applied Chemistry, Petrochemistry and Biotechnology; Technosphere Safety; Processing Machinery and Equipment.

Institute of Energy and Automation

Bachelor's Degree: Process and Production Automation; Information Systems and Technologies; Applied Mathematics and Informatics; Design; Heat-Power Engineering and Heat Technology; Electrical Power Engineering and Electrical Technology.

Master's Degree: Process and Production Automation; Heat-Power Engineering and Heat Technology.

Institute of Management and Economics

Bachelor's Degree: Management; Economics.

Master's Degree: Management.

Institute of Continuous Part-Time Training gives students (and trainees) opportunities to get higher education on a part-time basis, to join the course of professional retraining or advanced training at the KRONA Institute or at the Independent Attestation and Methodological Centre.

Case Study. A group of students and teachers from Boston University is on a visit at your Higher School. You are asked to tell the guests about your University. Make up a dialogue and present the following information:

- the name of your university;
- its location;
- the structure of your university;
- how long the degree programmes last;
- the number of students;
- the subjects you study (humanities, technical subjects, sciences);
- the equipment and laboratories;
- the examinations you take and the scholarships you receive;
- the students' dormitories;
- what you like and what you don't like about your university.

Exercise 4

Study the information about how to make a presentation.

Introduction

Welcoming the audience	Good morning / afternoon. ladies and gentlemen. Hello / Hi everyone. First of all, let me thank you all for coming here today. It's a pleasure to welcome you today. I'm happy / delighted that so many of you could make it today. It's good to see you all here.
Introducing yourself	Let me introduce myself. I'm Ann Brown from … For those of you who don't know me, my name is... Let me just start by introducing myself. My name is …
Introducing your topic	What I'd like to present to you today is... I'm here today to present... Today's topic is... The subject / topic of my presentation is ... In my presentation I would like to report on ... In my talk I'll tell you about … Today I'm going to talk about ... I'll be talking about ...
Stating your purpose	The purpose / objective / aim of this presentation is to ... Our goal is to determine how / the best way to ... What I want to show you is... My objective is to ... Today I'd like to give you an overview of...

	Today I'll be showing you / reporting on...
Structuring	I've divided my presentation into three (main) parts. In my presentation I'll focus on three major issues.
Sequencing	Point one deals with .... point two .... and point three... First, I'll be looking at.... second .... and third _. I'll begin/start off by… Then I'll move on to…. Then / Next / After that... I'll end with…
Timing	My presentation will take about 30 minutes. It will take about 20 minutes to cover these issues. This won't take more than...
Questions	There will be time for questions after my presentation. We will have about 10 minutes for questions in the question and answer period.
Saying what is coming	In this part of my presentation I'd like to talk about... So, let me first give you a brief overview.
Indicating the end of a section	This brings me to the end of my first point. So much for point two. So, that's the background on ... That's all I wanted to say about...
Summarizing a point	Before I move on. I'd like to recap the main points. Let me briefly summarize the main Issues. I'd like to summarize what I've said so far...
Moving to the next point	This leads directly to my next point. This brings us to the next question. Let's now move on/tum to ... After examining this point, let's turn to ... Let's now take a look at ...
Going back	As I said/mentioned earlier.... Let me come back to what I said before ... Let's go back to what we were discussing earlier. As I've already explained, ... As I pointed out in the first section...

Describing visuals

Introducing a visual	Let's now look at the next slide which shows... To illustrate this, let's have a closer look at... The chart on the following slide shows ... I have a slide here that shows … The problem is illustrated in the next bar chart ... According to this graph, our net profit has doubled. You can see the test results in this table. As you can see here, ...
Explaining a visual	First, let me quickly explain the graph. You can see that different colours have been used to indicate _. The new models are listed across the bottom. The biggest segment indicates... The key in the bottom left-hand comer...
Highlighting information	I'd like to stress / highlight / emphasize the following point(s). I'd like to start by drawing your attention to ... Let me point out that ... I think you'll be surprised to see that ... I'd like you to focus your attention on... What's really important here is….
Explaining cause and effect	What's the reason for this drastic decrease? The unexpected drop was caused by … This was because of … As a result ….

Conclusion

Indicating the end of your talk	I'm now approaching / nearing the end of my presentation. Well, this brings me to the end of my presentation. That covers just about everything I wanted to say about ... OK, I think that's everything I wanted to say about…. As a final point. I'd like to….. Finally, I'd like to highlight one key issue.
Summarizing points	Before I stop, let me go over the key issues again, lust to summarize the main points of my talk... I'd like to run through my main points again ... To conclude / ln conclusion. I'd like to... To sum up (then), we ...
Clarifying questions	I'm afraid I didn't (quite) catch that. I'm sorry, could you repeat your question, please? So. if I understood you correctly, you would like to know whether... So. in other words you would like to know whether...

	If I could just rephrase your question. You'd like to know._ Does that answer your question?
Avoiding giving an answer	If you don't mind, could we discuss that on another occasion? I'm afraid that's not really what we're discussing today. Well, actually I'd prefer not to discuss that today.
Admitting you don't know	Sorry, I don't know that off the top of my head. I'm afraid I'm not in a position to answer that question at the moment. I'm afraid I don't know the answer to your question, but I'll try to find out for you.

Useful words (in context)

to clarify Before we go on, let me clarify one point.
to focus on We need to focus or customer service.
to highlight Let me highlight the following points.
to illustrate This chart illustrates our success story.
to indicate The figures on the left mi a и sales In France.
to lead to This leads to my next point.
to mention As I mentioned earlier, our staff is well-qualified.
to move on to Let's move on to the next question.
to note Please note that prices rose slightly.
to notice You'll notice a sharp drop in August.
to solve How can we solve this problem?
to summarize Before I go on, let me summarize the key issues.

Unit 2. My future occupation

Exercise 1

Discuss the following questions in groups.

- Where does a person of such qualification work? What does a person do in this job?
- What tools and equipment does a person use in the job?
- What skills and abilities are important to do this job well?
- What technology might a person use in this job? What kind of person will be interested in this work?
- What level of education is required?
- What kind of job training and experience is required?
- What is the job outlook? (Will this be a good job with good opportunities in the future?)
- What is the average salary?
- Why have you chosen this profession?
- Why is the profession of a heat power engineer necessary?

Exercise 2

Read and translate the text.

My name is … I study at the Higher School of Technology and Energy at the Institute of Energy and Automation. My major is Heat-Power Engineering and Heat Technology. I have courses on Electrical engineering and Electronics, Material Processing, Mathematics, Technical Thermodynamics and Hydraulics.

My future profession is a heat power engineer. I'm going to work according to my education. I have chosen this profession because I am a creative person, and I like to question, analyze, invent, discover and create so engineering profession is ideal for me. My father taught me to build electrical circuits when I was 5 and since then it has become my hobby.

There are many reasons why more and more people in our country are choosing engineering as a career. The professional engineers are always in demand. Qualified engineers can quickly get a promotion and correspondingly a high salary.

Our industry and economy are greatly connected with the power engineering. It is impossible to imagine modern life without heat and electricity. Thermal power stations and municipal and industrial boiler houses play an important role in energy system of our country. At present great attention is paid to combined generation of heat and electricity at heat and power plants and to centralized heat supply. A qualified specialist should assure that the technological processes and operation of modern equipment along with the cost of heat energy and electricity to be produced suit market requirements. From this point of view the profession of a heat-power engineer is extremely necessary and important and a specialist in this field should be creative, innovative, have a keen interest and necessary skills, be able to solve problems quickly and understand how problems arise, understand computer programmes and other technical systems, know the latest technologies and developments in industry.

Our Institute trains qualified engineers capable of operating the most complicated up-to-date technological processes and highly competent in applying modern kinds of equipment and using it in the most efficient manner. I think that my future work is not easy, but absolutely necessary for our national economy.

Exercise 3

Match the phrases with their translations and make your own sentences with them:

1) power engineering (n)	a) специальность
2) boiler house (n)	b) обучение, подготовка
3) requirement (n)	c) теплоэнергетика
4) major	d) квалифицированный инженер
5) qualified engineer	e) обращать внимание на
6) pay attention to	f) получить повышение по службе
7) from this point of view	g) с этой точки зрения
8) field (n)	h) соответствовать
9) training(n)	i) играть роль
10) get a promotion	j) совместное производство
11) capable (a)	k) управлять
12) operate (v)	l) способный
13) suit (v)	m) играть роль
14) combined generation	n) требование
15) play a role	o) котельня
16) up-to-date (a)	p) применять
17) apply (v)	q) современный

Exercise 4

Discuss in pairs what qualities a successful engineer should have. Why?

Exercise 5

Retell the text according to the questions.

1. What specialists does your Institute train?
2. What is your future profession?
3. Where do the graduates of your Institute work?
4. Are you going to work as a heat-power engineer?
5. Do you like your future occupation? Why?

SECTION IV. THEORETICAL AND GRAMMATICAL SECTION

1. NON FINITE FORMS OF THE VERB (PARTICIPLE, GERUND, INFINITIVE) / НЕЛИЧНЫЕ ФОРМЫ ГЛАГОЛА (ПРИЧАСТИЕ, ГЕРУНДИЙ, ИНФИНИТИВ)

Неличные формы глагола выражают действие без указания лица и числа. Они имеют общие глагольные свойства: залог, время, могут иметь прямое дополнение и определяются наречием.

Таблица 1

Неличные формы глагола	**Формы**	**Active**	**Passive**
INFINITIVE	SIMPLE	to ask	to be asked
	CONTINUOUS	to be asking	—
	PERFECT	to have asked	to have been asked
	PERFECT CONTINUOUS	to have been asking	—
GERUND	SIMPLE	asking	being asked
	PERFECT	having asked	having been asked
PARTICIPLE	PRESENT PARTICIPLE I	asking	being asked
	PAST PARTICIPLE II	—	asked
	PERFECT	having asked	having been asked

2. THE PARTICIPLE / ЗАЛОГОВО-ВРЕМЕННЫЕ ФОРМЫ ПРИЧАСТИЯ, ФУНКЦИИ ПРИЧАСТИЯ В ПРЕДЛОЖЕНИИ И ОСОБЕННОСТИ ПЕРЕВОДА В НАУЧНО-ТЕХНИЧЕСКОМ ТЕКСТЕ

Таблица 2

Вид причастия	**Функция в предложении и перевод**		
	часть сказуемого	**определение**	**обстоятельство**
1. Participle I Active voice **solving writing**	He **is solving** a problem. Он **решает** задачу. (Для образования времен группы Continuous. Самостоятельно не переводится).	The engineer **solving** this problem works hard. Инженер, **решающий** эту задачу, много работает. We tested the device **showing** the disturbances. Мы проверили прибор, **показавший** нарушения в работе. (Причастие на -щий, -вший).	(When, while) **solving** the problem he read many books. **Решая** задачу, он прочитал много книг. (Деепричастие на -а, -я).
2. Participle I Passive voice **being solved being written**	The problem **is being solved**. Задача **решается**. (Для образования группы времен Continuous пассивного залога. Самостоятельно не переводится).	The problem **being solved** was difficult. **Решаемая** задача была трудной. (Причастие на -емый, -имый).	**(While) being solved**, the problem offered some unexpected aspects. **Когда ее решали** (**при решении**), задача представила некоторые неожиданные стороны. (Придаточное обстоятельственное предложение; существительное с предлогом).

Таблица 3

Вид причастия	**Функция в предложении и перевод**		
	часть сказуемого	**определение**	**обстоятельство**
3. Participle II Passive voice **solved** **written**	1) He **has solved** the problem. Он решил задачу. (Для образования времен Perfect. Самостоятельно не переводится). 2) The problem **is solved**. Задача решена. (Для образования пассивного залога. Самостоятельно не переводится).	The problem **solved** turned out to be fundamental. **Решенная** задача оказалась фундаментальной. The problem **discussed** yesterday is very important. Проблема, **обсуждавшаяся** вчера, очень важна. (Причастие на -щийся, -мый, -ный, -тый, -вшийся).	**If solved**, the problem will offer numerous consequences. **Если ее решить**, задача будет иметь многочисленные последствия. (Обстоятельственное придаточное предложение).
4. Perfect Participle active voice **having solved** **having written**	–	–	**Having solved** the problem he left the classroom. **Решив** задачу, он ушел из класса. (Деепричастие на -ив, -ав).
5. Perfect Participle Passive voice **having been solved** **having been written**	–	–	**Having been solved**, the problem offered some unexpected consequences. **После того как задача была решена**, обнаружились некоторые ее неожиданные следствия. (Придаточное обстоятельственное предложение).

Активные и пассивные формы Причастия 1 и Причастия 2 (Participle I, Participle II Active and Passive)

Упражнение 1

Translate the sentences with Participle I in the function of an Attribute into Russian.

1. I shall give the review of papers covering the most important problems in this area.
2. In this paper we survey the possibilities arising from the application of new high-precision instruments.
3. This paper is primarily concerned with the events accompanying solar flares.
4. The transformations taking place in such reactions have been listed explicitly in a number of works.
5. All papers concerning biological aspects of space flights will be presented at the panel sessions of the symposium.
6. Particles forming an atom are in motion.
7. We must have devices improving the accuracy of measurements.
8. The lab assistant making the experiment works in the evening.
9. The changes resulting in ion production are known.
10. The present work is a survey of the electron transfer mechanisms and underlying phenomena occurring in collisional processes.
11. The experimental data indicating the presence of this effect are given in the table.
12. The existing theories on this phenomenon are reviewed in Chapter 1.
13. The differences in the behavior of the particles under study are shown by the corresponding curves in Fig. 3.
14. Biochemical phenomena occurring in a living cell are much more complicated than those taking place in chemical reactions.

Упражнение 2

Translate the sentences with Participle II in the function of an Attribute into Russian.

1. The results *presented* here add to our knowledge of this mechanism.
2. A theoretical treatment of the problem *concerned* keeps in line with the main purpose of this paper.
3. Within the accuracy of the data *described* these rules are strikingly well satisfied.
5. The fundamental point of our approach is to use profitably the knowledge *gained* during the past two years.
6. In the two chapters which follow we shall try to survey the problems *listed* above.
7. For details the reader is referred to the paper by these authors *published* in 1990.
8. Two separate approaches to this problem depend on the applications employed and the accuracy required.

9. The aim of this paper is to find the proper value of the indices involved.

10. The structure thus obtained is a simple parallel-plane configuration.

11. There are few excited electrons in this region.

12. The images generated by the reflected waves have special properties.

13. As the injection current is increased the light produced by stimulated emission increases.

14. These positively charged particles referred to as holes occur in a region uniformly filled by negative charges – electrons.

Упражнение 3

Переведите предложения, учитывая разные функции в предложении и соответствующий перевод причастия Participle I (Active и Passive).

***Образец**: Some factors affecting testing (проверка) are described in the article. – Некоторые факторы, влияющие на проверку описаны в статье (Participle I Active в функции определения).*

1. The furnace walls are composed of tubes which are also connected to the boiler drum forming a very effective steam-generating surface.

2. The tubes of furnace walls are forming a very effective steam-generating surface.

3. The steam being separated from the water in the boiler drum flows through a superheater.

4. The gaseous products of combustion leaving the boiler tube bank are at a relatively high temperature.

5. The gaseous products of combustion are leaving the boiler tube bank at a relatively high temperature.

6. Many steam power plants of large size are being built now.

7. Steam generating units delivering 3,000,000 lb. of steam per hour are now in operation.

8. Overall efficiency of the plant depending upon the size, steam pressure, temperature and other factors is doubled.

9. Valves are opened periodically and some of the boiler water is blown to sewer, thus carrying out of the system the impurities.

10. Some of boilers have become popular and are sold including fire-tube boilers and water tube boilers.

Упражнение 4

Переведите предложения, учитывая разные функции в предложении и соответствующий перевод причастия Participle II.

1. The purposes of injectors sometimes called “atomizers” are numerous.

2. The grate bars made of heat resistant cast iron are cooled by the air supplied for combustion and form a flat surface for the fuel bed.

3. The grate bars are made of heat resistant cast iron.

4. High grade waste heat, which is defined as the heat carried by flue gases with a temperature of 250° and higher, can be recovered through properly selected and designed heat transfer system.

5. This heat transfer system is properly selected and designed.

6. The classification of injectors is based on the source of energy used to break up the liquid.

7. The heat of combustion is the heat released during the combustion reaction based on standard conditions.

8. The air supplied in the burner is defined as primary air and additional air supplied downstream of the burner as second air.

9. The higher gas temperature caused increased slagging of the boiler surface.

Упражнение 5

Переведите предложения, обращая внимание на перевод слов "following" и "followed by".

1. The results of this new test are described and discussed in the following sections (раздел).

2. The work followed by multi-stage drying studies (исследования) was carried out some years ago.

3. Following this development (вывод), the influence of temperature heating has been investigated by several researchers.

4. From these observations (наблюдения), the following conclusions (выводы) can be drawn.

5. The event featured four presentations followed by interactive discussions.

Перфектные формы причастия (The Perfect Participles)

Для повторения материала посмотрите видеоурок по теме «Причастие в английском языке» по ссылке https://www.youtube.com/watch?v=mJdc2E1VY_w.

Упражнение 1

Определите, в каких предложениях содержатся сложные формы причастий, подчеркните их, предложения переведите на русский язык.

1. The question being discussed now is very important.

2. Yesterday the professor told us about his experiments being carried at his laboratory.

3. The large house being built in our street is a new school.

4. Being packed in plastic cases the goods arrived in good condition.

5. Being asked whether he intended to return soon he answered that he would be away for a couple of weeks.

6. Having fulfilled the terms of the contract we refused to admit the claim (признать претензию) of the firm.

7. Having collected all the necessary material for the report he started writing it.

8. He left the office having finished all the work planned for that day.

9. Having been sorted the goods were placed in a warehouse.

10. Having been sent to the wrong fax number, the message was not received by the addressee.

11. The film being shown now is very interesting.

12. Being asked for help he gave us explicit instructions.

13. Having written the translation I gave it to the teacher.

15. Having been written the translation was given to the teacher.

16. Having been compiled very carefully the manual contained all the necessary instructions.

17. The house being built in our street will soon be ready.

18. Being built of prefabricated parts it will soon be ready.

19. Having used the device redesigned by a group of our researchers we increased the production of goods.

20. Being delivered by a famous scientist the lecture was listened to with great attention.

21. The lecture being delivered by a famous scientist is listened to with great attention.

Упражнение 2

Перефразируйте следующие предложения с помощью Perfect Participle вместо придаточного предложения. Используйте образец:

Sp.: After the hypothesis had found support it was extended and clarified.

St.: Having found support the hypothesis was extended and clarified.

1. After physicists had conducted the search they solved the problem.

2. After he had received an excellent education he adopted the career of a scientist.

3. After they had compared all these materials they were able to choose the best one for their purpose.

4. After he had attended a course of lectures on the subject he got a better understanding of it.

5. After they had considered that hypothetical experiment they could tell the difference between these two processes.

6. After we had analyzed the concept of energy more thoroughly we saw that...

7. After the scientists had used more powerful experimental tools and theoretical approaches they found new atomic states.

Контрольная работа по теме «Причастие»

Переведите предложения, учитывая разные функции и соответствующий перевод причастий.

1. Large power plants currently being built in regions of high fuel cost are designed for operations at pressures of more than 1500 psig.

2. Thermal analysis concerning combustion involves the heat and the temperature.

3. The first law of thermodynamics states that all the work done by the turbine comes from the energy in the steam flowing through the turbine.

4. The steam impinges on the wheel blades causing the wheel to rotate.

5. Each disc carrying the moving blades is perforated thus maintaining the same pressure on both sides of the wheel.

6. The double suction permits forces acting on the impeller to be balanced, thus

reducing the axial thrust (колебания) on the shaft.

7. Because of the heat radiated back from combustion zone, polymerization may occur at the nozzle tip causing tip plugging.

8. The small amount of unevaporated water is separated from the steam and is blown down to a lower pressure carrying out with it any impurities.

9. As the oxidation rate increases, the temperature gradually rises, increasing the rate of oxidation and hence the rate of temperature rise.

10. The overall length of the turbine is increased thereby necessitating larger building space and introducing additional losses by the use of interconnecting piping.

11. Having cooled sufficiently the products of combustion we may force them to enter the superheater tubes.

12. Having increased the furnace size and temperature it is necessary to improve refractory maintenance, particularly when firing with pulverized coal.

13. In the boilers with water tube furnace bent tubes are arranged to form furnace enclosure making it integral with the boiler.

14. The steam expands in the fixed blade increasing its velocity.

3. ABSOLUTE PARTICIPIAL CONSTRUCTION / НЕЗАВИСИМЫЙ ПРИЧАСТНЫЙ ОБОРОТ И ОСОБЕННОСТИ ПЕРЕВОДА

В данном обороте есть собственное подлежащее, которое выражается местоимением или существительным. НПО **всегда отделяется от основного предложения запятой**. Если НПО стоит до запятой, то он переводится придаточным обстоятельственным предложением времени, условия, причины, вводится союзами **когда, после того как, если, так как, поскольку**. Причастие переводится сказуемым. Время сказуемого может быть будущим, настоящим или прошедшим. Это зависит от формы причастия и времени, в котором стоит сказуемое главного предложения.

Если независимый причастный оборот стоит после запятой, то после нее ставятся союзы **а, и, причем, при этом**. В некоторых случаях союз может быть опущен.

НПО может вводиться предлогом with, который не переводится.

Время глагола, которым переводятся причастия I и II, зависит от времени сказуемого в предложении. Перфектные причастия всегда переводятся глаголом прошедшего времени.

The model used is a simple one, more complex models having been tried. – Использованная модель проста, но испытывались и более сложные модели.

Некоторые независимые причастные обороты представляют собой устойчивые словосочетания, например, other conditions (things) being equal – при прочих равных условиях.

Запомните некоторые слова, по форме совпадающие с причастием I.

Предлоги:

according to – согласно, по;

concerning, regarding, relating to – о, об, относительно, в отношении;

considering – учитывая, принимая во внимание.

excepting – за исключением, кроме

following – после, вслед за

depending on (upon) – в зависимости от

Союзы:

providing (= provided) – при условии (что), (если) supposing – предположим (что), допустим (что).

Запомните: некоторые причастные обороты в функции вводного члена предложения:

as already mentioned – как уже упоминалось

as stated earlier – как установлено ранее

as pointed out previously (above) – как указывалось ранее (выше) generally speaking – вообще говоря

strictly speaking – строго говоря.

Изучите образцы перевода независимых причастных оборотов в таблице и переведите предложения в задании.

СПОСОБЫ ПЕРЕВОДА НЕЗАВИСИМОГО ПРИЧАСТНОГО ОБОРОТА

Таблица 4

Примеры	Перевод
Независимый причастный оборот в **начале** предложения (переводим с союзами **так как** или **когда**)	
1. *The problem being difficult*, they worked hard.	***Так как*** *задача была трудная*, они работали много.
2. *The experiment being carried out*, he cannot leave the laboratory.	***Так как (когда)*** *эксперимент идет*, он не может уйти из лаборатории.
3. *With radioactivity discovered*, great progress was made in physics.	***Когда*** *была открыта радиоактивность*, в физике произошли огромные перемены.
Независимый причастный оборот в **конце** предложения (переводим с союзами **причем**, **при этом**, **и**, **а**)	
4. He read two articles on this subject, *the latter being more interesting.*	Он прочитал две статьи на эту тему, ***причем*** *последняя была более интересная.*

Упражнение 1

Переведите предложения, учитывая особенности перевода независимого причастного оборота.

Образец: **The work having been done**, they went home. – **После того как работа была сделана**, они пошли домой.

1. Noncondensable gases being highly corrosive, their removal of the condenser is important.
2. When some impellers are mounted on the same shaft and act in series, the pump is called a multistage pump, the number of stages corresponding to the number of impellers.
3. The source of cooling water being a lake or a river, there is no need for water conservation.
4. In the reaction turbines the pressure at entrance to the motor blade is greater than at exit, the expansion taking place in both the stationary and rotating passages.
5. The tubes are cast iron, the gases passing through plain tubes and the air – over the grill surface.
6. Simple turbines have a considerable number of pressure stages, a wheel in each stage having one row of blades.
7. The steam being condensed, heat is transferred from the vented steam to the water.
8. Steam turbines are grouped into 3 types, classification being made in accordance with the conditions of the operation of the steam on the rotor blades.
9. The economics of the situation permitting, the steam generating units are fired by pulverized coal.
10. Bent tubes being used instead of straight tubes, no floating head is necessary.
11. Cooling water being usually corrosive in nature, condenser tubes are of ten made of special alloys of copper or aluminum.
12. Noncondensable gases being collected in the condenser, the vacuum in the condenser will increase.
13. The major item (часть) of the cost of a boiler being the drums, as many boiler tubes as possible are placed between the drums.
14. Feed water entering the boiler at high temperature, the boiler is relieved of a part of its load, and temperature stresses within the boiler are reduced.
15. The circulation pump raises the water pressure to about 40 psi above the drum pressure, this being sufficient to overcome the resistance of the flow controlling orifices of the small diameter tubing.
16. There being no expansion in the passage between the rotor blades, the steam pressure is the same at the inlet and outlet of the blades.
17. In a pure reaction turbine expansion should take place only as the steam passes through the moving blades, the turning effect (эффект вращения) being due to the reaction consequent on the increase in velocity which accompanies expansion.
18. The tubes being vertical or nearly vertical, the tendency toward slag adherence is decreased.
19. The boiler producing dry steam, all the impurities remain in the boiler.

Упражнение 2

Определите тип причастного оборота в следующих предложениях и переведите их.

1. The weather being fine, they went for a walk.
2. The project being realised was proposed by a team of scientists.
3. The goods having been unloaded, the workers left the port.
4. Having read the note, he folded it and put it away.
5. The English spoken by most educated people in Britain is known as the Queen's English or standard English. It is the English taught in universities and schools and the kind heard on the BBC.
6. England being a constitutional monarchy, the Queen of England is only a formal ruler.
7. A trouble shared is a trouble halved.
8. The work finished, we went home.
9. When asked if he realized the danger, he said he did.
10. London is not only the centre of commerce and finance but also a great port, with many imported and exported goods passing through it.
11. It being Sunday, most shops in the town were closed.
12. The final round of the negotiations over, a joint communique was signed.
13. There being a lot of things to discuss, the conference lasted long.
14. The negotiations between the American and British representatives were conducted behind closed doors, measures having been taken so that no reporter should receive any information.
15. The proposal being unconstitutional, the committee rejected it.
16. When crossing the street in London, look to the right, then to the left.
17. Based on a real life event, the story aroused everybody's attention.
18. Entering or leaving a room with ladies, don't rush before them. Remember the golden rule of every gentleman: "Ladies first".
19. With the shipping strike in the United States still going on, arrivals of American cotton in Liverpool were rather small at that time.

Упражнение 3

Перефразируйте предложения, используя придаточное предложение вместо независимого причастного оборота:

Sp.: The equipment showing good characteristics, we could use it for several purposes.

St.: As the equipment showed good characteristics, we could use it for several purposes.

1. The results lacking precision, we had to employ another method.
2. The phenomenon demanding explanation, they began to study it thoroughly.
3. The instrument operating with high accuracy, we got satisfactory results.
4. The chamber leaking, we couldn't get vacuum.
5. The results confirming the theory, they considered the theory valid.
6. The substance exhibiting peculiar properties, we studied it with great interest.
7. The theory representing a radically different point of view, scientists didn't accept it at once.

Контрольная работа

Подчеркните в предложениях независимый причастный оборот, переведите предложения.

1. There being no other traffic, the driver can maintain constant speed of, say, 60 km/hr (kilometers per hour).

2. Part of the energy being changed into heat, not all chemical energy of the cell battery is transformed in electric energy.

3. The water leaves the wheel with a large relative velocity but a small absolute velocity, practically all original energy having been given to the wheel.

4. The cyclotron may be regarded as a modification of the linear accelerator, the particles being transferred from one to the other at the proper instants by an ion of a magnetic field.

5. The positive pole having been brought near the negative pole, the latter attracts it.

6. Two bodies having potentials of 100 volts and 50 volts, a potential difference exists between them of 50 volts.

7. The current distribution-over the cross-section of a conductor being non-uniform, the resistance increases.

8. The travelled distance having been given in meters and the time in seconds, speed was measured in m.p.s. that is in meters per second.

4. THE INFINITIVE / ЗАЛОГОВО-ВРЕМЕННЫЕ ФОРМЫ ИНФИНИТИВА

Инфинитив является неличной формой глагола, которая сочетает в себе свойства глагола и существительного. Следует помнить, что инфинитив употребляется без частицы to:

- после модальных и вспомогательных глаголов;
- после глаголов to make (заставлять), to let (разрешать);
- после выражений had better (лучше бы), would rather, would sooner (предпочел бы).

Simple Infinitive Active обычно переводится на русский язык неопределенной формой глагола. Перфектные формы инфинитива обычно переводятся придаточными предложениями.

He wants to study English. Он хочет изучать английский.

He is glad to have passed the exams well.

Он рад, что хорошо сдал экзамены.

С инфинитивом в английском языке возможны следующие конструкции:

- сложное дополнение (Complex Object);
- сложное подлежащее (Complex Subject).

4.1. ФОРМЫ ИНФИНИТИВА

Таблица 5

Вид	Active Voice	Passive Voice
Simple – выражает действие, одновременное с действием, выраженным глаголом-сказуемым	to produce	to be produced
Perfect – выражает действие, предшествовавшее действию, выраженному глаголом-сказуемым	to have produced	to have been produced
Continuous – длительный характер действия	to be producing	
Perfect Continuous – действие началось в прошлом и все еще продолжается	to have been producing	___

Упражнение 1

Найдите инфинитивы в предложениях и определите их форму. Переведите предложения.

1. You must be careful with him, otherwise you can find yourself in a trap.
2. “Come along” said she, “we must be getting back.”
3. You must have noticed her there; she was the only one wearing a bright red dress.
4. She can’t have been that naive! The whole thing must have been going on under her eyes!
5. She’s like a beautiful exotic flower that must be sheltered from bitter winds.
6. This meeting, she realized, must have been planned several hours ago.
7. ‘I want to know how long we are expected to wait’. – ‘Don’t make a fuss. We must have been waiting for only a couple of minutes’.
8. He seemed to be weighing something in his mind.
9. You know how I hate to interfere in other people’s business.
10. I considered myself to be standing much higher than all my fellow-workers.
11. Was the object attached to anything? No wires or anything? I mean, someone couldn’t have been having a joke or something?
12. He seemed to have taken his defeat quietly.
13. I rang the bell and the man answered with remarkable promptness; he seemed to have been waiting for it to ring.
14. He had in the meantime made himself as comfortable as circumstances would permit.
15. I’d rather be told the truth than be lied to.
16. She was known to have had a quick temper.

4.2. СИНТАКСИЧЕСКИЕ ФУНКЦИИ ИНФИНИТИВА

Таблица 6

Функция в предложении	Примеры	Перевод
1. Подлежащее	**To provide** three pulverizers is necessary for the efficient operation of the furnace.	**Обеспечить** три распылителя необходимо для эффективной работы топки. (Инфинитив, существительное).
2. Часть сказуемого: a) После глагола-связки “is” с существительными “aim”, “purpose”, “idea” и т.д. b) После модального глагола to be+to, to have+to и др. c) После прилагательного	a) Their aim is **to improve** the equipment. b) You have **to improve** the equipment. c) This film is interesting **to see.**	a) Их цель – (**состоит в том, чтобы*)* усовершенствовать** оборудование. (Инфинитив). b) Вы **должны усовершенствовать** оборудование. c) Этот фильм интересно **смотреть.**
3. Дополнение	The operator prefers **to use** the new equipment.	Оператор предпочитает **использовать** (**использование**) новое оборудование. (Инфинитив, существительное).
4. Определение	a) They have the possibility **to use** this system. b) The new equipment **to be used** at our power plant has just arrived. c) He was the first **to begin** this experiment.	a) У них есть возможность **использовать** эту систему. (Инфинитив, существительное). b) Новое оборудование, **которое должно быть (будет) использовано** на нашей электростанции, только что прибыло. (Определительное придаточное предложение со сказуемым, выражающим действие, которое ***должно быть*** или ***будет*** совершено). c) Он первым **начал** этот эксперимент.

Окончание табл. 6.

Функция в предложении	Примеры	Перевод
5. Обстоятельство a) цели Может вводиться союзами so as (to), с тем, чтобы, in order (to) – для того чтобы. b) следствия	**To design** a good turbine, you must have good knowledge of its construction.	**Чтобы спроектировать** хорошую турбину, вы должны иметь хорошие знания о ее конструкции. (Инфинитив с союзами **чтобы, для того чтобы**). **Примечание**: чтобы отличить инфинитив в роли подлежащего от инфинитива в роли обстоятельства цели (если он стоит в начале предложения), следует помнить, что если перед сказуемым нет другого подлежащего, кроме инфинитива (с относящимися к нему словами), то он выполняет роль подлежащего.
	It is **such** a small error **as to be** easily **neglected**. Methods for measurement and analysis of this vibration are too numerous to discuss here. This method is not accurate **enough to give** reliable results.	Эта такая незначительная погрешность, что ею **можно** легко **пренебречь**. Методы для измерения и анализа такой вибрации **слишком** многочисленны, чтобы о них **можно** было здесь сказать. Этот метод недостаточно точен, чтобы дать (чтобы он мог дать) надежные результаты.

Упражнение 1

Определите формы инфинитива, его функции и переведите предложения.

Образец: *The letter may have been sent to a wrong address. – Письмо, возможно, было отправлено по неправильному адресу. (Infinitive Perfect Passive после модального глагола в функции части сказуемого).*

1. He asked the student to define the unit of resistance more accurately.
2. She got a list of the books to be read.
3. The assistant came to be instructed by the professor.
4. To launch rockets a new type of fuel was needed.
5. The student wanted to be examined as soon as possible.
6. I am sorry to be asking you.
7. Experiments have shown that the amount of work to be used for producing a given amount of heat is the same under all conditions.
8. They were happy to have been sent to the international conference.
9. The engineers are glad to have obtained such good results.
10. We supposed the plan to have been explained to you long ago.

Упражнение 2

Переведите предложения, обращая внимание на перевод инфинитива в функции подлежащего и обстоятельства цели.

1. To change heat directly into electrical energy we must take two wires of dissimilar metals.
2. To change heat directly into electrical energy is not difficult.
3. To prove any statement it is necessary to make experiments and observations.
4. To prove any statement is a very difficult task.
5. To protect personnel from radiation is a very important task.
6. To protect personnel from radiation nuclear reactors are shielded with concrete walls.
7. To prolong this discussion is to waste time.
8. To complete a journey round the sun requires nearly 30 years.

Упражнение 3

Переведите предложения в зависимости от того, является ли сказуемое составным именным или составным глагольным.

15. We were to maintain a flow of that liquid in the pipe.
16. Our duty is to defend our country.
17. That assistant was to compare the resistance of the two conductors.
18. We are to control the speed of these particles.
19. He is to demonstrate the results of his experiments next Monday.
20. His aim is to demonstrate the results of his experiment.

Упражнение 4

Перефразируйте словосочетания, чтобы получить инфинитив в функции определения.

Пример: the questions which will he discussed => the questions to be discussed the reports which will be given; the choice which should be made; the conditions which must be met; the works which will be cited here; the point which should be stressed; the gap which must be filled; the controversy which must be resolved; the difficulties which must be overcome; the conference which is to be held in; the phenomena which will be described.

Упражнение 5

В приведенных ниже предложениях инфинитив используется в качестве подлежащего. Расставьте слова по порядку, прочитайте и переведите предложения.

1. is – cry – it – useless; never – helps – to.
2. to – it's – good – knock – a – then – man – not – down – and – ask – lives – him – why– he – dirt – in – the.
3. to – human – is, to – divine – err – forgive – is. (A proverb)
4. late – it – never – up – to – give – too – is – prejudice.
5. everything – to – know – know – is – nothing – to. (A proverb)
6. hard – not – it's – to – decisions – you – make – when – your – what – values – know – are.
7. to – or – not – compromise – not – to – a – be – is – be – question – of – a.
8. be – than – it's – to – occasionally – suspicious – better – cheated – perpetually.
9. wear – to – bought – not – all – these – have – nice – things – where – and – to – have – to – them – shame – was – a.

Упражнение 6

Переведите предложения с инфинитивом в роли определения

1. The difficulties to be resolved in the first place concern the technical aspects of the experiment.

2. For lack of time many of the important contributions to be considered in this connection will only be mentioned in passing.

3. The best experimental evidence for the correlation to be considered later in more detail comes from the recent work by Roberts and his collaborators.

4. The data to be reported here point to the possibility of a feedback mechanism.

5. The seminar course in theoretical physics to be held in Rome is scheduled for May-June.

6. The abstracting journal for biological chemistry to be printed since next year will cover only fundamental researches in this vast area.

7. The scientific meeting to be convened next year by the Atomic Energy Commission will tackle both experimental and theoretical aspects of research into plasma phenomena.

Упражнение 7

Переведите предложения, учитывая разные функции инфинитива и особенности его перевода. Подчеркните инфинитив, его перевод на русский язык, определите его форму и функцию.

1. To cover waste energy two major types of hardware are used: combustion equipment and heat transfer equipment.
2. Parameters to be measured in a control experiment include density and temperature of the fuel.
3. To lower the temperature of the cooling water by artificial means would require additional energy.
4. An additional factor to be considered is the cost and maintenance of cooling system.
5. Combination of radial and convective heat transfers are used to improve the effectiveness of heat transfer.
6. The materials to be used for the construction of the modern boilers are described in this book.
7. The tubes to be made of this metal will be used in different kinds of boilers.
8. An economizer and an air heater are provided to cool the products of combustion to the low temperature necessary for high efficiency.
9. The function of the economizer is to supply the boiler with wet steam and feed water.
10. To overcome the limited output at the exhaust end turbines are usually of multicylinder type.
11. To convert pulverized coal furnaces to firing with oil or gas is not difficult.
12. To create mechanical circulation is the only means of obtaining the desired fluid flow.
13. To reduce to a minimum the loss of the fuel is the function of the air heater.
14. All heat must be transferred through the heating surface to reach the water.
15. To obtain high economy it is necessary that the steam should flow through the turbine with high velocity.
16. For these fuels specially designed combustion systems are required to ensure complete oxidation of waste materials.
17. The problem to be solved consists in finding the new generator characteristics.
18. The shape of the furnace depends upon the kind of fuel burned, the equipment to burn the fuel and the type of boiler to absorb energy.
19. Some of the factors to be aimed at in stoker design are: maximum rate burning, highest continuous efficiency and the unlimited choice of fuels.
20. It is necessary to maintain a hot zone above the entering fuel to ignite the fuel on the grate.

4.3. ИНФИНИТИВНЫЕ ОБОРОТЫ

4.3.1. ОБЪЕКТНЫЙ ИНФИНИТИВНЫЕ ОБОРОТ (COMPLEX OBJECT / СЛОЖНОЕ ДОПОЛНЕНИЕ)

Инфинитив вместе с предшествующим ему существительным в общем падеже или местоимением в объектом падеже образует сложное дополнение или конструкцию «объектный падеж с инфинитивом». **На русский язык сложное дополнение переводится дополнительным придаточным предложением с союзами ЧТО, ЧТОБЫ, КОГД, КАК.**

существительное (местоимение) + инфинитив They want HIM TO BECOME A JOURNALIST Они хотят, чтобы он стал журналистом.

Таблица 7

Примеры	**Перевод**
1) после глаголов ***want, like, would like***: I'd like ***you to help*** me. They want (like) ***the plan to be fulfilled***.	 Мне бы хотелось, ***чтобы*** вы помогли мне. Они хотят, ***чтобы*** *план был выполнен*.
2) после глаголов ***order, allow, cause, force***. После глаголов ***1et*** (позволять), ***make*** (заставлять), ***help*** используется инфинитив без частицы "to". He ordered ***us to go*** there. We made ***him go*** there. They order, allow (let), cause, force (make) ***this fuel to arrive (arrive) immediately***.	 Он приказал нам, ***чтобы*** мы пошли туда. Мы заставили его поехать туда. Они приказывают (позволяют, заставляют), ***чтобы*** это топливо прибыло немедленно.

Окончание табл. 7.

Примеры	**Перевод**
3) после глаголов чувственного восприятия ***see, hear, feel*** и др. (инфинитив употребляется без частицы to): I saw ***her cross the street***. He heard ***them discuss their plan***. They see (hear) ***the engineer leave the room***.	Я видел, ***что*** она перешла улицу. Он слышал, ***как*** они обсуждали свой план. Они видят (слышат), ***что*** *инженер уходит из комнаты.*
4) после глаголов ***suppose, believe*** (полагать), ***consider*** (считать), ***find, know, think, prove*** (доказывать), ***expect*** (ожидать): I consider ***them to be good students.*** We expect ***her to return in May.***	Я считаю, ***что*** они хорошие студенты. Мы ожидаем, ***что*** она вернется в мае.

Упражнение 1

Переведите предложения со сложным дополнением.

1. They expected these new installations to be widely used in various kinds of power stations.
2. We know the alternating current to flow first in one direction and then in another.
3. The students saw the thermometer mercury fall to the fixed point.
4. The induced voltage causes the current to flow and the rotor to revolve.
5. We may expect a short circuit to result from wire fault.
6. The invention of James Watt made the engine double its velocity.
7. A forced-draft fan forces the combustion air to flow through the air heater into the furnace.
8. Some stations find the cyclone furnace to be advantageous.
9. They proved the combustion in the cyclone furnace to be complete and to have practically no carbon loss.
10. The practice proved the cyclone furnace to be suitable for a wide range of coals.
11. In the burner the gas under pressure enters the furnace through a burner port and lets a flow of air pass through the port.
12. In the ring burner the gas flows through an annular ring and causes the air to flow both around and within the annulus of gas.
13. The depth of the active bed enables an adequate supply of air to penetrate the fuel bed and enter the furnace.
14. The mixing of the volatile matter with turbulent air permits the volatile matter to burn smokelessly.
15. This type of stoker lets the fine sizes of anthracite and coke breeze burn quickly and pass through a screen with very small round openings.

Упражнение 2

Перепишите предложения. Используйте сложное дополнение.

Пример: I believe that Van Clibern is a great pianist. – I believe Van Clibern to be a great pianist.

1. He believes it is a mistake.
2. I consider that this business is very profitable.
3. I don’t expect you will understand me.
4. They know that he is a responsible person.

Упражнение 3

Выберите правильный вариант. Напишите полностью предложения и переведите их.

1. Jim said the switch was dangerous and warned me _____ touch it.

– do not
– not
– not to
– no

2. She said the letter was personal and didn’t let me _____ it.
– reading
– read
– to read
– read to
3. She didn’t want _____ to go.
– they
– I
– his
– me
4. I know him _____ a good student.
– is
– has been
– to be
– was
5. Carol’s parents always encouraged her _____ hard at school.
– to study
– studied
– studying
– studies
6. When did you _____ him to check the timetable?
– asked
– to ask
– ask
– ask to
7. He saw two girls _____ on the stage.
– to dance
– dancing
– dances
– are dancing
8. She made her brother _____ into the water.
– jump
– to jump
– jumps
– jump to
9. She didn’t want her child
– to take
– take
– to taken
– to be taken
– to hospital.
10. Who _____ you to drive?
– taught
– teach
– does teaches

– to teach

Упражнение 4

Поставьте слова в нужном порядке, чтобы получились предложения, переведите их.

1. to want / me / to pay by card / the shop assistant
2. her mother / Alice / to try the dress on / would like
3. to come so ate / her parents / to not want / Ann
4. they / Jack / to invite them to his house / to expect
5. our teacher /us/ to expect /to make a report
6. her brother/Jane / to start dieting / to not want
7. the guide / her / to pay attention to the picture / would like
8. our parents / my sister / to expect / to go to university

Упражнение 5

Используйте инфинитив с частицей “to” или без частицы “to”. Переведите предложения.

1. We expect him ...sign the contract on Monday.
2. He wants the doctor...be sent for.
3. Mr Garret wants the house ...be renovated in summer.
4. I don’t her ...sing at the moment.
5. When do you want me ...call?
6. We wouldn’t like Liz ...know the truth.
7. Why don’t you like them...come to the party?
8. I want my name ... be included in the list.
9. When do you want this work ... be completed?
10. She made him ...promise to stay with them.
11. They expected the letter ... have been received.

4.3.2. СУБЪЕКТНЫЙ ИНФИНИТИВНЫЙ ОБОРОТ (COMPLEX SUBJECT / СЛОЖНОЕ ПОДЛЕЖАЩЕЕ)

Конструкция «именительный падеж с инфинитивом» состоит из существительного в общем падеже или местоимения в именительном падеже и инфинитива и выполняет в предложении роль подлежащего.

Перевод предложения со сложным подлежащим следует начинать со сказуемого. Имя существительное (или местоимение), являющееся подлежащим в английском предложении, становится подлежащим русского придаточного предложения (...он...), а инфинитив переводится глаголом-сказуемым русского придаточного предложения (...говорят....). Придаточное предложение присоединяется к главному посредством союза **ЧТО**:

существительное (местоимение) + инфинитив
HE is said TO KNOW SEVERAL FOREIGN LANGUAGES.
Говорят, что он знает несколько иностранных языков.

Таблица 8

Примеры	Перевод
1) с глаголами в страдательном залоге ***to believe, to consider, to hold, to think, to suppose*** (переводятся на русский язык глаголами "считать, полагать, думать"), ***to expect*** (ожидать), ***to estimate*** (оценивать)***, to say*** (говорить)***, to report*** (сообщать): ***She*** is expected ***to arrive*** on Monday. ***The President*** is believed ***to be*** in London now. ***They*** are known ***to have lived*** in England.	Ожидают, ***что*** она приедет в понедельник. Полагают, ***что*** президент сейчас в Лондоне. Известно, ***что*** они жили в Англии.

Окончание табл. 8.

Примеры	**Перевод**
2) с глаголами в действительном залоге to ***seem***, to ***appear*** (казаться), to ***prove***, to ***turn out*** (оказываться), to ***happen*** (случайно сделать что-то): ***He*** seems ***to know*** little about it. ***She*** proved ***to be a good friend***. ***They*** appear ***to have been interested*** in their work.	По-видимому, он мало знает об этом. Она оказалась хорошим другом. Кажется, они интересовались своей работой.
3) с сочетаниями глагола to be и наречия –to be likely (вероятно), to be unlikely (маловероятно), to be certain (безусловно): ***He*** is likely ***to arrive*** tomorrow.	Вероятно, он приедет завтра.

4.3.3. СПОСОБЫ ПЕРЕВОДА СЛОЖНОГО ПОДЛЕЖАЩЕГО

Таблица 9

<table>
<tr><td colspan="3" rowspan="2">Примеры</td><td colspan="2">Перевод</td></tr>
<tr><td colspan="2">Переводится двумя способами:
1. Простым предложением с вводным словом, соответствующим сказуемому английского предложения.</td></tr>
<tr><td>Heat</td><td>is known
is likely
is certain
is found
is reported
is assumed
is considered
is expected
appears
seems
proved</td><td>to be a form of energy.</td><td>Известно,
Вероятно,
Несомненно,
Обнаружено,
Сообщают,
Допускается,
Считается,
Ожидается,
Оказывается,
Кажется,
Доказано,</td><td>что тепло – это форма энергии.</td></tr>
<tr><td>(2)</td><td>(1)</td><td>(3)</td><td>(1)</td><td>(2) (3)</td></tr>
<tr><td colspan="3"></td><td colspan="2">2. Дополнительным придаточным предложением с союзами «что», «чтобы», «как». Инфинитив переводится личной глагольной формой.</td></tr>
<tr><td colspan="3">Heat is known to be a form of energy.
(2) (1) (3)</td><td colspan="2">Тепло, как известно, является формой энергии.
(2) (1) (3)</td></tr>
</table>

Упражнение 1

Переведите предложения, сравнив перевод сложного дополнения и сложного подлежащего.

1. These conditions of the burning permit large amounts of fine particles of carbon to be blown upward into the furnace.

2. These conditions of the burning are expected to permit large amounts of fine particles of carbon to be blown upward into the furnace.

3. High velocity steam jets in the furnace allow the combustion to be im- proved and the smoke to be reduced.

4. High velocity steam jets in the furnace proved to improve the combustion and to reduce the smoke.

Упражнение 2

Переведите предложения, содержащие сложное подлежащее, со сказуемым в пассивном залоге.

1. She is said to speak English fluently.
2. Many people were reported to have become homeless after the flood.
3. The company is expected to make profit this year.
4. The students are supposed to come in time for their lessons.
5. The construction company is believed to have concluded two big contracts.
6. My close friend is known to have won the singers contest.
7. She is said to have borrowed money but not bothered to return it.
8. The book was believed to have been.
9. The picture is considered to have been painted by a great artist.
10. That magazine is said to have been sold out already.
11. The Chinese dancers are announced to be arriving next week.
12. The girl is expected to be wearing a white jacket and black skirt.

Упражнение 3

Переведите предложения, содержащие сложное подлежащее, со сказуемым в активном залоге.

1. You seem to be excited. What has happened?
2. Her mood seems to have changed for the worse.
3. Megan doesn’t seem to have lost her weight.
4. I happened to be out of town at that time.
5. One day Mary happened to meet Bill. – Однажды так случилось, что Мэри встретила Билла.
6. Do you happen to know Mr. Brown?
7. The new film of this producer appeared to be very interesting.
8. Mary appeared to have moved in a new flat.
9. My prediction turned out to be correct.
10. The language of the article turned out to be quite easy.

Упражнение 4

Переведите предложения, содержащие сложное подлежащее.

1. He is sure to come to the meeting. – Он обязательно придет на встречу.
2. If you continue arguing, you are sure to fight. – Если вы продолжите спорить, то обязательно подеретесь.
3. This film is sure to be a great success. – Этот фильм обязательно будет иметь успех
4. She is not likely to come in time tomorrow. – Похоже, что завтра она не придет вовремя.

Упражнение 5

Переведите предложения, учитывая особенности перевода сложного подлежащего.

1. Lightning proved to be a discharge of electricity.
2. Heat is known to be a form of energy.
3. Coal is considered to be a valuable fuel.
4. Some liquids, called electrolytes, are found to change greatly when an electric current passes through them.
5. The alternating current used for power and lighting is assumed to go through 50 cycles in one second.
6. The Fahrenheit scale is known to be used in English speaking countries.
7. Amber is said to attract and to hold minute light objects after rubbing.
8. Heat is known to pass from a hotter body to a colder one.
9. A fuse is expected to melt and break the circuit.
10. The overloading of the line is likely to produce a short circuit.
11. When electrical devices are connected so that the current flows from one device to another, they are said to be connected in series. The electrical bell circuit is considered to be a typical example of a series circuit.
12. The cyclone furnace is known to be water cooled as an adjunct to the boiler circulation system.
13. The furnace height is proved to be the function of the required furnace volume.
14. All pulverized coal fired furnaces constructed today are considered to be partially or completely water-cooled.
15. The coal is expected to fall by gravity from the bunkers through a valve into feeding chutes.
16. A glass tube filled with neon gas was found to be suitable for the use as signalling source.
17. The condensate leaving the condenser and entering the boiler feed pump is always assumed to be saturated water at the condensate pressure.

4.3.4. FOR-TO-INFINITIVE-CONSTRUCTION / ИНФИНИТИВНЫ ОБОРОТ С ПРЕДЛОГОМ “FOR”

Этот оборот представляет собой сочетание предлога for с существительным (или личным местоимением в объектном падеже), за которым следует инфинитив. Этот оборот может выполнять функцию любого члена предложения (в научной литературе он чаще всего – в функции обстоятельства цели или следствия).

FOR+ существительное в общем падеже (или местоимение в объектном падеже)+ инфинитив
He waited FOR HER TO SPEAK, but she did not.
Он ждал, чтобы она заговорила, но она молчала.

Перевод оборота зависит от выполняемой им функции, предлог for не переводится, а весь оборот переводится: 1) придаточным предложением (часто с союзом ЧТОБЫ, ДЛЯ ТОГО ЧТОБЫ, КОТОРЫЙ, ЧТО, где существительное (или местоимение) с предшествующим ему предлогом *for* английского предложения является подлежащим русского предложения, а инфинитив – его глаголом-сказуемым в личной форме; 2) простым предложением, если оборот занимает место подлежащего.

Примеры	**Перевод**
It is necessary ***for us to examine*** this phenomenon (в функции подлежащего).	Нам необходимо проверить это явление.
For this information to be valuable, it must contain well-founded conclusions and advance new ideas and recommendations (в функции обстоятельства цели).	Для того чтобы эта информация была полезной, она должна содержать аргументированные выводы и выдвигать новые идеи и рекомендации.
The period T is the time required ***for a particle to make*** one complete vibration (в функции обстоятельства следствия).	Период Т – это время, необходимое для того, чтобы частица сделала одно полное колебание.

Упражнение 1. Найдите оборот с предлогом “for” и переведите предложения:

1. It was impossible for me to solve this problem myself. 2. She was waiting for somebody to come. 3. The lady was speaking too fast for me to get her. 4. He asked for the papers to be brought. 5. I an anxious (мне очень хочется) for Mr. Smith to succeed in all he undertakes. 6. The best thing for you to do is to meet him. 7. He spoke loud enough for you to hear. 8. She was impatient for him to be gone. 9. ‘There was really nothing for him to do there. 10. For a force to exist there must be two objects involved. 11. The temperature was too low for the substance to decompose. 12. The tendency was for the gas to become ionized. l3. It is possible for the reaction to occur. 14. The only conclusion for him to make was the following one. 15. The motion took place long enough for the bodies to become heated.

Упражнение 2. Заполните предложение, используя оборот с предлогом “for”. Используйте образец:

Sp.: It was not easy, (she, to compare these substances).

St.: It was not easy for her to compare these substances.

1. It was important, (he, to provide broad answers to their questions) 2. It was difficult, (she, to treat the subject thoroughly) 3. It was useful, (they, to touch on a variety of more general topics) 4. It was impossible, (the author, to consider all these questions) 5. It was necessary, (they, to participate in the meeting) 6. It was not easy, (he, to prove the validity of his conclusions) 7. It was necessary, (they, to obtain the substance in extremely pure form)

Упражнение 3. Переделайте предложения, пользуясь образцом:

Sp.: For the effect to be understood we have to consider it in detail.

St.: To understand the effect we have to consider it in detail.

1. For these observations to be accounted for we use a new model. 2. For the defect to be found they had to examine the instrument carefully. 3. For this value to be specified one must use a new set of equations. 4. For the effect to be studied directly we shall apply a novel technique. 5. For the structure of these molecules to be determined he used an ingenious scheme. 6. For a body to be supported we have to exert a force. 7. For the formation of these electron pairs to be better understood we should study the phenomenon carefully.

Упражнение 4. Найдите инфинитивные конструкции и переведите их:

1. The engineers of that plant are said to have constructed a new device. 2. We want you to see the new university building. 3. The company is believed to have lost a lot of money last year. 4. We suppose the construction of that building to be completed

in a week. 5. The construction of that building is supposed to be completed in a week. 6. He is sure to call on us today. 7. She waited for him to speak. 8. They are certain to cope with the problem facing them. 9. We think them to build the pipeline next month. 10. This pipeline is thought to be built next autumn. 11. That was for him to find out. 12. The engineer believes the mechanic to finish repairing the engine ahead of time. 13. The mechanic is believed to finish repairing the engine ahead of time. 14. He appears to have been reading the book since 10 o'clock in the morning. 15. I hope you won't think it very odd for a perfect stranger to talk to you like this. 16. I heard somebody mention his name at the last meeting. 17. He seems to have travelled much. 18. This experiment is said to have been completed successfully. 19. He wanted me to follow him. 20. This issue is unlikely to be discussed at the meeting tomorrow. 21. Nobody watched her dance. 22. It was necessary for you to hear him report on the results of his experiments. 23. She didn't expect me to do it so quickly. 24. We noticed a taxi stop at the door. 25. It is impossible for them to complete the work so quickly without using this device.

5. THE GERUND / ГЕРУНДИЙ

Герундий – неличная форма глагола, которая называет процесс действия и обладает одновременно свойствами существительного и глагола. В русском языке герундия нет. Герундий образуется от основы неопределенной формы глагола прибавлением суффикса **-ing.**

5.1. ФОРМЫ ГЕРУНДИЯ

Таблица 10

	Active	Passive
Indefinite – выражают действие, одновременное с действием глагола-сказуемого, или действие, относящееся к будущему.	Taking	Being taken
Perfect – выражают действие, предшествующее действию глагола-сказуемого.	Having taken	Having been taken

По своей форме герундий совпадает с причастием (Participle I), но по функциям отличается от причастия:

1. Герундий бывает подлежащим (причастие – никогда). Стоит перед сказуемым.

Learning English is necessary. – Изучение английского языка необходимо.

2. Герундий может быть дополнением (причастие не бывает в этой роли).

3. Герундий употребляется после предлогов: He thinks of learning German. – Он думает об изучении немецкого языка.

Не следует путать предлоги с союзами when, while, которые употребляются с причастием (в роли обстоятельства). When learning English we use dictionaries. – Изучая (при изучении, когда мы изучаем) английский язык, мы пользуемся словарями.

5. После глаголов enjoy, give up, mention, mind, to be busy (быть), to be worth (стоить) и др. Например: Stop talking, please. – Прекратите, пожалуйста, разговаривать. I don't mind going there. – Я не возражаю пойти туда.

6. После глаголов continue, begin, prefer и другие. Например: He began reading this article. – Он начал читать эту статью.

5.2. ФУНКЦИИ ГЕРУНДИЯ

Таблица 11

Функция	Пример	Перевод
1. **Подлежащее**	**Making** the first measuring instrument was not an easy thing.	**Сделать** первый измерительный прибор было нелегко
2. **Именная часть составного сказуемого**	The main task is **switching off** the sys- tem in time.	Главная задача – **выключить** (**выключение**) систему вовремя.
3. **Прямое дополнение** (без предшествующего предлога)	The equipment allows **increasing** the temperature.	Оборудование позволяет **повысить** температуру.
4. **Косвенное дополнение** (после предлога)	I am fond of reading.	Я люблю чтение (читать).
5. **Определение** (обычно с предлогом **of, for** после существительного)	The final temperature depends upon the method **of firing** and classes of coal. Have you any reason **for saying** such a thing. Thermometer is an instrument **for measuring** temperature.	Конечная температура зависит от способа **сжигания** и видов угля. Есть ли у вас основание **говорить** такую вещь? Термометр – прибор **для измерения** температуры.
6. **Обстоятельство** (обычно с предлогами: **in – при, в то время как, on (upon) – по, после, after – после, before – перед, by – творит. падеж, instead of – вместо того чтобы, for – для** и т. д.	The operator examined the machine **without diminishing** its speed. **On finding** that the engine was working badly, he finished experiment. He improved his article **by changing** the end.	Оператор осмотрел машину **без уменьшения** (**не уменьшая**) ее скорости. Обнаружив, что двигатель работает плохо, он закончил эксперимент. Он улучшил статью, **изменив** конец.

5.3. THE GERUND CONSTRUCTION / ГЕРУНДИАЛЬНЫЙ ОБОРОТ

Перед герундием может стоять существительное в притяжательном падеже или притяжательное местоимение (они никогда не употребляются перед причастием). Герундий с относящимися к нему словами образует герундиальный оборот. Пример: I know of this engineer's having learned German. – Я знаю, **что** этот инженер изучал немецкий. I know of his having learned German. – Я знаю, **что** он изучал немецкий. Герундиальный оборот переводится на русский язык придаточным предложением, вводимым союзами ТО, ЧТО; ЧТО (ЧТОБЫ); ТОГО, ЧТО; О ТОМ, ЧТО; ТАК, ЧТО и т. д.

Герундий с относящимися к нему словами представляет собой один сложный член предложения, где слово, стоящее перед герундием, становится подлежащим, а сам герундий – сказуемым. На русский язык переводится придаточным предложением.

Пример: We know of silver and copper being good conductors of electricity. Мы знаем, что серебро и медь – хорошие проводники электричества.

Besides being important for the life oxygen is also important for industry. – Кроме того, что кислород важен для поддержания жизни, он также важен для жизни, он также важен и для промышленности.

Упражнение 1

Переведите предложения, учитывая функцию в предложении и особенности перевода герундия.

1. This method for storing and transporting flue gases becomes criticized.
2. The cooling water after passing through the condenser is pumped to a cooling tower.
3. The equipment for producing the fluid is divided into two major classes: pumps for handling liquids and fans, blowers and compressors for handling gases and vapors.
4. The tubular air heater is constructed by expanding vertical tubes into par- allel tube sheet.
5. The American Society for testing materials had adopted a test procedure for determining the ignition temperature of liquid combustibles.
6. It is important for industries to investigate the possibility of recovering the millions of calories of heat that are lost every day.
7. If steam is required for processing, a turbine may be modified by extract- ing the steam.
8. There are two general methods of firing fuel commonly used: 1) on stationary grates, 2) on stokers.
9. Determining the type and multiplicity of burners, their arrangement and the flame shape will cause the furnace width and depth dimensions.
10. Using more equipment and more complex cycles gives better theoretical efficiencies.
11. Building mechanical equipment supplements the natural circulation in a boiler.
12. Pumping large quantities of fluid against a relatively small static head requires the use of axial flow impellers.
13. The spreader stoker is not adaptable to light operation because of the difficulty of maintaining ignition and combustion in the very thin fuel bed with a cold surface.
14. In condensing the steam gives up heat to the water.
15. Leakage between the tube and end plate is prevented by packing.
16. Care should be taken in operating any positive displacement blower.
17. Better theoretical efficiencies are possible by using more equipment in more complex cycles.
18. Comparing the data obtained by different tests is the only means of solving many problems.
19. Protecting buildings from strokes of lightning was a great achievement in the field of electricity.
20. Being out in the open field during a thunderstorm is dangerous.

Упражнение 2

Определите часть речи -ing форм и их функцию. Переведите предложения.

1. His friend's being at home was of much relief.
2. His friend's being away from home for four years was really pressing.
3. He insisted on his daughter's being at home early in the evening
4. Look, they are being greeted by the president.
5. He is surprised by being greeted by the president.
6. Being in China they often went shopping.
7. While being in China they often went shopping.
8. She had a comforting feeling of well-being.

Упражнение 3

Переведите, обращая внимание на слова в -ing форме и их функции.

The first records of Novgorod *dating* back to 859 A. D. contain some *interesting* facts. *According* to the legend, two brothers, *having* settled by a lake from which there flowed a river, founded a town Slovensk. We also know of their *naming* the lake and the river of their children – Ilmen and Volkhov. With years the legends of the land were still *circulating* among the Slavs. When settlers came again to Slovensk in the Xth century there was no good *trying* to rebuild the ruined settlement. So they built their own town a little further upstream the Volkhov *giving* it the name "Novgorod", i. e. a new town.

Упражнение 4

Выберите правильный вариант.

1. _____ I want you to her for your rudeness.

A) to apologise
B) apologising

2. _____The ship avoided the iceberg by sheer chance.

A) to strike
B) striking

3. _____My brother learnt when he was in his teens.

A) to drive
B) driving

4. _____ I suggest there in a boat.

A) to go
B) going

5. _____She offered at the nearest shop.

A) to make a stop
B) making a stop

6. _____ I can't say I enjoy in the company of her relatives.

A) to be
B) being

7. _____ Would you mind your bag a little so that I could sit down?

A) to move
B) moving
8. _____She seems very upset.
A) to be
B) being
9. _____They finished the new submarine in August.
A) to test
B) testing
10. _____ Are you prepared part in the expedition?
A) to take
B) taking

Упражнение 5

Найдите герундий (или герундиальный оборот) в следующих предложениях. Определите его роль и переведите предложения.

1. The work could not be finished without carrying out some necessary experiments.
2. He could not help thinking about his future job.
3. We cannot go to the conference without being invited.
4. I have never heard of his teaching at that university.
5. I have never heard of his having taught at that university.
6. His being invited to take part at the conference was quite unexpected to him.
7. Reading English books in the original is very pleasant.
8. In 1883 Leskov wrote to his friend: “I cannot forgive myself for never having learned the French language well enough to work in it like a native” (носитель языка).
9. This book is worth translating.
10. Learning a foreign language helps us to know better our native one.
11. I don’t like learning grammar rules.
12. I remember having bought that book.
13. Kramskoy is also known for his having painted the portraits of his famous contemporaries: writers, poets, painters and actors.
14. Besides being a great sculptor, Michelangelo was also a great painter and architect.
15. Lebedev’s having worked out an efficient method of making Artificial rubber (каучук) made our industry independent of imported rubber.
16. This is done by employing the latest equipment.
17. You might help me by translating this article.
18. The apparatus is used for recording the temperature.
19. The apparatus has the advantage of being relatively cheap.
20. It is worth (while) discussing your suggestion.
21. Carrying out the reaction was hindered by the presence of admixtures (примеси).
22. Newton’s having stated his laws of motion is very important for modern science.
23. On receiving wrong results one must repeat the experiment.
24. By studying Newton’s laws of motion we learn that they are applied not only in engineering but also in our daily life.

6. SUBORDINATE CLAUSES WITHOUT CONJUNCTION / БЕССОЮЗНЫЕ ПРИДАТОЧНЫЕ

Значительную трудность при переводе научно-технической литературы представляет опознавание придаточных дополнительных и определительных предложений, соединенных с главным предложением без союза или союзного слова.

Таблица 12

Вид предложения	**Примеры**	**Перевод**
1. *Дополнительное придаточное предложение* – следует за сказуемым главного предложения (стоит на 3-м месте, как любое дополнение), содержит свои подлежащее и сказуемое.	We believe *the temperature of the water does not change*.	Мы считаем, ***что*** *температура воды не меняется.*
2. *Определительные придаточные предложения* –стоит после существительного, являясь правым определением (отвечает на вопрос какой?). Признак – наличие двух подряд стоящих сущ-х или сущ. и личн. мест., не связанных между собой предлогом и не отделенных друг от друга запятой, из которых второе слово – подлежащее определительного придаточного предложения.	Metals *we define as good conductors of electricity* are also good conductors of heat.	Металлы, ***которые*** *мы определяем как хорошие проводники электричества*, являются также хорошими проводниками тепла.
3. Условные придаточные предложения с инверсией с глаголами **were**, **had**, **could**, **should.**	***Were*** *one electron removed*, a positive charge would be left.	***Если бы*** *один электрон был удален,* остался бы положительный заряд.

Упражнение 1

Переведите на русский язык и подчеркните союз, который вы употребили. Разделите бессоюзные предложения на главную и придаточные части.

Пример*: *Further investigation showed | it could be done. – Дальнейшие исследования показали, что это может быть выполнено.

1. Metals we define as good conductors of electricity are also good conductors of heat.
2. The economiser is a bank of tubes the boiler feedwater is pumped through on its way to the boiler drum.
3. The expansion of the steam is carried out in stages we call “pressure stages”.
4. The condensing turbine is used chiefly for the low cost of electric power it produces.
5. The next problem the professor dealt with was connected with the application of magneto-hydrodynamic generator.
6. James Watt noticed the alternately heating the steam cylinder with steam and cooling it with injection water produced a large waste of energy.
7. Experiments show all gases expand when heated.
8. The condensing turbine is used chiefly for the low cost of electric power it produces.
9. The next problem the professor dealt with was connected with the application of magneto-hydrodynamic generator.
10. James Watt noticed the alternately heating the steam cylinder with steam and cooling it with injection water produced a large waste of energy.
11. Experiments show all gases expand when heated.
12. James Watt realized the loss of energy in Newcomen engine could be reduced.
13. We believe the temperature of the water does not change during this experiment.
14. In spite of many difficulties they consider the new turbine will arrive in time.
15. This means magnetic effect could be produced by electricity alone with- out any magnet.
16. Should care be taken in providing the properly driven motor, the overload characteristics of the centrifugal blower would cause no trouble.
17. Were the pressure in the furnace high, there would be air leakage to the furnace with a corresponding reduction in the furnace temperature.
18. Could the steam be condensed and the water removed by pumps, a partial vacuum would be formed in the exhaust chamber of the turbine.
19. Had the factory process required steam at a specific pressure an automatic extraction turbine would be necessary.
20. Were the system properly controlled, the necessary pressure would be maintained in the furnace.

7. THE SUBJUNCTIVE MOOD / ПРИЗНАКИ СОСЛАГАТЕЛЬНОГО НАКЛОНЕНИЯ В НАУЧНО-ТЕХНИЧЕСКОЙ ЛИТЕРАТУРЕ

Сослагательное наклонение выражает *предполагаемое* или *желательное* действие. В русском языке признаком сослагательного или условного наклонения является глагол в прошедшем времени с частицей «бы», которая часто сливается с союзом что (чтобы) придаточного предложения.

Таблица 13

Признак	Пример	Перевод
1. Вспомогательный глагол **would** (реже **should**) с инфинитивом смыслового глагола без **to.**	Such data would be far more valuable than tests on a sample taken from the end of the reel. We should like to make this experiment in our laboratory.	Такие данные были бы гораздо более ценными, чем анализы образца, взятого в конце рулона. Мы бы хотели провести этот опыт в лаборатории.
2. Глагол **to be** в форме **were** при подлежащем **единственного числа**.	If it were possible to design stock preparation systems capable of operating at higher consistencies, there would be possibility for cost reduction.	Если бы можно было спроектировать систему приготовления бумажной массы, способную работать с более высокой концентрацией, было бы возможно снизить себестоимость.

Окончание табл. 13

Признак	Пример	Перевод
3. **Инверсия**, т. е. измененный порядок слов (в придаточном условном предложении), при котором в повествовательном предложении перед подлежащим стоят глаголы: were, had, could, should. Союз “if” опускается.	Could a plant be located at a point favourable both to the obtaining of raw material and the market for the paper, it would be ideal.	Перевод таких придаточных условных предложений следует начинать фразой «Если бы»: Если бы можно было расположить завод на месте, удобном с точки зрения сырья и сбыта продукции (бумаги), это было бы идеально.
	Under proper conditions we would have much higher yields.	**Примечание**. Глагол **would**, как и **could** или **might**, иногда переводится «возможно», «вероятно». При соответствующих условиях выход, возможно (вероятно), был бы гораздо более высоким.

Упражнение 1

Переведите предложения, пользуясь инструкциями. Укажите признак условного наклонения.

1. It would be interesting to know whether the Government had conducted any targeted studies to discover the reasons for that phenomenon.

2. Should it get lost all progress would be held up for many years.

3. You've got to have some sort of power that's spinning the rotating fields, and in this case it would be water.

4. Furthermore it would result in performance degradation.

5. This coordinated approach would result in a more efficient use of resources both at the national and the international level.

6. Could green investment exist throughout the ECE region, could they be overcome

7. Could also be any kind of heavy metal toxicity.

8. This second option would be less desirable than the first.

9. Available data was summarized to demonstrate how these might be used.

10. Were the surface of the earth uniform (ровный), there would be three parallel zones of precipitation (осадки) higher than the average.

11. Could the objectives be attained (достигать), all states, in particular the least developed countries, would get the benefits of the peaceful uses of nuclear energy.

12. If sufficient water power were available the year round (круглый год), there would be no necessity for motor driven vehicles.

13. Heat could also cause damage to equipment, especially when made from metal with limited heat resistance.

14. Because of the lower proportion of these cells (клетки), such a loss would remain unnoticed (незамеченный).

8. THE CONDITIONALS / УСЛОВНЫЕ ПРИДАТОЧНЫЕ ПРЕДЛОЖЕНИЯ

Таблица 14

1. **Союзные** – употребляются с союзами **if** – если, **provided** (that), **providing** (that), **supposing** (that), **on condition** (that) – при условии (что)		
I тип (реальные условия)	If he **goes** to bed early, he **will get up** early. Времена: после союза – Present Simple, в главном – Future Simple.	Если он ляжет спать рано, то и встанет рано.
II тип (не вполне реальные условия)	If he **went** to bed early in summer, he **would get up** early. Времена: после союза – Past Simple, в главном – Would + Infinitive	Если бы он ложился спать рано летом, то и вставал бы рано.
III тип (нереальные условия)	If he **had gone** to bed early yesterday, he **would have got up** early. Времена: после союза – Past Perfect, в главном – Would + have + Participle II.	Если бы он лег спать рано вчера, то и встал бы рано.
2. **Бессоюзные** условные (с инверсией – в начале предложения: **had, were, could, should**)		
Признаком является **инверсия**, т. е. измененный порядок слов, если сказуемое условного предложения выражено глаголами **were, had, could, should.** Союз **if** опускается.	**Could he** swim well, he **would take part** in the competition. **Were he** here, **he would help** us.	Перевод таких придаточных условных предложений следует начинать фразой «Если бы»: Если бы он хорошо плавал, то принял бы участие в соревновании. Если бы он был здесь, он помог бы нам.

Упражнение

Переведите условные придаточные предложения, исходя из типа выраженного в них условия и значения условного союза или его отсутствия.

1. If a fluid expands at constant entropy, maximum work will be obtained.
2. On condition that the boiler is provided with a brick furnace which is external to the boiler itself, it is known as an externally fired boiler.
3. Provided direct contact heaters are used in series, a feed water pump must be installed ahead of each heater.
4. Were scale free feedwater be available, the flanged return bend (профланцованное обводное соединение) could be eliminated.
5. Supposing that oil, gas or pulverized coal were burned, an air heater would often be installed without economizer.
6. Should it be standard practice to install one steam generator per turbine, they would be very carefully designed to insure reliable and continuous operation of the turbines.
7. Provided water passed through coils in the vent condenser, it could then enter the tray of the feed water heater.
8. If we used the jet condenser instead of surface condenser, it would require more cooling water.
9. Provided all the heat was released, the reaction could not proceed.
10. Provided the reaction were started, it would proceed till completion.
11. If care is taken in providing the proper drive motor, the overload characteristics of the centrifugal blowers will cause no trouble.
12. If combustion is to be complete, the combustible gases must be brought into intimate contact with the residual oxygen in a furnace atmosphere composed principally of inert gases.

Ключи к тексту на с. 8.

nature, forms, ice, water, steam, temperatures, state, gaseous, pressure, point, temperature, scale, cooled, exist, liquid, expansion.

Ключи к упражнению на с. 9.

1. Answer: False
Explanation: A heat engine is a cyclical device that transforms heat energy into work.
2. Answer: True
Explanation: It is an example for a cyclic heat engine.
3. Answer: True
4. Answer: True
Explanation: Zeroth law of thermodynamics.

Ключи к упражнению на с. 10.

1.B. 2.B. 3.D. 4.C. 5.C.

Ключи к упражнению на с. 13 – 14.

1.H. 2.F. 3.E. 4.C. 5.B. 6.A. 7.D. 8.I. 9.L. 10.G. 11.J. 12.K. 13.M.

Сокращения, встречающиеся в текстах

сокращение	читается / означает	перевод
%	percent (per cent) [pə’sent]	процент
C	degrees Centigrade	градус (Цельсия)
F	degrees Fahrenheit	градус (Фаренгейта)
A. D.	of our era [‘ıərə]	нашей эры
a. k. a.	also known as	также известный как
B. C.	before Christ [kraıst]	до нашей эры
Btu	British thermal unit	британская тепловая единица
Btu	British thermal unit	британская тепловая единица
e. g.	for example	например
etc.	[et’set(ə)rə]	и так далее
EU	European Union	Евросоюз

ft	foot (мн. число feet)	фут
hp	horse power	лошадиная сила
hr	hour	час
i. e.	that is	то есть
in	inch	дюйм
kJ/kg	kilojoule per kilogram	килоджоуль на килограмм
kw	kilowatt	киловатт
lb	pound	фунт
mm	millimeter	миллиметр
Mpa	megapascal	мегапаскаль
Mw	megawatt	мегаватт
MWt	megawatt	мегаватт
MWth	megawatt thermal	мегаватт
o. d.	outer diameter	внешний диаметр
psi	pounds per square inch	фунтов на квадратный дюйм
psia	pounds per square inch absolute	фунтов на квадратный дюйм
?		(абсолютное давление)
psig	pounds per square inch gauge	фунтов на квадратный дюйм

Температура читается:

25 °C – twenty-five degrees Centigrade [‘sentıgreıd] (по шкале Цельсия);
34 °F – thirty-four degrees Fahrenheit [‘færənhaıt] (по шкале Фаренгейта).

Сокращения: обозначения частей речи

сокращение	**означает**	**перевод**
a.	adjective	имя прилагательное
adv.	adverb	наречие
cj. (conj.)	conjunction	союз
n.	noun	имя существительное
part.	participle	причастие
pl.	plural	множественное число
prep.	preposition	предлог
pron.	pronoun	местоимение
v.	verb	глагол

СЛОВАРЬ ТЕРМИНОВ

A		
ability	[ə’bılıtı]	n способность
absorb	[əb’zɔ:b]	v поглощать
accessibility	[ək,sesə’bılıtı]	n доступность
achieve	[ə’tʃi:v]	v достигать
act	[ækt]	v действовать
addition in addition to	[ə’dıʃn]	n вдобавок
additional	[əd’ıʃnəl]	a дополнительный

admission	[əd’mɪʃn]	n доступ
advantageous	[ˌædvən’teɪdʒəs]	a выгодный
adversaly	[‘ædvɜ:slɪ]	adv обратно
affect	[ə’fekt]	v влиять (на)
airfoil	[‘eəfoɪl]	n крыло
alternately	[ɔ:l’tɜ:nɪtlɪ]	adv попеременно
amber	[‘æmbə]	n янтарь
amount	[ə’maunt]	n количество
application	[ˌæplɪ’keɪʃn]	n применение
area	[‘eərɪə]	n область, площадь
artificial	[ˌa:tɪ’fɪʃəl]	a искусственный
asphyxiating	[ˌæs’fɪksɪeɪtɪŋ]	a удушающий
assistant	[ə’sɪstənt]	n помощник
assumption	[ə’sʌmpʃən]	n допущение
attach	[ə’tætʃ]	v присоединять
attract	[ə’trækt]	v притягивать
available	[ə’veɪləbl]	a доступный
B		
bank	[bæŋk]	n батарея, пучок
barge	[ba:dʒ]	n баржа
bed	[bed]	n слой
behavior	[bɪ’heɪvjə]	поведение
blade	[bleɪd]	n лопасть
blow	[bləʊ]	v дуть
blower two-lobe blower	[‘bləʊə]	n вентилятор вентилятор с двумя зубчатыми колесами

positive-displacement blower		вентилятор с положительной подачей
boil	[boɪl]	v кипеть
boiler fire tube boiler pulverized coal fired boiler	[‘boɪlə]	n котел жаротрубный котел котел, работающий на пылевидном угле
bottom	[‘botəm]	n дно
boundary	[‘baʊndərɪ]	n граница
break (broke, broken)	[breɪk]	v разбивать
bunker	[‘bʌŋkə]	n бункер
burn	[bɜ:n]	v сжигать, гореть
burner	[‘bɜ:nə]	n горелка
C		
capacity	[kə’pæsɪtɪ]	n производительность
carry carry out	[‘kærɪ]	v нести проводить, выполнять
casing	[‘keɪsɪŋ]	n оболочка
cast iron	[,ka:st’aɪən]	n чугун
centrifugal	[,sentrɪfju:gəl]	a центробежный
chamber	[‘tʃæmbə]	n камера
charge	[tʃa:dʒ]	v заряжать
chimney	[‘tʃɪmnɪ]	n дымоходная труба
circuit short circuit	[‘sɜ:kɪt]	n электросхема, цепь, замыкание n короткое замыкание
circular	[‘sɜ:kjʊlə]	a круговой

cleanliness	[‘klı:nlınəs]	n чистота
clearance	[‘klıərəns]	n зазор, пространство
coal	[kəʊl]	n уголь
coil	[koıl]	n катушка, змеевик
collector dust collector	[kə’lektə]	n сборник; пылесборник, пылеуловитель
combustible	[kəm’bʌstəbl]	a 1) горючий n 2) горючее
combustion fluidized bed combustion	[kəm’bʌstʃən]	n сгорание сжигание в псевдоожиженном слое
compound	[‘kəmpaʊnd]	n соединение
condensate	[kən’densaıt]	n конденсат
conductor	[kən’dʌktə]	v проводник
consumption	[kən’sʌmpʃn]	n потребление
contain	[kən’teın]	a содержать
contribution	[,kontrı’bju:ʃn]	n вклад
convective	[kən’vektıv]	a конвективный
conventional	[kən’venʃənəl]	a обычный
converter	[kən’vɜ:tə]	n преобразователь
convertible	[kən’vɜ:tıbl]	a обратимый
cool	[ku:l]	v охлаждать
cooler interstage cooler	[‘ku:lə]	n охлаждатель; межступенчатый охлаждатель
correspond	[,korı’spond]	v соответствовать

cover cover conditions	[‘kʌvə]	1) v покрывать 2) n крышка отвечать условиям
crush	[krʌʃ]	v размельчить
current alternating current	[‘kʌrənt]	n ток переменный ток
curved	[kɜ:vd]	a искривленный
D		
dump	[dæmp]	a сырой
decompose	[,dɪ:kəm’pəʊz]	v разлагать
decrease	[‘dɪ:krɪ:s] [dɪ:’kr ɪ:s]	1) n уменьшение 2) v уменьшать
deliver	[dɪ’lɪvə]	v подавать, поставлять
demand	[dɪ’ma:nd]	n спрос
density	[‘densɪtɪ]	n плотность
depend	[dɪ’pend]	v зависеть
depth	[depθ]	n глубина
determine	[dɪ’tɜ:mɪn]	v определять
device	[dɪ’vaɪs]	n прибор
diffuser	[dɪ’fju:zə]	n диффузор
dimension	[dɪ’menʃn]	n размер
direct	[daɪ’rekt]	v направлять
direction	[daɪ’rekʃn]	n направление
discharge	[dɪs’tʃa:dʒ]	1) n разряд 2) v разряжать, разгружать
distribution	[,dɪstrɪ’bju:ʃn]	n распределение

draft forced draft induced draft	[dra:ft]	n тяга; принудительная тяга косвенная (искусственная) тяга
draw (drew, drawn)	[drɔ:]	v тянуть
drive (drove, driven)	[draıv]	v приводить в движение, за – пускать
drop	[drop]	n перепад, падение
drum	[drʌm]	n барабан
drying	[‘draııŋ]	n сушка
dust	[dʌst]	n пыль
E		
economizer non steaming economizer steaming economizer	[ı’konə,maızə]	n экономайзер; некипящий экономайзер; кипящий экономайзер
effect	[ı’fekt]	v осуществлять
efficiency	[ı’fıʃənsı]	n производительность
efficiently	[ı’fiʃəntlı]	a эффективно
effort	[‘efət]	n усилие
eliminate	[ı’lımıneıt]	v удалять
end exhaust end	[end]	n конец выходной конец
engine steam engine	[‘endʒin]	n двигатель паровой двигатель
engineering	[,endʒı’nıərıŋ]	n техника
entrance	[‘entrəns]	n вход

equipment	[ɪ'kwɪpmənt]	n оборудование
essential	[ɪ'senʃl]	a важный
evolve	[ɪ'volv]	v выделять
evaporate	[ɪ'vəæpəreɪt]	v испарить(ся)
exchanger heat exchanger	[ɪks'tʃeɪndʒə]	n обменник теплообменник
exhaust	[ɪg'zɔ:st]	1) n выпуск, выхлопная труба 2) v выпускать
exit	['eksɪt]	n выход
expansion	[ɪks'pænʃn]	v расширение
expensive	[ɪks'pensɪv]	a дорогой
extract	[ɪks'trŋkt]	v удалять
F		
fan foil air fan axial flow fan long blade plate type fan	[fæn]	n вентилятор вентилятор лопастного типа осевой вентилятор вентилятор с лопастями плоского типа
fault	[fɔ:lt]	n повреждение, сбой
feeder	['fɪ:də]	n питатель
feedwater	['fɪ:d,wɔ:tə]	n питательная вода
fine	[faɪn]	a мелкий
fire	['faɪə]	v зажигать, сжигать
fission	['fɪʃn]	n расщепление
flame	[fleɪm]	n пламя
flange	[flændʒ]	n край

flood	[flʌd]	n поток
flow axial flow	[fləʊ]	1) n поток; осевой поток 2) v течь
fluid fluid-like	[‘flu: ɪd]	n жидкость, жидкая среда adj подобный жидкости
force	[fɔ:s]	1) v направлять, 2) n сила
foundation lay foundation	[faʊn’deɪʃn]	n основы заложить основы
frequency	[‘frɪ:kwənsɪ]	n частота
friction	[‘frɪkʃn]	n трение
fuel fossil fuel	[fjʊəl]	n топливо органическое топливо
furnace cyclone furnace	[‘fɜ:nɪs]	n печь циклонная печь
fusion	[‘fju:ʒn]	n сплавление, спекание
G		
gas flue gas	[gæs]	n газ топочный газ
gears	[gɪəs]	n pl зубчатый механизм
generate	[‘dʒenəreɪt]	v порождать, образовывать
generation	[,dʒenə’reɪʃn]	n образование
generator steam generator	[,dʒenə’reɪtə]	n генератор n парогенератор
give (gave, given) give up	[gɪv]	v давать v отдавать

governor	[‘gʌvənə]	регулятор
grate	[greɪt]	n решетка
gravity	[‘grævɪtɪ]	n сила тяжести
grill	[grɪl]	n решетка
grind (ground, ground)	[graɪnd]	v размалывать
H		
handling	[‘hændlɪŋ]	n обслуживание
hardware	[‘ha:dweə]	n оборудование
hazard	[‘hæzəd]	n опасность
head velocity head	[hed]	n напор скоростной напор
heat	[hɪ:t]	n тепло
heater air heater	[‘hɪ:tə]	n подогреватель воздухоподогреватель
housing	[‘hauzɪŋ]	n кожух
hydrogen	[‘haɪdrədʒən]	n водород
I		
ignition	[ɪg’nɪʃn]	n зажигание, воспламенение
impeller	[ɪm’pelə]	n рабочее колесо
impinge	[ɪm’pɪndʒ]	v действовать на, давить
improve	[ɪm’pru:v]	v улучшать
impurities	[ɪm’pjʊərɪtɪz]	n pl примеси
inclination	[,ɪnklɪ’neɪʃn]	n наклон
inclined	[ɪn’klaɪnd]	a наклонный
include	[ɪn’klu:d]	v включать
induce	[ɪn’dju:s]	v собираться, возникать
inescapable	[,ɪnəs’keɪpəbl]	a неизбежный

influence	[‘ɪnflʊəns]	v влиять
injection	[ɪn’ʤekʃn]	n впуск
inspection	[ɪn’spekʃn]	n осмотр
install	[ɪn’stɔ:l]	v установить
installation	[,ɪnstə’leɪʃn]	n установка
insulation	[,ɪnsjʊ’leɪʃn]	n изоляция
intake	[‘ɪnteɪk]	n всасывание
intermediate	[,ɪntə’mi:dɪət]	a промежуточный
introduce	[,ɪntrə’dju:s]	v вводить
investigate	[ɪn’vestɪgeɪt]	v исследовать
involve	[ɪn’volv]	v включать
L		
lamp	[læmp]	n лампа
layer	[’leɪə]	n слой
lead (led, led)	[li:d]	v вести
leak	[li:k]	n утечка
leave (left, left)	[li:v]	v покидать, уходить
length	[lenθ]	n длина
level	[‘level]	n уровень
light	[laɪt]	n свет v освещать
lightning	[‘laɪtnɪŋ]	n молния
link	[lɪŋk]	v соединять
liquid	[‘lɪkwɪd]	n жидкость a жидкий
load	[ləʊd]	n нагрузка
lobe	[ləʊb]	n выступ, лопасть

locate	[ləʊ'keɪt]	v располагать(ся)
loose (lost, lost)	[lu:z]	v терять
loss	[loss]	n потеря
M		
machine	[mə'ʃi:n]	n машина v обрабатывать
machinery	[mə'ʃi:nərɪ]	n механизмы
maintain	[meɪn'teɪn]	v поддержать
maintenance	['mentənəns]	n обслуживание
manufacture	[ˌmænju:'fæktʃə]	v производство
mean	[mi:n]	v означать
means by means of	[mi:nz]	n средства prep посредством
measure	['meʒə]	v измерять
medium (*pl* media)	['mi:dɪəm]	n среда
melt	[melt]	v расплавлять(ся)
merit	['merɪt]	n достоинство
mill pulp and paper mill	[mɪl]	n завод целлюлозно-бумажный завод
minute	['mɪnɪt]	a мельчайший
missile guided missile	['mɪsaɪl]	n ракета управляемая ракета
mix	[mɪks]	v смешивать
motion	['məʊʃn]	n движение
mount	[maʊnt]	v монтировать
move	[mu:v]	v двигаться

N		
nozzle fixed nozzle	[‘nozl]	n сопло неподвижное сопло
nuclear	[‘nju:klıə]	a ядерный
number a number of	[‘nʌmbə]	n число несколько
O		
obtain	[əb’teın]	v добывать, получать
occupy	[‘okjʊpaı]	v занимать
occur	[ə’kɜ:]	v случаться, возникать
oil	[ɔıl]	n нефть
operation	[,opə’reıʃn]	n работа
output	[‘aʊtpʊt]	n выход
outside	[aʊt’saıd]	adv за пределы, вне
overcome (overcame, overcome)	[,əʊvə’kʌm]	v преодолевать
overhead	[,əʊvə’hed]	a верхний
overloading	[,əʊvə’ləʊdıŋ]	n перегруз
oxygen	[‘oksıdʒən]	n кислород
P		
partial	[‘pa:ʃl]	a частичный
passage	[‘pæsıdʒ]	n проход
perfect	[pəf’ekt]	v совершенствовать
photocell	[‘fəʊtəsel]	n фотоэлемент
pick pick up	[pık]	v брать подхватывать

pipe	[paɪp]	n труба
piping	[‘paɪpɪŋ]	n трубопровод
piston	[‘pɪstn]	n поршень
plate	[pleɪt]	n пластина
plant	[pla:nt]	n завод, электростанция
plunger	[‘plʌnʤə]	n плунжер
power	[‘paʊə]	n мощность v снабжать энергией
preliminary	[prɪ’lɪmɪnərɪ]	a предварительный
pressure exhaust p.	[‘preʃə]	n давление выпускное давление
prevent	[prɪ’vent]	v предупредить
prime mover	[‘praɪm’mu:və]	n двигатель
process	[prə’ses] [‘prəʊses]	v обрабатывать n процесс
produce	[prə’dju:s]	v производить
profitable	[‘profɪtəbl]	a выгодный
promote	[prə’məʊt]	v вызвать, способствовать
property	[‘propətɪ]	n свойство
protect	[prə’tekt]	v защищать
provide	[prə’vaɪd]	v обеспечить
pulverized	[‘pʌlvəraizd]	a распыленный
pump centrifugal pump fluid-impellent pump hot-well pump multistage pump piston pump	[pʌmp]	n насос центробежный насос жидкостный насос конденсатный насос многоступенчатый насос поршневой насос поршневой

reciprocating pump rotary pump		насос ротационный насос
put put into operation	[pʊt]	v ставить, класть пустить в эксплуатацию
Q		
quantity	[‘kwontıtı]	n количество
R		
radial	[‘reıdıəl]	a радиальный
rarefied	[ˌreərı’faıd]	a разряженный
rate volume rate	[reıt]	n скорость обменный расход
ratio	[‘reıʃıəʊ]	n отношение
ration	[‘ræʃən]	n порция
raw	[rɔ:]	a сырой
reach	[ri:tʃ]	v достигать
rear	[rıə]	n задняя сторона
reciprocating	[rı’siprəkeıtıŋ]	a поршневой
recover	[rı’kʌvə]	v восстановить
reduce	[rı’dju:s]	v уменьшать
reheater	[ri:’hi:tə]	n подогреватель
release	[rı’li:s]	v освобождать, выделять
relieve	[rı’li:v]	v освобождать(ся)
remain	[rı’meın]	v оставаться
removal	[rı’mu:vəl]	n удаление
remove	[rı’mu:v]	v удалять
renewable	[rı’nju:əbl]	a восстановимый
require	[rı’kwaıə]	v требовать

resemble	[rɪ’zembl]	v походить (на что-либо)
residual	[rɪ’zɪdjʊəl]	a остаточный
rest	[rest]	n остальное
result result from result in	[rɪ’zʌlt]	1) n результат 2) v образовываться в результате 3) v приводить к
return	[rɪ’tɜ:n]	v возвращаться
revolve	[rɪ’vɔlv]	v вращаться
rim	[rɪm]	n край
ring	[rɪŋ]	n кольцо
rise	[raiz]	1) v расти 2) n рост
room boiler room	[ru:m]	n отделение котельная, котельное отделе- ние
rotary	[‘rəʊtarɪ]	a вращающийся
rotate	[rəʊ’teɪt]	v вращать(ся)
row	[rəʊ]	n ряд
rub	[rʌb]	v натирать
runoff	[‘rʌnof]	n отходы
S		
sand sand-like	[sænd]	n песок adj подобный песку
saturated	[‘sætʃəreɪtɪd]	a насыщенный
savings	[‘seɪvɪŋgz]	n pl экономия
scale	[skeɪl]	n масштаб

semiconductor	[ˌsemɪkən’dʌktə]	n полупроводник
separation	[ˌsepə’reɪʃn]	n отделение
set	[set]	n установка
sewer	[‘sju:ə]	n коллектор
shaft	[ʃa:ft]	n вал
sheet tube sheet	[ʃi:t]	n лист трубный лист
shell	[ʃel]	n корпус
shield containment shield	[ʃi:ld]	n щит ограждающий щит
side	[saɪd]	n сторона
similar	[‘sɪmɪlə]	a подобный
sinuous	[‘sɪnjʊəs]	a извилистый
slagging	[‘slægiŋ]	n ошлакование
solution	[sə’lu:ʃn]	n решение
source	[sɔ:s]	n источник
spaced	[speɪst]	a расположенный на расстоянии друг от друга
split	[splɪt]	v расщеплять(ся)
stack	[stæk]	n выводная труба
stage	[steɪdʒ]	n ступень
start	[sta:t]	v начинать
state	[steɪt]	n состояние
station electric power station nuclear power station	[‘steɪʃn]	n станция электростанция атомная электростанция
steam	[sti:m]	n пар

stocker chain-grate stocker	[‘stokə]	n механический погрузчик механическая топка с цепной решеткой
store	[stɔ:]	v хранить
streamline	[‘stri:mlaın]	n направление потока
subject	[‘sʌbdʒıkt] [‘sʌbdʒıkt] [səb’dʒekt]	n тема, предмет a подчиненный v подчинять
substance	[‘sʌbstəns]	n вещество
suction	[‘sʌkʃən]	n отсос
suit	[sju:t]	v подходить
superheater	[ˌsju:pə’hi:tə]	n перегреватель
superheating	[ˌsju:pə’hi:tıŋ]	n перегрев
supplement	[‘sʌplımənt]	v дополнять
supply	[sə’plaı]	v обеспечить, снабжать
support	[sə’pɔ:t]	v поддерживать
surface	[‘sɜ:fıs]	n поверхность
surround	[sə’raʊnd]	v окружать
surrounding	[sə’raʊndıŋ]	n окружающее пространство
T		
table	[‘teıbl]	n таблица
throttel	[‘θrotl]	n дроссель, клапан
thrust axial thrust	[θrʌst]	n толчок, давление осевое давление
throw (threw, threw)	[θrəʊ]	v сбрасывать
tidal	[‘taıdl]	a связанный с приливами и отливами
tight	[taıt]	a непроницаемый

top	[top]	n верх
tower cooling tower	[‘taʊə]	n башня охладительная башня
transfer	[‘trænsfɜ:] [træns’fɜ:]	n передача v передавать
transmission	[trænz’mɪʃn]	n передача
treatment	[‘trɪ:tment]	n обработка
trend	[trend]	n тенденция
trouble	[‘trʌbl]	n нарушение
turbine automatic extration-turbine impulse turbine reaction turbine	[‘tɜ:bɪn]	n турбина турбина с регулируемым отбором активная турбина реактивная турбина
turbojet	[‘tɜ:bəʊdʒet]	a турбореактивный
turbulence	[‘tɜ:bjʊləns]	n турбулентность, завихрение
tube	[‘tju:b]	n труба
tubular	[‘tju:bjʊlə]	a трубчатый
U		
undergo	[ˌʌndə’gəʊ]	v подвергаться
underground	[ˌʌndə’graʊnd]	a подземный
unit	[‘ju:nɪt]	n установка
unload	[ʌn’ləʊd]	v разгружать
urgent	[‘ɜ:dʒənt]	a срочный
user	[‘ju:zə]	n потребитель

V		
valve safety valve	[vælv]	n клапан предохранительный клапан
slide valve		золотник
vane	[vein]	n лопата
vary	[‘veərı]	v меняться, различаться
velocity slip velocity	[vı’losıtı]	n скорость скорость скольжения
vented	[‘ventıd]	a вентилированный
viscosity	[vıis’kosıtı]	n вязкость
volume specific volume	[‘volju:m]	n объем удельный объем
volute	[və’lu:t]	n спиральный корпус
W		
warfare	[‘wɔ:feə]	n война, приемы ведения войны
waste	[weıst]	n отходы
water feed water	[‘wɔ:tə]	n вода питательная вода
wave	[weıv]	n волна
wear	[weə]	n износ
weight specific weight	[weıt]	n вес удельный вес
welding	[‘weldıŋ]	n сварка
wheel	[wi:l]	n колесо
width	[wıdθ]	n ширина
wire	[waıə]	n провод

БИБЛИОГРАФИЧЕСКИЙ СПИСОК

1. Израилевич, Е. Е. Практическая грамматика английского языка / Е. Е. Израилевич, К. Н. Качалова. – Москва: Юнвес, 1998. – 720 с.
2. BBC news. – URL: https://www.bbc.com/news.
3. Boiler furnace system: how does it work in thermal power plants. – URL: https://www.youtube.com/watch?v=s_ja-xk1WJA.
4. Boiler in thermal power plant. – URL: https://www.coalhandlingplants.com/boiler-in-thermal-power-plant/.
5. Boilers basic principles & types. – URL: https://youtu.be/nxvav0Ijd4E.
6. Definition of a steam boiler. – URL: https://youtu.be/q7t1naS-kLs.
7. Energy engineers at my next move. – URL: https://www.mynextmove.org/profile/summary/17-2199.03.
8. Fluidized bed boilers. – URL: https://youtu.be/T6IcdLfV3G4.
9. How does a boiler work? – URL: https://youtu.be/nL-J5tT1E1k.
10. Nuclear energy pros and cons. – URL: https://greentumble.com/nuclear-energy-pros-and-cons-notes/.
11. Steam boiler fundamentals, basic and operation. – URL: https://youtu.be/GOCX_IrDPis.
12. Steam power plant construction, working, advantages and disadvantages with diagram/ – URL: https://www.mechanicalbooster.com/2016/08/steam-power-plant.html#google_vignette.
13. Thermal energy. Macmillan encyclopedia of energy. Encyclopedia.com. (June 17, 2021) – URL: https://www.encyclopedia.com/environment/encyclopedias-almanacs-transcripts-and-maps/thermal-energy.
14. Thermodynamics Questions and Answers – Temperature Basics. – URL: https://www.sanfoundry.com/thermodynamics-questions-answers-cyclic-heat-engine/.
15. Try this Earth-friendly diet: How to shop, cook and eat to fight climate change. – URL: https://edition.cnn.com/2020/08/24/health/eco-friendly-foods-wellness/index.html.

Учебное издание

Кириллова Виктория Витальевна
Сечина Ксения Александровна
Семчук Елена Владимировна

Иностранный язык
Английский язык

Редактор и корректор А. А. Чернышева
Техн. редактор Д. А. Романова Темплан 2021 г., поз.5299

Подписано к печати 07.12.21. Формат 60x84/16. Бумага тип № 1.
Печать офсетная. Печ.л. 6,6. Уч.-изд. л. 6,6.
Тираж 50 экз. Изд. № 5299/21. Цена «С». Заказ №

Ризограф Высшей школы технологии и энергетики СПбГУПТД,
198095, Санкт-Петербург, ул. Ивана Черных, 4.