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ИНОСТРАННЫЙ ЯЗЫК
АНГЛИЙСКИЙ ЯЗЫК

Учебное пособие для бакалавров

по специальности

«Промышленная теплоэнергетика»

Часть I

Санкт-Петербург
2020

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

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Учебное пособие содержит научно-специальные тексты для чтения и Перевода, теоретико-грамматический раздел, разнообразные лексико-грамматические упражнения, разговорные темы и словарь терминов. Предназначено для бакалавров I курса института автоматизации и энергетики.

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INTRODUCTION
ВВЕДЕНИЕ

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

Цель учебного пособия - подготовить студентов к чтению и переводу научно-технических текстов с извлечением информации, познакомить с терминологической лексикой, содержащейся в текстах по изучаемой студентами специальности, развить их грамматические и разговорные навыки.

Пособие содержит 4 основных раздела: тексты по специальности с упражнениями, предназначенные для занятий вместе с преподавателем (I раздел), тексты для дополнительного чтения (раздел II), тексты для развития навыков монологической и диалогической речи (раздел III), теоретико-грамматический раздел (раздел IV). В конце пособия есть словарный минимум с основными терминами и сокращениями, а также приложения. В приложении даны правила чтения и произношения.

В учебном пособии также содержится необходимое количество лексико-грамматических упражнений. Предтекстовые упражнения направлены главным образом на расширение потенциального словаря и на знание способов словообразования. Послетекстовые упражнения закрепляют полученные знания и развивают навыки устной речи.

Пособие рекомендуется для практических занятий по дисциплине «Иностранный язык» со студентами на первом курсе. Тематика текстов пособия носит общенаучный и общепрофессиональный характер. Устные темы имеют общую и специальную направленность.

Терминологический словарь содержит основные слова, встречающиеся в пособии в их контекстуальном значении, и помогает развить навыки самостоятельной работы над иноязычными текстами.

I. TEXTS FOR READING WITH EXERCISES
ТЕКСТЫ ДЛЯ ЧТЕНИЯ С УПРАЖНЕНИЯМИ

UNIT 1

1. Read and translate the following words and word combinations:

fuel, substance, certain, to burn, flame, accomplishing, to convert, various, combustion, usable, sufficient, release, efficient, criteria, adversely, to run out, ignition, handling, require, furnace, equipment, solid / non-solid, liquid, gaseous, pipe.

2. Define the part of speech of the words in bold and translate them.

safe – **safety**; change – **unchangeable**; to use – **usable**; to combust – **combustible**; ready – **readily**; close–**closely**;definitely – **indefinitely;** respectively – **irrespectively;** cheap – **cheaply;** high **– highly;** certain – **uncertainty;** desire – **undesirable,** flame **– inflammable,** easy**-easily;** available **– availability;** wide**– widely.**

3. Translate and learn the expressions:

according to; for example; neither …or…; therefore; thus; in other words; if; while; both …and…; the former; due to; furthermore; enough; so far.

4. Compare the meaning of the verb "to be" in these sentences, translate the sentences into Russian. Make them negative.

1. The meeting is to take place in our Institute.
2. He is a second-year student.
3. There is a good library in our Institute.
4. She is speaking to the professor now.
5. I was very busy yesterday.
6. They are to carry out many interesting experiments.
7. He was to return the book after the lecture.

5. Read and translate the following text:

TEXT №1. FUEL

According to the law of conservation of energy, it can neither be created nor destroyed; it can only be changed from one form to another. Thus, we cannot produce energy to do certain work. Therefore, we use certain substances which help us transform one form of energy to another form.

For example, when we burn paper with a matchstick, light is produced by the flame. If we analyse this closely, light energy is not created over there, it has just been produced due to the transformation of heat energy provided by the matchstick into light energy. Thus, we always need a certain substance to convert one form of energy into another for accomplishing various jobs. We call such materials as fuels. In other words, any substance which upon combustion produces a usable amount of energy is known as fuel.

Now, the energy produced by burning paper is not sufficient to run cars but energy produced by burning petrol is enough to do so. Thus, we can say that each fuel releases its own set of energy i.e. all of them do not release the same amount of energy upon combustion. The energy produced by combustion of one kg of fuel is known as its calorific value.

Thus, we can differentiate different fuels on the basis of their calorific value for their efficient usage. Furthermore, each of them has a different cost with respect to another. Some are cheaper while others are expensive. Therefore, we categorize fuel as an ideal based on different criteria.

Some properties of ideal fuel are:

- An ideal fuel is readily available.
- An ideal fuel is cheap.
- An ideal fuel burns easily in the air at a moderate rate.
- It releases a large amount of energy.
- It should not leave behind any undesirable substances which can be harmful to us.
- It should not affect the environment adversely.

TEXT №2. SOLID FUELS

There are many different types of fuel. Solid fuels includecoal, wood and peat. All these types of fuel are combustible (they create fire and heat). Coal was burnt by steam locomotivesfor rail transport to heat water into steam to move parts and provide power. Peat and wood are mainly used for domestic and industrial heating,though peat has been used for power generation, and wood-burning steam locomotives were common in times past. Steam power is becoming more and more desirable as oil and gas supplies begin to run out, given the wide number of possiblethings that canburnto heat water.

Advantages:

- Easier transportation and storage.
- Low production cost.
- Moderate ignition temperature.

Disadvantages:

- Large portion of energy is wasted.
- Cost of handling is high and controlling is also hard.
- Ash content is high and burn with clinker formation.

Liquid and gas fuels

Non-solid fuels includepetroleumandgas(both fuel types have myriad varieties includingpetrol(gasoline) andnatural gas). The former is widely used in theinternal combustion enginewhile both are used in power generation.

Advantages of liquid fuels:

- Higher calorific value per unit mass.
- Burn without ash, clinkers, etc.
- Controlling the combustion is easier.
- Transportation easier through pipes and stored indefinitely without loss.
- Loss of energy is comparatively lower.
- Require less furnace space for combustion.

Disadvantages:

- Cost of liquid fuel is much higher compared to solid fuel.

- Storage methods are costlier.
- Greater risk of fire hazards.
- Special burning equipment required for more efficient combustion.

Gaseous fuels occur in nature and are manufactured from solid and liquid fuels. Most gaseous fuels are composed of hydrocarbons, carbon monoxide, hydrogen or a mixture of them all.

Advantages:

- Transportation through pipes is easy.
- Sparking combustion is really easy.
- They have a higher heat content.
- Clean after use.
- Do not require any special burner technology.

Disadvantages:

- Large storage tanks required.
- As they are highly inflammable, the chance for fire hazards is extremely high and strict safety measures need to be followed.

EXERCISES AFTER THE TEXT

6. Find in the text the words or phrases which mean the same as:

обеспечивать, преобразовывать, закон сохранения энергии, природный газ, энергетическая ценность, дифференцировать, эффективное сжигание, стоимость обработки, различные критерии, методы хранения, неблагоприятно влиять на окружающую среду, риск возникновения пожароопасных ситуаций, температура воспламенения, образование очаговых остатков и золы, твердое / не твердое топливо, двигатель внутреннего сгорания, выработка электроэнергии, строгие меры безопасности, бытовое и промышленное отопление.

7. Find in the text the synonyms to the following words:

to change, damaging, to demand, flashing, to need, very easy to obtain

8. Find the antonyms among the following words:

low – efficient - hard – loss – uncertain – very fast – costly - undesirable - high - conservation - inefficient - moderate - cheap - easy - certain - desirable

9. Form the adjectives with the suffix -able from these verbs and translate them:

understand, rely, respect, profit, count

10. Form the comparative and superlative forms of adjectives and translate them:

high, costly, great, easy, efficient, cheap, desirable, small, large, easy, heavy, warm, light, important, good, bad

11. Translate the following adjectives with negative prefixes un- and dis-:

unknown, dishonest, unreliable, discontented, undiscovered

UNIT 2

1. Read and translate the following words and word combinations:

underground waters, energy sources, energy supply, electric power stations, agricultural wastes, city runoff, cosmic forces, annihilation energy, specific state

2.Translate the sentences and pay attention to verb "to be":

1. Their exploitation is usually much more expensive than energy supply.
2. They can be employed in obtaining gas.
3. In addition it may happen that new energy sources will be discovered.
4. The vacuum is a boundless ocean of matter in some specific state.
5. Now this isa fantasy which may become a reality.

3. Make the nouns from the verbs using suffixes –tion,(-ation,-ion):

expand,add,extract,produce, annihilate, fuse

4. Translate the following sentences and explain the meaning of the modal verb:

1. They can be employed in obtaining gas.
2. In addition it may happen that new energy sources will be discovered.
3. Now this is a fantasy which may become a reality.
4. Unknown and undiscovered phenomena can be found more effective, than

familiar ones.

5. Translate the nouns using suffix –ing which means the name of the action and its result:

using,utilizing,obtaining,discovering,getting,fusing, including

6. Read and translate the text:

TEXT №3. RENEWABLE SOURCES OF ENERGY

In the future the energy of the sun, wind, sea and the heat of underground waters will be used on a large scale. These are the so-called “free” energy sources. They will be utilized only when they are more profitable than the traditional ones, because their exploitation is usually much more expensive than energy supply from large electric power stations which run on coal or nuclear fuel.

The utilization of the biomass – agricultural wastes and city runoff – can be found very effective: they can be employed in obtaining gas.

In addition it may happen that new energy sources will be discovered. What if, for example, the vacuum is a boundless ocean of matter in some specific state? Perhaps in the future man will discover some ways of getting energy from this matter? Or, for example, the undiscovered cosmic forces or the annihilation energy which arises from the fusion of matter and antimatter.

Now this is a fantasy which may become a reality. Unknown and undiscovered phenomena can be found more effective, than familiar ones.

EXERCISES AFTER THE TEXT

7. Choose the necessary preposition: in, of, from.

1.In the future the energy … the sun, wind, sea and the heat …underground waters will be used on a large scale.

2. The utilization … the biomass – agricultural wastes and city runoff – can be found very effective: they can be employed … obtaining gas.

3. What if, …example, the vacuum is a boundless ocean …matter …some specific state?

4. Or… example, the undiscovered cosmic forces or the annihilation energy which arises …the fusion of matter and antimatter.

8.Complete the sentences, using the necessary verb:arises,can be employed,will be used

1. In the future the energy of the sun, wind, sea and the heat of underground waters …on a large scale.

2. The utilization of the biomass – agricultural wastes and city runoff – can be found very effective: they …in obtaining gas.

3. The undiscovered cosmic forces or the annihilation energy which …from the fusion of matter and antimatter.

9. Translate and remember the phrasal verb "run". Make up your own sentences with it:

Run off,run on,run across

10.Agree or disagree with the statements:

1. In the future the energy of the sun, wind, sea and the heat of underground waters will be used on a large scale.

2. These are the so-called "busy" energy sources.

3. They will be utilized only when they produce more profit than the traditional ones.

4. In addition it may happen that new energy sources will be discovered.

5. Known and undiscovered phenomena can be found more effective, than familiar ones.

UNIT 3

1. Match the words with their meanings:

hard-to-reach	маяк
space vehicle	труднодоступный
light-house	космический корабль
communication facilities	средства связи
semiconductor silicon	полупроводниковый кремний
converter	преобразователь
photocell	работающий на солнечной энергии
crystal-gallium arsenide	экономия тепла
solar-powered	сельскохозяйственная продукция
fuel savings	фотоэлемент
farm products	кристалл горного хрусталя
boiler room	котельня

2. Compare the meaning of the verb "to have" in these sentences, translate the sentences into Russian. Make them negative.

1. We have many interesting books on physics.
2. We have already finished our work.
3. We have got four lectures a day.
4. Have you seen him today?
5. I have already read this book.
6. I have to repeat this experiment.
7. He has to stay at the office.
8. They had to stop their work.

3.Read and translate the word combinations:

solar energy, electric energy, light-houses, communication facilities, semiconductor silicon, preliminary concentrated light, photoelectric method,

renewable energy sources, solar-powered homes and public buildings, solar installations, drying farm products.

4.Make the noun from the verb using suffix – ment:

develop,improve,manage,equip

5.Find in the text the sentences with Present Perfect Tense.

6. Make theadverbs from theadjectives with suffix –ly:

usual, ready,main,local,efficient,significant,profitable,experimental

7. Read and translate the text:

TEXT №4. THE USE OF SOLAR ENERGY

One of the uses of solar energy is its transformation into electric energy. Photoelectric converters operate not only aboard space vehicles (космические корабли). They are used to supply hard-to-reach (трудно доступный) sites, for instance, light-houses (маяки), communication facilities (средства связи), etc. with electric power. Such installations can operate continuously for 20 years, and their capacity is up to 500 watts. They are reliable and do not need constantly handling by personal.

At present, mainly semiconductor silicon is used for the manufacture of photocells. Now the researchers have designed photocells on the basis of linking two materials in a single crystal-gallium arsenide and aluminum arsenide. They are most promising for the transformation of preliminary concentrated light since they continue to operate efficiently at temperature of over 200˚ C. Using heat that is released in photocells one can raise the efficiency up to 30%. Their use in solar power station will greatly cut the cost of the photoelectric method of energy transformation.

The problem of wider uses of renewable energy sources – solar, tidal and geothermal ones is of great local importance. So far (пока что) the practical use of solar energy is not very significant but the use of this energy can be profitable in many areas even now. Specialists designed water-heating installations for both seasonable and year-round operation. They have already built solar-powered homes and public buildings with hot water supply, heating and air-conditioning. Within the

next few years experimental constructions will go on. After tests the best solutions will be used in solar-powered homes and public buildings

The application of solar installations in agriculture has considerable effect. The experience in experimental solar-heating greenhouses (теплица, парник) has shown that, as compared with ordinary greenhouses that receive heat from boiler rooms, the expenses on vegetable-growing are reduced by 60% due to fuel savings alone. Solar-powered installations for drying farm products were also tested successfully.

EXERCISES AFTER THE TEXT

8. Find in the text the words or phrases which mean the same as:

превращение, электроэнергия, установка, эффективность, освобождать (выделять), выгодный, по сравнению с, получать, затраты, сокращать, благодаря, значительный, применение, решение, проект, энергия приливов, мощность, геотермальный, обработка

9. Find in the text the synonyms to the following words: change (n), successful (a), to provide (v), usual (a), place (n), important (a)

10. Complete the gaps with the verb (use,have designed, is released, are reduced, need).

1. The lighthouses … a photoelectric cell to supply with an electric power a signal that guides ships away from danger.

2. They are reliable and do not …constantly handling by personal.

3. The expenses on vegetable-growing …by 60% due to fuel savings alone.

4. Using heat that …in photocells one can raise the efficiency up to 30%.

5. Now the researchers …photocells on the basis of linking two materials in a single crystal-gallium arsenide and aluminum arsenide.

UNIT 4

1.Translate the following words and word combinations:

fossil fuels, crude oil, remains (n), to subject, primarily, pressure, earth's crust, nuclear, source, hydrocarbons, convenient, amount, plant, fern, to harden, excessive

2. Form the nouns with the meaning of action or its result from these verbs using the suffix-tion (-ation,-ion) and translate them:

intervent, decompose, consume, pollute, conduct, subject, invent, apply, consider, combine, add, form, modify, compose, degrade, continue

3. Fill in the following sentences with "many" or "much":

1. How _____ does this book cost?
2. _____ rain has fallen on the mountains.
3. He doesn't know_____ English.
4. He hasn't_____ money.
5. Have they _____ books?
6. Are there ____ students absent today?
7. Too ____ teachers went to the concert.
8. There isn't ____ food in the house.
9. Does she take _____ interest in it?
10. I haven't _____ time.

4. Translate the words with negative prefixes un-, in-, im, de-, dis-:

unchanged, unbleached, disadvantage, to defiber, improper, untreated, to displace,to discover, to discharge

5. Translate sentences using the Passive Voice:

1.The energy can be created.

2.The light is produced by the flame.

3. The energy is produced by burning petrol.

4. Peat and wood are mainly used for domestic and industrial heating.

6. Add the appropriate preposition of time to these phrases:

1. _____ 6.30 p.m.
2. _____ the beginning.
3. _____ last.
4. _____ an hour.
5. _____ weekends.
6. _____ 2020.

7. _____ summer.

8. _____ March 25.

9. _____ midnight.

7. Read and translate the text:

TEXT №5. NON-RENEWABLE SOURCE OF ENERGY

Non-renewable energy is energy from fossil fuels such as coal, crude oil, natural gas, and uranium. Unlike renewable energy, non-renewable energy needs human intervention to make it suitable for consumption. Fossil fuels are mainly made up of carbon. It is believed that fossil fuels were formed over 300 million years ago when the earth was a lot different in its landscape.

Non-renewable energy is mainly fossil fuels. Apart from fossil fuels, nuclear fuels are also non-renewable.

Fossil Fuels

Fossil fuels are the dead and decayed remains of plants and animals subjected to decades of pressure and temperature under the earth's crust. Primarily fossil fuels are hydrocarbons. They are convenient and effective. They provide the calorific value required to fulfill our needs. Even though they are available in plenty right now, they are a non-renewable source of energy. The burning of fossil fuels is responsible for a large section of the world's pollution index.

Fossil fuel is divided into three categories:

Natural Gas	Coal	Oil
The process of decomposition is longer as it is conducted to high amounts of pressure and heat.	It is formed by the decomposition of trees, plants, and ferns which are hardened due to pressure and heat.	Due to excessive pressure, smaller organisms like zooplankton and algae are decomposed into oil.

EXERCISES AFTER THE TEXT

8. Fill in the gaps with the appropriate preposition: into, by, to, of, for, under, for, due to. Where do we need to put the conjunction "like"?

1. Fossil fuels are the dead and decayed remains … plants and animals subjected … decades … pressure and temperature … the earth's crust.

2. The burning of fossil fuels is responsible … a large section … the world's pollution index.

3. Fossil fuel is divided … three categories: natural gas, coal and oil.

4. Environmentalists would like to see fossil fuels replaced … renewable energy sources.

5. Fossil fuels are mainly made up … carbon.

6. Known oilreserves are enough to last … 40 years, naturalgas … over 65 years and coal … 250 years.

7. … excessive pressure, smaller organisms … zooplankton and algae are decomposed … an oil.

9. Change the gaps by the correct verb: provide, are, is

1. Non-renewable energy … energy from fossil fuels such as coal, crude oil, natural gas, and uranium.

2. Apart from fossil fuels, nuclear fuels … also non-renewable.

3. They … the calorific value required to fulfil our needs.

10. Form the PastSimple form of the verbs:

divide, decay, subject, require, make, replace, need, give

11. Find the pairs of antonyms and remember them:

divide, decay, subject, require, make, replacehard, solid, wide, liquid, cool, low, narrow, heat, big, small, suitable, soft, high, unsuitable

UNIT 5

1. Read and translate the following words and word combinations:

single atom,a great quantity,nuclear reactor,reactor produces energy, the most reliable "furnaces",the steam generator,electric generator,nuclear power station,the

familiar coal-burning furnace

2. Make three forms of the following verbs:

make, see, be, know, get, find, held, forget, light, lead, rise, spend

3. Choose the correct item:

1. You ____ write and thank everyone for the birthday presents they gave you.

A) shouldn't B) need C)ought to

2. It's very late. The children ____ be sleeping.

A) must B) can't C) shouldn't

3. We _____ finish the project by Friday or else we'll lose the client.

A) might B) needn't C) mustn't

4. The north of England _____ get very cold during the winter.

A) may B) can C) could

5. Susan has a broken leg. She _____ gone skiing.

A) can't have B) couldn't C) may

4. Translate and define the tense of the forms:tries, will see, will not be able to see,has learned,produces,is circulated

5. Make Present Simple sentences with "be" (positive, negative, interrogative).

Example: he/ not/ be/ an accountant. - He is an accountant.

1. you / be / hungry.
2. they / not / be / at home.
3. when / be / the party ?
4. she / be / kind.
5. they / be / German.
6. you / be / late?
7. I / be / from London?
8. they / be/ sad.
9. where / be / you?
10. how old / be / she?

6. Complete the sentences with at, in, to or no preposition.

1.I didn't see you ____ the party last night.

2. I didn't go ____ the party.

3. My sister lives ____ Moscow.

4. Sue flies from ____ London _____ Scotland every Monday morning.

5. What time did you arrive ____ the airport?

6. I was _____ work all day on Saturday.

7. It was very cold and so I ran _____ home.

8. We meet _____ town every Sunday evening.

9. We meet _____ the underground station every Monday and Wednesday.

7. Read and translate the text:

TEXT №6. ATOMIC ENERGY

A man that tries to see a single atom is like a man trying to see a single drop of water in the sea. He will see the sea made of great many drops of water but he will not be able to see a single drop. However, man has learned the secret of the atom. He has learned to split atoms in order to get a great quantity of energy.

The nuclear reactor is one of the most reliable "furnaces" that produce atomic energy. When a reactor produces energy it produces energy in the form of heat. In other words, when atoms split in the reactor heat is developed. Gas, water, melted metals and some other liquids circulate through the reactor to carry that heat away. The heat may be carried to pipes of the steam generator that contains water. The steam drives a turbine; the turbine in its turn drives an electric generator. So we see that a nuclear power station is like any other power station but the familiar coal-burning furnace is replaced by a nuclear one.

Nuclear technology uses the energy released by splitting the atoms of certain elements. It was first developed in the 1940s, and during the Second World War research initially focused on producing bombs. In the 1950s attention turned to the peaceful use of nuclear fission, controlling it for power generation.

EXERCISES AFTER THE TEXT

8.Find in the text the English equivalents for the following words:

Источник энергии, количество энергии, атомная энергия, турбина, труба, жидкость, циркулировать, капля воды, ядерный реактор, расплавленные металлы, в свою очередь, знакомый, атомная электростанция, приводить в движение, технология, исследование, расщепление атомов, электроснабжение

9.Change the gaps by the correct verb:uses,may be carried,produces,**has learned**, **will see**

1. He….. the sea made of great many drops of water but he will not be able to see a single drop.

2.Man …..the secret of the atom.

3. When a reactor …..energy it …..energy in the form of heat.

4. The heat …..to pipes of the steam generator that contains water.

5. Nuclear technology ….. the energy released by splitting the atoms of certain elements.

10.Fill in the gaps with the appropriate preposition:by, in,of.

1. A man that tries to see a single atom is like a man trying to see a single drop…..water ….. the sea.

2. He has learned to split atoms ….. order to get a great quantity ….. energy.

3. The steam drives a turbine; the turbine ….. its turn drives an electric generator.

4. So we see that a nuclear power station is like any other power station but the familiar coal-burning furnace is replaced….. a nuclear one.

UNIT 6

1.Translate the following words and word combinations:

nuclear power station, to put into operation, to serve, to achieve, contribution, superheating,directly, capacity, generator, installation, currently, dominance

2.State the part of speech of the following words with the same root and translate them:

operate, operation, operable, inoperable

peace, peaceful , peacefully

science, scientist, scientific

generate, generation, generator

achieve, achievement, achievable

3. Form adverbs using the suffix –ly and translate all the words:

general, certain, direct, common, current, primary, ultimate, efficient, main, frequent, rough, constant, independent.

4. Read and translate the text:

TEXT №7. NUCLEAR POWER IN RUSSIA

The first industrial nuclear power station in the world was constructed in Obninsk not far from Moscow in 1954. The station was put into operation two years earlier than the British one and three and a half years earlier that the American nuclear power stations.

A number of nuclear power stations have been put into operation since 1954. The Beloyarskaya nuclear power station named after academician Kurchatov may serve as an example of the peaceful use of atomic energy. The scientists and engineers achieved a nuclear superheating of steam directly in the reactor itself before steam is carried into the turbine. It is certainly an important contribution to nuclear engineering achieved for the first time in the world.

We might mention here another important achievement that is the first nuclear installation where thermal energy generated in the reactor is transformed directly into electrical energy. Speaking of the peaceful use of atomic energy it is also necessary to mention our nuclear ice-breakers. “Lenin” is the world’s first ice-breaker with nuclear installation. Its machine installation is of a steam turbine type and steam is produced by three reactors and six steam generators.

At present Russiahas 38 operable nuclear reactors, with a combined net capacity of 28.6 GWe. In 2019 nuclear power generated 20% of the country'selectricity.

A government decree in 2016 specified construction of 11 nuclear power reactors by 2030, in addition to those already under construction. At the start of 2020, Russia had four reactors under construction, with a combined capacity of 4.8 GWe.

The strength of Russia's nuclear industry is reflected in its dominance of export markets for new reactors. The country's national nuclear industry is currently involved in new reactor projects in Belarus, China, Hungary, India, Iran and Turkey, and to varying degrees as an investor in Algeria, Bangladesh, Bolivia, Indonesia, Jordan, Kazakhstan, Nigeria, South Africa, Tajikistan and Uzbekistan among others.

EXERCISES AFTER THE TEXT

5. Answer the questions after the text

1. What nuclear power stations do you know?
2. What are the uses of a nuclear reactor for peaceful purposes?
3. What was the most important achievement in the development of the nuclear installation?

6. Find the equivalents from the text:

совокупная мощность, кроме того, ледокол, использование в мирных целях, выработка тепловой энергии, в процессе строительства, важный вклад

7. Put these words into the text: nuclear, forced, island,damaged, station, earthquake, accident , worried, reactor.

The Fukushima I Nuclear Power Plant is a ... power …. that was on Honshu .... in Japan. In March 2011 a huge … and tsunami seriously … the cooling system of the … .As a result of the ..., radiation got into the air.Local people were ... to leave the area and many people were ... about the safety of food and water.

8. Fill in the gaps with “to have to” or “to be to”.

1. I can’t go with them as I … (to be) at the Higher School at 9.30.
2. If you want to understand this phenomenon better, you …(to look through) some articles devoted to this problem.

3. As this question is not solved the meeting …(to be put off).
4. At 10 a.m. he … (to make a report), I think it will be interesting to listen to him.
5. As he made many mistakes in his last work he … (to rewrite) it.

9.Translate the following sentences paying attention to the word "number": a number of - ряд; the number of - число, номер, количество.

1. A number of nuclear power stations have been put into operation since 1954.
2. The number of cars on our roads rose dramatically last year.
3. A number of questions involved had been discussed long before.
4. A number of issues were discussed.
5. Take a look at question number three.
6. Basic rule here is never give out your password or account number, not online or over the phone.
7. The regulations limit the number of students in each class.
8. The number of new synthetic products produced by our chemical industry increases every year.

10. Translate the following sentences with "the…, the…" (чем…, тем…) construction.

1. The higher the temperature, the greater is the amount of heat evolved.
2. The faster an object moves, the greater is the air resistance.
3. The lower the atomic weight or atomic number of the inert gas, the lower are its boiling and melting points.
4. The greater the difference in temperature between two points, the more heat will flow per second.

UNIT 7

1.Translate the following words and word combinations:

combustion, oxidation, to apply, to produce, twig, log, chemical, friction, kindling, flame, moisture, vapour, hydrogen, monoxide, moisture, carbon dioxide, component, furnace, sufficient, flue gas, biomass, pollutant, to result in, soot, ash,

smoke, to release, to consume

2.Match the words with their similar meanings:

heat	burning
combustion	quick
outside	warmth
rapid	to be affected by smth/smb
to depend on	matter
substance	quantity
amount	external

3. Read and translate the text:

TEXT №8. COMBUSTION

Combustion can be defined as the complete, rapid exothermic oxidation of a fuel, such as coal, oil, gas or wood, with sufficient amount of oxygen or air with the objective of producing heat, steam and/or electricity. The process of combustion occurs with a high speed and at a high temperature. Essentially, it is a controlled explosion. Combustion occurs when the elements in a fuel combine with oxygen and produce heat. All fuels, whether they are solid, liquid or in gaseous form, consist primarily of compounds of carbon and hydrogen called hydrocarbons (natural gas, coal, oil, wood, etc.), which are converted in the combustion process to carbon dioxide (CO_2) and steam. Sulphur, nitrogen, and various other components are also present in these fuels.

Combustion usually begins when heat from an outside source is applied to a fuel. The burning process is initiated by striking the match to generate enough friction heat to set it aflame. The flame's heat is used to light kindling, and the kindling's heat to start the logs. This method of using an easily lighted object to provide heat for ignition of a harder-to-light fuel is common in engineering.

In general, the degree of flammability depends on how easy it is to burn the

particular substance into a gas, because nothing truly burns until it is a gas. This, in turn, depends on the nature and quantity of the substance, compared with the amount of heat available to start combustion. It is easier to start wood-burning than coal, and easier to ignite a twig than a log.

While combustion is essentially a chemical reaction, most of the practical problems of fuel-burning are mechanical.

4. Name the verbs from which the following nouns were formed and translate all the words:

Burning - ; vaporization - ; combustion - ; production - ; introduction- ; consumption- ; emission - ; equipment - ; formation - ; development- ; difference - ; pollution -

5.Translate the words having the same root:

intensity – intensive – intensively – intensify;

production – product – productivity – to produce – productive – nonproductive;

to pollute - pollution – gaseous pollutant – nonpolluting;

available – availability – unavailable;

to consume – consumption – consumer goods;

to use – user – useful – useless – usage;

environment – environmental – environmentalist.

6. Read and translate the text:

TEXT №9. PRODUCTS OF COMBUSTION

When the hydrogen and oxygen combine, intense heat and water vapor is formed. When carbon and oxygen combine, intense heat and the compounds of carbon monoxide or carbon dioxide are mixed. These chemical reactions take place in a furnace during the burning of fuel, provided (приусловии)there is sufficient air (oxygen) to burn the fuelcompletely. Very little of the released carbon is actually "consumed" in the combustion reaction because flame temperature seldom reaches the vaporization point of carbon. Most of it combines with oxygen to form CO_2 and passes out the vent. The final gaseous product of combustion is called a flue gas.

Combustion can never be 100% efficient. All fuels contain moisture. Other fuel components may form by-products, such as ash, and gaseous pollutants that need emission control equipment.

There are three types of combustion:

Perfect combustion is achieved when all the fuel is burned using only the theoretical amount of air, but as stated earlier, perfect combustion cannot be achieved in a boiler.

Complete combustion is achieved when all the fuel is burned using the minimal amount of air above the theoretical amount of air needed to burn the fuel. Solid fuels, such as coal, peat or biomass are typically fired at air factors 1.1 – 1.5, i.e. 110 – 150% of oxygen needed for perfect combustion.

Incomplete Combustion occurs when part of the fuel is not burned, which results in the formation of soot and smoke.

7. Find the equivalents from the text:

не/полное сжигание, углекислый газ, угарный газ, газообразные загрязняющие вещества, побочный продукт, химическая реакция,оборудование для контроля выбросов в атмосферу, точка испарения

8.Translate the following words and word combinations:

high/low grade, bark, firing method, biofuel, scale, bottom, to employ

9. Read and translate the next text:

TEXT №10. COMBUSTION OF SOLID FUELS

Solid fuels can be divided into high grade - coal and low grade - peat and bark. The most typical firing methods are grate firing, cyclone firing, pulverized firing and fluidized bed firing. Pulverized firing has been used in industrial and utility boilers from 60 MWt to 6000 MWt. Grate firing has been used to fire biofuels from 5 MWt to 600 MWt and cyclone firing has been used in small scale 3–6 MWt.

Oil and gas are always combusted with a burner, but there are three different ways to combust coal:

1. Fixed bed combustion (grate boilers)

2. Fluidized bed combustion

3. Entrained bed combustion (pulverized coal combustion)

In fixed bed combustion, larger-sized coal is combusted in the bottom part of the combustor with low-velocity air. Stoker boilers also employ this type of combustion. Large-capacity pulverized coal fired boilers for power plants usually employ entrained bed combustion. In fluidized bed combustion, fuel is introduced into the fluidized bed and combusted.

EXERCISES AFTER THE TEXT

10. Find the equivalents from the text:

сжигание в колосниковой печи / в циклонной топке, крупногабаритный уголь, сжигание измельченного угля, коммунальный / пылеугольный котел, низкоскоростной воздушный поток, сжигание в фиксированном слое / в кипящем слое, оборудование для контроля выбросов в атмосферу, точка испарения

11. Translate the sentences, taking into account the meaning of the multifunctional word “one”.

1. **One** of the uses of solar energy is its transformation into electric energy.

2. Photoelectric converters operate not only aboard space vehicles. Using heat that is released in photocells **one** can raise the efficiency up to 30%.

3. **One** of the easiest ways to improve home efficiency is to add outdoor solar lighting to your property.

4. Utilizing smaller products and home improvements to improve the efficiency of **one’s** home is a great practice, but at the end of the day, the ultimate opportunity to improve **one’s** carbon footprint and electric bill is with a home solar panel installation.

5. Solar energy also has some disadvantages associated with it. The biggest **one** is the fact that it also emits greenhouse gases which is harmful to the environment.

6. The problem of wider uses of renewable energy sources – solar, tidal and geothermal **ones** is of great local importance.

UNIT 8

1. Read and translate the following words:

property, to boil, superheating, liquid, beyond, medium, explosive, to transfer, to select, to design, to continue, thoroughly, vapor, to lead to (led-led), to resemble

2. Read and translate the following international words:

theoretical, efficiency, reaction, equivalent, industrial, percent, device, technology, practical, boiler, expansion, evaporation, hydroelectric, superheating, atmosphere, generation, temperature, enthalpy, condensation

3. Translate the following "attribute chains":

combustion process,steam-and-power-generation equipment, water boiling point, saturation point, temperature rise, phase/liquid change, moisture content, turbine exhaust, dry saturated steam condition, evaporation temperature

4. Name the verbs from which these nouns were formed:

expansion, pollution, purification, evaporation, oxidation, ignition, combustion, treatment,saturation, user, continuing, comparison, dependable, additional, entering

5. Read and translate the next text:

TEXT №11. PROPERTIES OF WATER AND STEAM

Water is a useful and cheap medium to use as a working fluid. When water is boiled into steam its volume increases about 1,600 times, producing a force that is almost as explosive as gunpowder. The force produced by this expansion is the source of power in all steam engines. It also makes the boiler a dangerous device that must be carefully treated.

The theoretical amount of heat that can be transferred from the combustion process to the working fluid in a boiler is equivalent to the change in its total heat content from its state at entering to that at exiting the boiler. In order to be able to select and design steam-and-power-generation equipment, it is necessary to thoroughly understand the properties of the working fluid, steam, the use of steam tables and the use of superheat.

Boiling of water

Water and steam are typically used as heat carriers in heating systems. Steam, which is the gas phase of water, resultsfrom adding sufficient heat to water to cause it to evaporate. This boiler process consists of three main steps: the first step is the adding of heat to the water that raises temperature up to the boiling point of water, also called preheating. The second step is continuing addition of heat to change the phase from water to steam, the actual evaporation, the third step is the heating of steam beyond the boiling temperature of water, known as superheating. The first step and the third one are the part where heat addition causes a temperature rise but no phase change. When all the water has been evaporated, the steam is called dry saturated steam. If steam is heated beyond its saturation point, the temperature begins to rise again and the steam becomes superheated steam. Superheated steam is defined by its zero moisture content: it contains no water at all, only 100 % steam.

Evaporation

During the evaporation the enthalpy rises drastically. If water is evaporated at atmospheric pressure from saturated liquid to saturated vapor, the enthalpy rise needed is 2260 kJ/kg, from 430 kJ/kg (saturated water) to 2690 kJ/kg (saturated steam). When the water has reached the dry saturated steam condition, the steam contains a large amount of latent heat, corresponding to the heat that was led to the process under constant pressure and temperature. So despite pressure and temperature arethe same for the liquid and the vapour, the amount of heat is much higher in vapour compared to the liquid.

Superheating

If the steam is heated beyond the dry saturated steam condition, the temperature begins to rise again and the properties of the steam start to resemble those of a perfect gas. Steam with higher temperature than that of saturated steam is called superheated steam. It contains no moisture and cannot condense until its temperature has been lowered to that of saturated steam at the same pressure. Superheating the steam is particularly useful for eliminating condensation in steam lines, decreasing the moisture in the turbine exhaust and increasing the efficiency (i.e. Car-

not efficiency) of the power plant.

Effect of pressure on evaporation temperature

It is well known that water boils and evaporates at 100˚C under atmospheric pressure. By higher pressure, water evaporates at higher temperature – e.g. a pressure of 10 bar equals an evaporation temperature of 184ºC. The pressure and the corresponding temperature when a phase change occurs are called the saturation temperature and saturation pressure. During the evaporation process pressure and temperature are constant, but if the vaporization occurs in a closed vessel, the expansion that occurs due to the phase change of water into steam causes the pressure to rise and thus the boiling temperature rises.

When 22.12 Mpa is exceeded (the corresponding temperature is 374ºC), the line stops. The reason is that the border between gas phase and liquid phase is blurred out at that pressure. The point, where the different phases cease to exist, is called the critical point of water.

EXERCISES AFTER THE TEXT

6. Find in the text the words with similar meaning:

to happen, to take care, operation, continual, dramatically, to rise, generally, characteristics, to get rid of, line, to make it difficult to see, to stop

7.Translate the sentences with the verbs in thePassive Voice:

1. The steam (is / was / has been / has to be / had to be / will be / must be / can be / could be) heated.

2. The temperature (was / has been / has to be / had to be / will be / must be / should be / should have been / could be / will have to be) raised.

3. The boiler (must be / was / will be / has been / has to be / should be / can be / could be / had to be / should have been) carefully treated.

4. The water (has been / was / has to be / had to be / will be / must be / can be / could be) evaporated.

8. Revise the translation of the multifunctional words "those", "that", "this", "these":

1. It contains no moisture and cannot condense until its temperature has been lowered to **that** of saturated steam at the same pressure.

2. The temperature begins to rise again and the properties of the steam start to resemble **those** of a perfect gas.

3. This amount of heat is equivalent to the change in its total heat content from its state at entering to **that** at exiting the boiler.

4. When water is boiled into steam its volume increases about 1,600 times, producing a force **that** is almost as explosive as gunpowder.

5. **This** will be discussed in the next chapter.

6. Is there any way of solving **these** problems?

9. Pay attention to the meaning of the word "cause" in the following sentences:

1. Heat to be absorbed by a liquid **causes** the liquid to evaporate.

2. Pressure in any fluid is due to one of two **causes** either compression or the weight of the fluid itself.

3. Since water as aliquid occupies a smaller volume than its solid form, moderate pressure tends **to cause** ice to melt.

4. The difference between the voltage actually required**to cause**a reaction to proceed and the theoretical voltage calculated for the process is known as overvoltage.

5. Combustion is **caused** by union of the oxygen atoms of the air with carbon and hydrogen atoms of the fuel.

6. Pressure changes **caused** by differences between the external and the internal vapour pressure may have more serious consequences.

UNIT 9

1.Translate the following words and word combinations:

steam engine, mechanical force, pressure, to require, internal combustion engine, pressure, various, particular, cycle, purpose, condenser,primarily, plant, to develop, to power, device.

2. Translate the following words with the same root:

industry(n) –industrial (a)

power (n) - powerlessness(n) - powerful (v)

clean(v), cleaner (n), cleaning, cleanliness, unclean (v) cleanly (adv)

efficient, inefficient, efficiency, efficiently.

3. Put the verbs in the Past Simple form:

1. A boiler feed pump (deliver) the water to the economizer.
2. The construction of the steam engine (involve) great difficulties.
3. They speak English rather well, but last year they (speak) poorly.
4. For three days they (carry out) this interesting work.
5. I (get) interested in mathematics when I (be) at school.

4. Put in "must" or "have to/has to".Choose the best for the situation.

1. Tom _____go to the bank. He hasn'tgot any money.
2. I _____ go to the airport. I'm meeting someone.
3. I _____ put the heating on. I feel really cold.
4. I _____ work late tomorrow. We are very busy at the office.
5. You really _____ make less noise. I'm trying to concentrate.

5. Choose the right variant:

1. Martin was the (more talented/ most talented) of two brothers.
2. Of the three shirts I like the blue one (better/ best).
3. My dog is the (prettier/ prettiest) of the two.
4. There are nine planets in our solar system and Pluto is the (farther/ farthest).
5. Mary is the (tallest /taller) of two girls.
6. The boss likes my plan the (better / best) of the two.

6. Substitute “that” or “those” for the repeated noun:

1. Their poetry was not the poetry of Milton and Byron.
2. Scarlett’s eyes met the eyes of Grandma.
3. The expression on his face was the expression of a crossed child.
4. The trees in our garden are taller than the trees in the park.
5. Most people would consider such a marriage as the marriage of Soames and Irene quite fairly successful.
6. His eyes were melancholy as the eyes of a monkey.

7. Read and translate the text:

TEXT №12. A STEAM ENGINE

A steam engine is a device that converts the potential energy that exists as pressure in steam, and converts that to force. Early examples were the steam locomotive trains, and steamships that relied on these steam engines for movement. The Industrial Revolution came about primarily because of the steam engine. The thirty seconds or so required to develop pressure made steam less favored for automobiles, which are generally powered by internal combustion engines.

Steam engines are of various types but most are reciprocal piston or turbine devices. The strength of the steam engine for modern purposes is in its ability to convert raw heat into mechanical work. Unlike the internal combustion engine, the steam engine is not particular about the source of heat. Since the oxygen for combustion is unmetered, steam engines burn fuel cleanly and efficiently, with relatively little pollution.

One source of inefficiency is that the condenser causes losses by being somewhat hotter than the outside world. Thus any closed-cycle engine will always be somewhat less efficient than any open-cycle engine, because of condenser losses.

Most notably, without the use of a steam engine nuclear energy could not be harnessed for useful work, as a nuclear reactor does not directly generate either mechanical work or electrical energy – the reactor itself does nothing but sit there and get hot. It is the steam engine which converts that heat into useful work.

EXERCISES AFTER THE TEXT

8. Find the equivalents from the text:

двигатель со встречным движением поршней, турбина, двигатель внутреннего сгорания, превращать, полезная работа, неэффективность, измерять, потери, мощность (сила), в отличие, кислород

9. Answer the questions about the text:

1. What is a steam engine?
2. What are the most popular types of steam engines?
3. Which engine does a lot of harm to the environment? Why?
4. What kind of engine is favoured by cars? Why?
5. Why is an open-cycle engine more efficient than a closed-cycle engine?

10. Put the necessary form of the verb:does not generate, could not be harnessed ,is, are powered,made,were

1. Early examples ….. the steam locomotive trains, and steamships that relied on these steam engines for movement.

2. The thirty seconds or so required to develop pressure ….. steam less favored for automobiles, which ….. generally powered by internal combustion engines.

3.One source of inefficiency …..that the condenser causes losses by being somewhat hotter than the outside world.

4. Most notably, without the use of a steam engine nuclear energy …..for useful work, as a nuclear reactor …..directly …..either mechanical work or electrical energy – the reactor itself does nothing but sit there and get hot.

UNIT 10

1. Translate the following words

consequently, capacity, range, unit, vessel, feedwater, to apply, to require, area, to install, to discharge

2. Read and translate the following international words:

hydroelectric, magnitude, economizer, installation, turbine, economy, surface,practice, central, plant

3. Read and translate the followingword combinations:

standard practice,steam boiler, capacity range,pressure vessel,high qualityheat-transfer surfaces, boiler heating surface

4.Translate the sentences, paying attention to "with" (prep.) –с; "which" (pron.) - который:

1. The steam boiler is a pressure vessel in which feedwater can be converted into saturated steam of high quality at some desired pressure.

2. When other heat-transfer surfaces such as superheater, air heater, or economizer surfaces are combined with boiler surface into a unified installation, the name steam-generating unit is applied to the complete unit.

3. Boiler heating surface is defined as that surface which receives heat from the flame or hot gases and is in contact with water.

5. Read and translate the text:

TEXT №13. STEAM GENERATION

Steam is used for space heating, in manufacturing processes, and for power generation. Except for hydroelectric power plants, practically all the central-station generating capacity is in the form of steam turbines. Because of the magnitude of the load and the economies that are effected through the use of the smallest possible number of largest machines, most central-station turbines now being built are in the size range of 1000,000 to 600,000 kw. It is standard practice to install one steam-generating unit per turbine. Consequently, these turbines require steam-generating units in the capacity range of 750,000 to over 3,000,000 lb of steam per hr.

The steam boiler is a pressure vessel in which feedwater can be converted into saturated steam of high quality at some desired pressure. When other heat-transfer surfaces such as superheater, air heater, or economizer surfaces are combined with boiler surface into a unified installation, the name of steam-generating unit is applied to the complete unit.

Boilers in which the water is inside the tubes are called water-tube boilers, whereas boilers that have the hot products of combustion in the tubes and the water outside the tubes are called fire-tube boilers. Boiler heating surface is defined as that

surface which receives heat from the flame or hot gases and is in contact with water. The area is based on the surface receiving the heat, that is, the outside area of water tubes and the inside area of fire tubes.

EXERCISES AFTER THE TEXT

6. Put the following words into the gaps:hydroelectric, magnitude, vessel, economizer, whereas, heating, receiving.

1. Except for … power plants, practically all the central-station generating capacity is in the form of steam turbines.

2. Because of the … of the load and the economies that are effected through the use of the smallest possible number of largest machines.

3. The steam boiler is a pressure … in which feedwater can be converted into saturated steam of high quality at some desired pressure.

4. The surfaces such as superheater, air heater, or … surfaces are combined with boiler surface into a unified installation.

5. Boilers in which the water is inside the tubes are called water-tube boilers, … boilers that have the hot products of combustion in the tubes and the water outside the tubes are called fire-tube boilers.

6. Boiler … surface is defined as that surface which receives heat from the flame or hot gases and is in contact with water.

7. The area is based on the surface … the heat, that is, the outside area of the water tubes and the inside area of fire tubes.

7. TranslatefromRussianintoEnglish

производственный процесс, практический, следовательно, нагревательная установка, паровая турбина, котел с дымогарными трубами, генерирующая мощность электростанции;парогенератор, диапазон мощности, водотрубный котел.

8. Make up three forms of the verbs:

forget, give, say, tell, know, mean, write, fall, feel, sleep

9. Put the necessary prepositions:

1. Steam is used … space heating, … manufacturing processes, and … power generation.

2. The steam boiler is a pressure vessel … which feedwater can be converted …saturated steam … high quality … some desired pressure.

3. Boiler … which the water is inside the tubes are called water-tube boilers, whereas boilers that have the hot products …combustion … the tubes and the water outside the tubes are called fire-tube boilers.

4. Boiler heating surface is defined as that surface which receives heat ( ) the flame or hot gases and is … contact … water.

5. The area is based …the surface receiving the heat, that is, the outside area … water tubes and the inside area …fire tubes.

10. State to what partof speech the following words belong and translate them.

extract-extraction-extractive

expand-expansion-expensive

exist-existence-existent

mix-mixture

present-presence-presentable

use-useful-useless

11.Choose the correct grammar form to translate a predicate:

1. Этот дом был построен в прошлом году.

a. was being built

b. has been built

c. was built

2. На этой неделе преподаватель объяснил новый материал.

a. had been explained

b. was explained

c. has been explained

3. Цветы уже политы.

a. are watered

b. have been watered

c. were watered

4. Такие столы делают из дорогого дерева.

a. are being made

b. have been made

c. are made

5. Их еще не пригласили.

a. were not invited

b. had not been invited

c. have not been invited

UNIT 11

1. Read and translate the following word combinations:

steam power plant, manufacturing process, separation, superheated steam, chimney, induced-draft fan, forced-draft fan, condensed steam

2. Read and translate the text:

TEXT №14. THE STEAM POWER PLANT

The function of a steam power plant is to convert 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 suitable prime mover such as a turbine or engine. A non condensing plant discharges the steam from the prime mover at an exhaust pressure equal to or greater than atmospheric pressure. A condensing plant exhausts from the prime mover into a condenser at a pressure less than atmospheric pressure.

In general, central-station plants are condensing plants since their sole output is electric energy and a reduction in the exhaust pressure at the prime mover decreasesthe amount of steam required to produce a given quantity of electric energy. Industrial plants are frequently non condensing plants because large quantities of low-pressure steam are required for manufacturing operations. The power required

for operation of a manufacturing plant may often be obtained as a by-product by generating steam at high pressure and expanding this steam in a prime mover to the back pressure at which the steam is needed for manufacturing processes.

The steam-generating unit is made up of several key components. For a steam cycle, this includes some combination of the following items:

- Combustor / furnace in which the fuel is burned;
- Boiler
- Superheater and economizer in which high pressure steam is generated;
- Air heater in which the loss of energy due to combustion of the fuel is reduced to a minimum.

EXERCISES AFTER THE TEXT

3. Put the following verbs in the Active or Passive Voice into the gaps:exhausts, is generated, are required, is reduced, is burned, be obtained, is made up.

1. A condensing plant … from the prime mover into a condenser at a pressure less than atmospheric pressure.
2. Industrial plants are frequently non condensing plants because large quantities of low-pressure steam for manufacturing operations.
3. The power required for operation of a manufacturing plant may often … as a by-product.
4. The steam-generation unit consists of a furnace in which the fuel …, a boiler, superheater, and economizer, in which high-pressure..., air heater in which the loss of energy due to combustion of the fuel ...
5. The steam-generating unit … of several key components.

4. Translate from Russian into English:

механическая или электрическая энергия, низкое давление, в основном, уменьшать, требуемый для производства, состоит из, котельныетрубы, отделен от воды, через перегреватель, побочный продукт

5. Make up 3 forms of the following verbs:

burn, begin, flow, show, feed, supply, do, form, run, remove, use

6. Put the necessary prepositions: “of”, “into”, “from”, “through”, “for”.

1.The function … a steam power plant is to convert the energy in nuclear reactions or in coal, oil or gas … mechanical or electric energy … the expansion of steam … a high pressure to a low pressure in a suitable prime mover such as a turbine or engine.

2. A condensing plant exhausts … the prime mover … a condenser at a pressure less than atmospheric pressure.

3. In general, central-station plants are condensing plants since their sole output is electric energy and a reduction in the exhaust pressure at the prime mover decrease the amount … steam required to produce a given quantity … electric energy.

4. Industrial plants are frequently non condensing plants because large quantities … low-pressure steam are required …manufacturing operations.

7.Put the verbsin one of the Perfect Passive forms. Put a subject before them and translate:

to be delivered

to be expanded

to be connected

to be required

8.Change the following sentences into the corresponding noun-phrases with attributes:

MODEL: The room had a low ceiling. - A room with a low ceiling.

The water is for drinking. - Drinking water.

1. The day was rainy. 2. The remark is very clever. 3. Her heart was kind. 4. The desk is for writing. 5. The train was approaching. 6. The coat was made of wool. 7. The problem had a difficulty.

9. Form three forms of the verb:

forget, shine, speak, put, draw, sing, take, teach, win, see, lose, hurt

UNIT 12

1.Translate the following words and word combinations:

facility (n), residues (n), to encompass, to yield , chips (n), pellet (n), sawdust (n), straw (n), wastes (n), to store, compared to (prep.),

2. Read and translate the following international words, paying special attention to their pronunciation:

generate v, biomass n, synthesis n, approximate v, material n, method n, system n, agricultural a, aeration n, gasification n, pyrolysis n, reactor n, organic a, system n, electric a,electricity n, regulations pl n, bacteria pl n (singular "bacterium" [-riəm]).

3. Name the verbs from which the following nouns were formed. Use your dictionary. Translate all the worlds:

conversion, combustion, regulation, generation, combination, digestion, usable, decomposition, dispatchability, modification, meaning, gasification.

What suffixes of nouns were used to form them from the corresponding verbs?

4. Find in the text words of similar meaning:

rapidly**,** typically**,** include**,** option, advantage

5. Form "attribute chains" instead of word combinations with the preposition "of" and translate them:

the method of biomass conversion, direct combustion of biomass material, the content of medium-energy gas, the fuel value of biomass, the combustion of biomass, options of the conventional process, the absence of oxygen, the generation of electricity.

6.Read and translate the text:

TEXT №15. BIOMASS FOR ELECTRICITY GENERATION

Biomass is used for facility heating, electric power generation, and combined heat and power. The term biomass encompasses a large variety of materials, including wood from various sources, agricultural residues, and animal and human waste.

Biomass can be converted into electric power through several methods. The most common is direct combustion of biomass material, such as agricultural waste or woody materials. Other options include gasification, pyrolysis, and anaerobic digestion. Gasification produces a synthesis gas with usable energy content by heating the biomass with less oxygen than needed for complete combustion. Pyrolysis yields bio-oil by rapidly heating the biomass in the absence of oxygen. Anaerobic digestion produces a renewable natural gas when organic matter is decomposed by bacteria in the absence of oxygen.

Different methods work betterwith different types of biomass. Typically, woody biomass such as wood chips, pellets, and sawdust are combusted or gasified to generate electricity. Corn stover and wheat straw residues are baled for combustion or converted into a gas using an anaerobic digester. Very wet wastes, like animal and human wastes, are converted into a medium-energy content gas in an anaerobic digester. In addition, most other types of biomass can be converted into bio-oil through pyrolysis, which can then be used in boilers and furnaces.

Compared to many other renewable energy options, biomass has the advantage of dispatchability, meaning it is controllable and available when needed, similar to fossil fuel electric generation systems. The disadvantage of biomass for electricity generation, however, is that the fuel needs to be procured, delivered, stored, and paid for. Also, biomass combustion produces emissions, which must be carefully monitored and controlled to comply with regulations.

7. Translate from Russian into English:

соблюдать законы, по сравнению с, подобный, опилки, жидкие отходы, анаэробный перегниватель, пеллета, древесная биомасса, недостаток, упаковывать в кипы, синтетический газ, давать выход

8. Mind different translation of “in addition” – кроме того, к тому же;“in addition to”- наряду с. Translate the following sentences:

1. In addition, most other types of biomass can be converted into bio-oil through pyrolysis, which can then be used in boilers and furnaces.

2. In addition, emission controls for unburned hydrocarbons, oxides of nitrogen, and sulfur might be required, depending on fuel properties and local, state, and Federal regulations.

3.In addition, small-scale (100 to 1,500 kW) steam enginesand steam turbines (100 to 5,000 kW) that are fueled by solid biomass are currently available in Europe.

4. The analysis should be conducted during controlled test runs in addition to ongoing testing that may be required by local regulatory authorities.

9.Translate the sentences with preposition "by" (посредством, спомощью):

1.Gasification produces a synthesis gas with usable energy content by heating the biomass with less oxygen than needed for complete combustion.

2. Pyrolysis yields bio-oil by rapidly heating the biomass in the absence of oxygen.

3. Anaerobic digestion produces a renewable natural gas when organic matter is decomposed by bacteria in the absence of oxygen.

10. Make the comparative and superlative form of the adjective:

large,little, natural, organic, simple, difficult, cheap, far, urgent

II. TEXTS FOR SUPPLEMENTARY READING
ТЕКСТЫДЛЯДОПОЛНИТЕЛЬНОГОЧТЕНИЯ

Text №1.INVENTIONOFSTEAM_ENGINE

The first steam device, the aeolipile (эолипил, шар Герона), was invented by Hero of Alexandria, a Greek, in the 1st century AD, but used only as a toy. Incidentally, 700 years earlier in Corinth, Greece, rail tracks were invented; however the Greeks never thought of putting the two together.

Early industrial steam engines were designed by Thomas Savery (The "fire-engine", 1698) and Thomas Newcomen (1712). In 1769 Watt patented improvements to the Newcomen engine that made it much more fuel efficient, which finally led to the general acceptance and use of steam power.

The first industrial applications of the vacuum engines were in the pumping of water from deep mineshafts. The Newcomen steam engine operated by admitting steam to the operating chamber, closing the valve, and then admitting a spray of cold water. The water vapor condenses to a much smaller volume of water, creating a vacuum in the chamber. Atmospheric pressure, operating on the opposite side of a piston, pushes the piston to the bottom of the chamber. In mineshaft pumps, the piston was connected to an operating rod that descended the shaft to a pump chamber. The oscillations of the operating rod are transferred to a pump piston that moves the water, through check valves, to the top of the shaft.

The first significant improvement, 60 years later, was creation of a separate condensing chamber with a valve between the operating chamber and the condensing chamber. This improvement was invented on Glasgow Green, Scotland by James Watt and subsequently developed by him in Birmingham, England, to produce the Watt steam engine with greatly increased efficiency. The next improvement was the replacement of manually operated valves with valves operated by the engine itself.

In 1802 William Symington built the "first practical steamboat", and in 1807 Robert Fulton used the Watt steam engine to power the first commercially successful steamboat.

Such early vacuum, or condensing, engines are severely limited in their efficiency but are relatively safe since the steam is at very low pressure and structural failure of the engine will be by inward collapse rather than an outward explosion. Their power is limited by the ambient air pressure, the displacement of the working chamber, the combustion and evaporation rates, and the condenser capacity. The maximum theoretical efficiency is limited by the relatively low boiling point of water at near atmospheric pressure (100 °C, 212 °F).

The next big improvement in efficiency came with Richard Trevithick's use of pressurized steam, which used a far greater pressure, but more importantly (from a thermodynamic standpoint) operates at a higher temperature differential. But with this added pressure came much danger and many disasters due to exploding boilers and machinery. The most important refinement at this point was the safety valve,

which releases excess pressure. Reliable and safe operation came only with a great deal of experience and codification of construction, operating, and maintenance procedures.

Text №2. THE INTERNAL-COMBUSTION-ENGINE POWER PLANT

The internal-combustion-engine power plant may include essential auxiliaries. The fuel is burned directly in the cylinder of the engine or prime mover, and the high pressure thus generated drives the piston downward and rotates a crank- shaft.

Air is supplied to the engine silencer and cleaner, the function of which is to reduce noise and remove dust which would accelerate cylinder and piston wear if allowed to enter the cylinder.

A supercharger is installed in the air-intake system. The function of the supercharger is to increase the amount of air supplied to the cylinder by acting as an air pump. This, in turn, permits burning more fuel and obtaining more power from a given size of cylinder. An intake manifold is used to distribute the air equally from the supercharger to the various cylinders of multi-cylinder engine.

The exhaust system consists of an exhaust manifold for collecting the discharge gases from each of the cylinders into a common exhaust line, an exhaust silencer or muffler for reducing noise, and the exhaust stack for disposing of the exhaust gases to the atmosphere without creating a public nuisance.

The cooling system includes a pump for circulating water through the cylinder jackets and heads of each cylinder and a heat exchanger to remove the energy absorbed in the engine by the cooling water. The heat exchanger may be air-cooled as in the automobile radiator, or it may be water-cooled. Seldom is raw water fit to circulate directly through the jackets of an internal-combustion engine.

The lubricating oil may be passed through a cooler, filter, and reservoir and is supplied to the engine under pressure by means of an oil pump, usually to a hol- low crankshaft. The oil serves as a lubricant, for the rubbing surfaces of the engine and also as a coolant.

The fuel system consists of a storage tank from which the fuel may be supplied to a small day tank or reservoir. The oil is filtered and pumped as needed to the fuel-injection system which is an integral part of the engine.

Since the fuel is burned directly in the cylinder of the prime mover, the internal-combustion-engine power plant is simpler and more compact than the steam power plant. It is seldom built in engine sizes of more than 4000 hp, whereas a 300,000-hp steam turbine is common. It is more efficient than a steam power plant of comparable size but not so efficient as large steam central-station plants, which moreover can burn a cheaper grade of fuel. Consequently, the internal-combustion engine is used primarily in the transportation field for driving automobiles, buses, trucks, tractors, locomotives, ships, and airplanes where a compact, light-weight, efficient power plant of relatively small size is necessary.

Text №3. BOILERS

Boilers are of two main types:

1. *Fire-tube boilers.* These are boilers with straight tubes that are surrounded by water and through which the products of combustion pass. The tubes are usually installed within the lower portion of a single drum or shell below the water-line.

2. *Water-tube boilers.* These are boilers in which the tubes themselves contain steam or water, the heat being applied to the outside surface. The tubes are usually connected to two or more drums set parallel, or across, the centerline. The drums are usually set horizontally.

The location of the furnace to the boiler is indicated by the description of the furnace as being internally or externally fired: 1) the furnace is internally fired if the furnace region is completely surrounded by water-cooled surfaces; 2) the furnace is externally fired if the furnace is auxiliary to the boiler or built under the boiler.

During the evolution of the boiler as a heat producer many new shapes and designs have appeared. Some of these boilers have become popular and are widely recognized in the trade, including the following:

1. Fire-tube boilers - horizontal return tubular, short firebox, compact,

locomotive, vertical tube (steam jenny), Scotch type, and residential units.

2. Water tube boilers - both horizontal straight tube and bent tube units.

The horizontal straight tube boiler may have a box type header made of steel plate, or a sectional header each section of which connects the tubes in a single vertical row. The bent tube boiler may have one to four drums.

If the drum is parallel to the tubes, the boiler islong - longitudinal drum; if across the tubes, it is a cross drum. If the furnace is enclosed with water-cooled surfaces, it is a waterwall (water-cooled) furnace.

Text №4. A SIMPLE POWER PLANT CYCLE

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.

Text №5.CARNOT EFFICIENCY

When considering any heat process or power cycle it is necessary to review the Carnot efficiency that comes from the second law of thermodynamics. The Carnot efficiency equation gives the maximum thermal efficiency of a system undergoing a reversible power cycle while operating between two thermal reservoirs at different temperatures.

The maximum efficiency as a function of the steam exhaust temperature can be plotted by keeping the cooling water temperature constant. Assuming the

temperature of the cooling water is around 20 ºC (a warm summer day), larger temperature difference leads to a higher thermal efficiency.

Although no practical heat process is fully reversible, many processes can be calculated precisely enough by approximating them as reversible processes.

To give a practical example of the use of this theory on steam boilers, consider the Rankine cycle. The temperature of the hot reservoir would then be the temperature of the steam produced in the boiler and the temperature of the cold reservoir would be the temperature of the cooling water drawn from a nearby river or lake.

Text № 6. BASICS OF BOILERS AND BOILER PROCESSES

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, preheater 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.

III. УСТНЫЕ ТЕМЫ
TOPICSFOR DISCUSSION

Text № 1.ABOUT MYSELF

My name's… I'm a first-year student of the Higher School of Technology and Energy which is a part of Saint Petersburg State University of Industrial Technologies and Design. I study at the Institute of Energy and Automation. I'm a full-time student.

I have a small (big) family. My brother (sister) and I live with my parents. My brother's (sister's) name is …. . He (she) is …years old. My brother (sister) studies economics in college. My father is a software developer. He works on his own project. My mother's a housewife. Gardening is my mother's favourite pastime.

I got interested in physicswhen I was at school and now it's my favourite subject. I think I'm good at it. It's also the key subject at our Institute. Besides physics the first-year students study mathematics, chemistry, history of Russia, technical drawing, computer science, a foreign language and some other subjects. My weak point is English. I have to work hard at it in order not to lag behind the group.

We have lectures, classes and work in the laboratories. As a rule, we have three or four lectures a day. Our lectures begin at 9.30. So I have to get up early in order not to be late for them. I go to the Higher School by underground (by bus). It takes me about an hour to get to it. We try not to miss our classes and lectures. We usually take notes at the lectures as it will be easier to read up for our exams. We'll have our

exams in January and then we'll have vacation.

It's very interesting to study new subjects, but it's not always easy to work regularly.There are 26 students in our group. Many of them live in the dormitory (students' hostel). It's not far from the Higher School and they walk there.

We have to study hard so we don't have free time on week days. At weekends we go to the cinemas, theatres, museums, exhibitions, or to a disco.

Work in pairs. Ask and answer the questions:

1.What's your name?

2.What do you do?

3.Tell me about your family.

4.Where do you study?

5.What are your hobbies?

6.What is your favourite subject?

7.What subject is your weak point?

8.How many lectures (classes) do you have a day?

9.What time do they begin?

10.Do you sometimes miss lectures (classes)?

11.What can you do to become an excellent student?

12.What time do you have to get up in order not to be late for lectures?

13.How long does it take you to get to the Higher School?

14.How many students are there in your group?

15.What do you usually do in your free time?

Text № 2. THE HIGHER SCHOOL OF TECHNOLOGY AND ENERGY

The Higher School of Technology and Energy was founded in 1931. At that time it was an Institute for the pulp and paper industry and trained specialists for this branch. Every other engineer working in this field was the graduate of the Institute. Some years ago its structure was modernized. Today the Higher School of Technology and Energy has become a part of Saint Petersburg State University of Industrial Technologies and Design.There are 4 educational Institutes at our Higher

School:

1. The Institute of Technology which trains engineers of different specializations for the pulp and paper industry;

2. The Institute of Power Engineering and Automation which trains qualified engineers capable of operating the most complicated up-to-date technological processes, who are competent in applying modern kinds of equipment;

3. The Institute of Management and Economics which trains engineers-economists who can supervise all kinds of problems connected with the management of industrial manufacturing from the economic point of view;

4. The Institute of Part-Time and Distance Education. These two types of education train the same specialists as the full-time education, and the graduates get the same diploma at the end of their studies.

So there are full-time, part-time students and students of distance education. At the Higher School of Technology and Energy the education is realized by different chairs, where qualified lecturers, assistant professors and professors deliver lectures, direct classes and carry out laboratory works. Every theoretical course is followed by practical training. The course of studies lasts 4 and 6 years. The first- and second-year students study general engineering subjects. In the third year the students 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. If the results of the examinations are good, the students get grants.

Recently the Higher School of Technology and Energy has switched to 2-level education programs. The students study according to Bachelor's (4 years of full-time education) and Master's (two years more of full-time education) programs. At the end of their studies the students are granted Bachelor's and Master's diplomas.

Work in pairs. Ask and answer the questions:

1.What's your name?

2.Tell me about your family.

3.Where do you study?

4.What are your hobbies?

5. What is your favourite subject?

6. What subject is your weak point?

7. How many lectures (classes) do you have a day?

8. .How long does it take you to get to the Higher School?

9. How many students are there in your group?

10. What do you usually do in your free time?

Text № 3. SAINT PETERSBURG

St. Petersburg is my home town. It is one of the largest industrial and cultural centres and one of the most beautiful cities in the world.It was founded in 1703 by Peter I and for over 200 years (from 1714 till 1917) was the capital of Russia.

The city began with the Peter and Paul Fortress. The Peter and Paul Cathedral, the first church of the city, is worth seeing: it is an outstanding architectural monument.

St. Petersburg is famous for its architecture. There are many fine buildings, beautiful monuments, rich museums, parks and gardens in the city. The monument to Peter I (Bronze Horseman), St. Isaac's Cathedral, the Admiralty, the Hermitage, the Summer Gardens, the Russian Museum, Palace Square with the Alexander Column - all of them have a world fame.

The historical center of St. Petersburg is the Admiralty. Nevsky Prospect is the main street of the city. It begins at the Admiralty and ends at the Alexander Nevsky Lavra. If you walk along Nevsky Prospect, you will see many beautiful buildings. You will see the famous Kazan Cathedral with the monuments to the Russian generals Kutuzov and Barklay deTolli, the Alexandrinsky Theatre with the monument to Kathrine II in front of it, the Anichkov Palace and the Belosselsky-

Belozersky Palace, facing each other across the Fontanka River. The bridge over the Fontanka is famous for Klodt' s sculptural groups of a man taming a horse.

There are many theatres in St. Petersburg, such as the Mariinsky Opera and Ballet House, the Maly Opera and Ballet House, the Alexandrinsky Theatre, the Tovstonogov Drama Theatre, the Akimov Comedy Theatre, the Musical Comedy and many others.

St. Petersburg is also famous for the beautiful Neva and its embankments and bridges. The city is especially beautiful during the White Nights in summer.

Work in pairs. Ask and answer the questions:

1. When was St. Petersburg founded?Who is the founder of St. Petersburg?
2. What did St. Petersburg begin with? Which is the first church built in the town?
3. When was St. Petersburg the capital of Russia?
4. What is worth seeing in St. Petersburg?
5. What is the historical center of St. Petersburg?
6. What is the main street of St. Petersburg?
7. What can you see if you walk along the Nevsky Prospect?
8. What monument stands in front of the Alexandrinsky Theatre?
9. What is the bridge over the Fontanka famous for?
10. In what season is St. Petersburg especially beautiful?

Text № 4. MY FUTURE OCCUPATION

I study at the Higher School of Technology and Power engineering of Saint Petersburg State University of Industrial Technologies and Design. I am a full-time second-year student of the Institute of Power Engineering and Automation.

Our Institute trains qualified engineers capable of operating the most complicated up-to-date technological processes, who are highly competent in applying modern kinds of equipment in the most efficient manner.My future specialization is Heat Power Engineering.

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 a real professional.

After graduation I am going to work according to my education. I think that my future work is not easy, but absolutely necessary for our national economy.

Work in pairs. Ask and answer the questions:

1.What department do you study at?

2.What is your future specialization?

3.Where do the graduates of your department work?

4. Why is our industry and economy connected with power engineering?

5.At present great attention is paid to combined generation of heat and electricity at heat and power plants and to centralized heat supply, isn'it?

6. Why isn't impossible to imagine our life without heat and electricity?

7. Why do you think that a heat-power enginer is an extremely necessary and important specialist?

8. Do modern enterprises (предприятия) play an important role in the energy system?

9. Are you going to work as a heat-power engineer?

10. Do you like your future occupation?

IV. THEORETICAL AND GRAMMATICAL SECTION

ТЕОРЕТИКО-ГРАММАТИЧЕСКИЙ РАЗДЕЛ

1. МНОГОФУНКЦИОНАЛЬНЫЕ ГЛАГОЛЫ TOBE ИTOHAVE

Таблица 1

Употребление	**To be** **Находиться, пребывать**	**To have** **Иметь, обладать**
1	2	3
1. Смысловой глагол	The fuel-injection system **is** an integral part of the thermal engine. - Система введения топлива **является** неотделимой частью теплового двигателя.	A steam generator **has** a series of heat exchangers. - Парогенератор **имеет** ряд теплообменников.Упарогенератора **имеется**целыйрядтеплообменников.
2.Вспомогательныйглаголдляобразованиягруппвремен, непереводится.	Thismaterial**isoffering**highresistance totheflowofcurrent (Continuous). - Этотматериал**оказывает**высокоесопротивлениепотокутока.	Thismethod**hasfound**universalrecognition (Present Perfect) - Этотметод**нашел**всеобщеепризнание.
3. Вспомогательный глагол для образования страдательного залога	Thelecture**wasdelivered**yesterday. - Лекцию**прочитали**вчера. Лекция **была прочитана** вчера.	_

Окончание табл. 1

1	2	3
4. Модальный глагол (в сочетании с инфинитивом с частицей “to”) в значении долженствования.	A boiler **is to generate** steam. - Котёл **должен вырабатывать** пар.	They **have to** use this new method in their research worn. - Они **должны** использовать этот новый метод в своем исследовании.
5. Оборот there is/there are	In recent years **there has been** a great increase in size, capacity and output of Russian turbines. - Внедавниегоды**было**(**произошло**) большоеувеличениевразмерах, объёмеипроизводительностироссийских турбин.	

EXERCISES

1. Translate the following sentences taking into account the different functions of the verb «to be».

1. Most steam power plants of large size are now being built for operation at steam pressure of 1500 to 2400 psi, and in some plants more high pressures are being used.

2. Turbine generator units of these capacities are being supplied with steam from a single steam generating unit.

3. These engineers are looking for new methods of cooling materials.

4. Some of the boiler water is blown to a sewer, carrying out of the system the impurities that are coming into the boiler.

5. The aim of many early experimenters was the production of light sources small enough to be used in the house.

6. The fundamentals of electricity are the fundamentals of electronics, both are branches of physics.

7. Industrial power plants are frequently noncondensing plants because large quantities of low pressure steam are required for manufacturing operations.

8. A superheater is a coil of tubing surrounded by the hot products of combustion.

9. If combustion is to be complete in a furnace of economical size, turbulence is essential.

10. As the pressure increases, greater tube spacing is required and the tubes are to be smaller in diameter.

11. The furnace walls are to be covered with boiler tubes either partially or fully.

12. The jet condenser is to be used for small prime mover installations.

13. The aim of a circulating pump in a condenser is to circulate the cooling water.

14. In many cases the air circulation is inadequate, and mechanical equipment is to be built to supplement the natural circulation.

15. There are two types of water turbines: the reaction turbines and the impulse turbines.

16. The volute shape of the pump casing is to permit flow with minimum friction to convert a part of velocity head into static head.

17. Besides the principal components of a modern thermal power-station there are many additional parts of the plant.

18. There is a danger of corrosion in the tube due to low flue gas temperature.

19. If the source of cooling water is a lake or a river, there is no need for water conservation.

20. In this superheater there will be a decrease in steam pressure due to friction in the superheater tubing.

21. Conduction occurred in liquids and gases at rest, that is, where there was no motion of the molecules.

2. Translate the following sentences taking into account the different functions of the verb « to have ».

1. The plungers have a characteristic forward and upward motion.

2. Combustion in the cyclone furnace is complete and has practically no carbon loss.

3. Series of lectures on new types of turbines have been delivered at our research centre this year.

4. The coal has to be taken from the bunkers to the feeding hoppers on the boilers. 5. An extensive program of theoretical research and experimentation has been carried out before the first departments of the mill were built.

6. Long tubes closely spaced have to maintain high air and gas velocities.

7. Condensate from the turbine condenser has to be used as cooling water to condense the steam in the ejector.

8. A chain-grate stoker has a moving grate in the form of a continuous chain.

9. Polzunov’s engine has been working from August to November 1766.

10. One of the most important problems the engineers have to study is the efficient and controlled transfer of fluids from one point to another.

11. Boilers that have the hot products of combustion in the tubes and water outside the tubes are called fire tube boilers.

12. One has to maintain the gas at a low temperature in order to permit an increase in the mass rate of flow with corresponding reduction in size and horsepower.

13. The horizontal straight tube boiler is simple in operation and has low draft loss. 14. Since the economizer has water in the tube and dry gas around the tube, the major resistance to heat transfer is on the gas side.

15. A small stoker fired steam generating unit has a capacity of 72,500 lb. of steam per hr.

16. Because of variable or seasonable supply of gaseous fuels, combination burners have been developed to permit the simultaneous burning of the available gas together with pulverized coal or oil.

17. Among the advantages of this type of generators is the fact that it does not have to be synchronized.

18. The condensate pump has to return the condensate to a surge tank where it can be reused as boiler feedwater.

19. The atmospheric relief valve has to relieve the pressure in the condenser in case the condenser or auxiliaries do not function properly.

20. The turbine operating at high speed has the following advantages: lighter weight, more compactness, great suitability for high-pressure, high-temperature operation.

21. Heat has been defined as energy that is being transferred across the boundaries of a system because of a temperature difference.

22. The simplest type is the single-cylinder turbine, for it is compact and has few parts.

23. During the evolution of the boiler as a heat producer many new shapes and designs have appeared.

24. Small turbines, varying in size from a few horsepower to several thousand horsepower have to be used, wherever steam is readily available at low cost or where exhaust steam is needed.

25. Liquid, gaseous and vapour states of fluid have a tendency to move because of natural forces.

2. ИМЕНА СУЩЕСТВИТЕЛЬНЫЕ В РОЛИ ОПРЕДЕЛЕНИЯ

Существительное в притяжательном падеже является определением к другому, следующему за ним существительному: *themanager'ssignatureподпись заведующего, thecaptain'scabin капитанская каюта (каюта капитана).* Однако существительное может служить определением к другому существительному, когда оно стоит перед ним и в общем падеже, т.е. без всякого изменения своей формы. В этом случае существительное, стоящее слева от основного слова, переводится на русский язык прилагательным или существительным в родительном падеже (отвечает на вопросы: «какой?», «какие?», «чего?») или существительным с предлогом ***в, из, на, для***:

waterlevel – уровень воды,

pressuredrop – спад (перепад) давления,

watervapor – водяной пар,

circulationpump – циркуляционный насос,

boilerpressure– давление в котле.

Такие словосочетания («цепочки») могут состоять из существительного и определений, расположенных **слева** от него, выраженных прилагательным, причастием, местоимением или числительным, а также сочетаниями из этих слов, соединёнными дефисом. Слева могут быть два и более существительных. Необходимо обратить внимание на то, что внутри такого сочетания **слова не отделены друг от друга ни артиклями, ни предлогами, ни запятыми**:

renewableenergysources – возобновляемые источники энергии

thesimpleopengas-turbinepowercycle – энергетический цикл простой открытой газовой турбины.

Для перевода «цепочки» существительных важно найти в ней главное слово. О*сновным словом* любой «цепочки» существительных является ***последнее*** *существительное, с которого и следует начинать анализ* такой «цепочки». Справа от основного слова, указывая на то, что «цепочка» закончилась, может стоять новый артикль, предлог, местоимение, прилагательное, причастие или глагол-сказуемое с предшествующим наречием или без него.

При переводе многочленных словосочетаний рекомендуется:

1) перевести последнее существительное «цепочки»;

2) разбить остальную часть словосочетания на *смысловые группы* и перевести их (внутри смысловой группы анализ проводится слева направо);

3) перевести всё словосочетание (всю «цепочку»), следуя *справа налево.*

Пример:*waterqualityresults – результаты по качеству воды; qualitycontrolmethod – метод контроля качества.*

Если прилагательное предшествует «цепочке» существительных, необходимо обратить внимание на то, *к какому слову оно относится*.

high*evaporationrate– высокая скорость испарения,* ***automatic*temperaturecontrol***– автоматическое регулирование температуры.*

В состав «цепочки» существительных в качестве определения могут входить числительные, местоимения, причастия, существительные в притяжательном падеже и т.д. Следует обратить внимание, *к какому слову эти определения относятся. Основное слово словосочетания – последнее существительное, которое переводится* существительным:

thishighpressuresteam*– этот пар высокого давления,* ***ratedeterminingfactor****– фактор, определяющий скорость.*

Иногда одно из слов «цепочки» существительных необходимо перевести *поясняющими словами (группой слов):*

steampressuremeasuringdevice*– прибор для измерения давления пара.*

EXERCISES

1. Translate the sentences paying special attention to the translation of nouns.

Example: This scientist works at some problem of **low temperature physics**. - Этот учёный работает над одной проблемой **физики низких температур**.

1. Natural gas is used for steam generation in gas producing areas.

2. These areas are served by natural gas transmission lines.

3. The furnace height is the function of the regrouped furnace volume.

4. Superheaters requirements may govern exit temperature.

5. Pulverized coal furnaces are usually convertible to firing with oil or gas.

6. The flame shape determines the furnace width and depth dimensions. The design of the amount of heat transfer surface is based on the laws of heat transfer and economics.

7. Heat is an energy that is transferred across the boundaries of a system because of a temperature difference.

8. When the gases leave the completely water cooled furnace they pass across the superheater furnace. A heat exchanger consists of a metal wall through which heat flows from one fluid to another.

3. СТЕПЕНИ СРАВНЕНИЯ ПРИЛАГАТЕЛЬНЫХ

Таблица 2

Положительная степень	**Сравнительная степень**	**Превосходная степень**
1. Односложные прилагательные		
long – длинный	longer – длиннее	the longest – самый длинный
2. Многосложные прилагательные		
important – важный	more important – более важный less important – менее важный	the most important – самый важный the least important – наименее важный
Сравнительные союзы		
than– чем: **You are older than me.** – Ты старше **меня**. (Ты старше, **чем я**.) **as…as...** – такой же... как... **notso...as...** – не такой... как... **the…the…** – чем…, тем...: **Themore, thebetter – чем больше, тем лучше.**		
3. Исключения		
good - хороший	better – лучше	the best – самый лучший
bad - плохой	worse – хуже	the worst – хуже всех
much, many- много, многие	more – больше	the most – наибольший
little – маленький	less – меньше	the least – наименьший

Mostперед существительным – «большинство», «большая часть»: mostofthestudents – большинство студентов

4. СТЕПЕНИ СРАВНЕНИЙ НАРЕЧИЙ

Таблица 3

Положительная степень	**Сравнительная степень**	**Превосходная степень**
fast быстро	faster быстрее	fastest быстрее всего
hard усердно	harder усерднее, более усердно	hardest усерднее всего
late поздно	later позднее	latest позднее всего
soon скоро	sooner скорее	soonest скорее всего
early рано	earlier раньше	earliest раньше всего
Наречия на –ly		
clearly ясно	more clearly яснее, более ясно	most clearly яснее всего
correctly правильно	morecorrectly правильнее, более правильно	most correctly правильнее всего
Исключения из правила:		
well хорошо	better лучше	best лучше всего
badly плохо	worse хуже	worst хуже всего
much много	more больше	most больше всего
little мало	less меньше	least меньше всего
far далеко	farther, further дальше	farthest, furthest дальше всего

EXERCISES

1. Translate the sentences taking into account the degrees of comparison of adjectives and adverbs.

1. The thermonuclear reactors absorb more energy than they generate.

2. The more satisfactory ignition may be ensured, the better.

3. The coals of this type are most satisfactorily burned on chain-grate stoker.

4. The more space is provided by the furnace, the less unburned fuel will escape from it.

5. Most fuel is burned near the exit from the furnace.

6. The better the equipment suits to the type of the fuel, the more its efficiency will be.

7. Man is using more and more the organic fuel sources.

8. The lower the combustible gases are cooled, the worse they will burn.

9. The pressure in the furnace was slightly less than the atmospheric pressure.

10. The greater is the mixing of oxygen with combustible gases, the more is the increase of combustion rate.

11. The thinner the wire, the greater the developed heat. On the contrary, the larger the wire, the more negligible is the heat produced.

12. In order to produce electricity under the most ecological conditions, the generators must be as large as possible.

13. In case that the number of turns (виток) on the secondary winding is greater than those on the primary, the output voltage is larger than the input voltage and the transformer is called a step-up-transformer.

14. In some countries, such as Norway, Sweden and Switzerland more electric energy is produced from water power than from steam.

15. Cleaning is easier when the gases pass through the tubes.

16. In general, most of the steam is generated is the furnace wall tubes, because they can absorb radiated energy from the high temperature flame.

17. Physics is the most precise and mathematical science.

18. The planet Mars is much less massive than the Earth but its density is greater than that of the crustal rock of the Earth.

5. ВРЕМЕНА ГЛАГОЛА В АКТИВНОМ ЗАЛОГЕ

Таблица 4

	SIMPLE	**CONTINUOUS**	**PERFECT**	**PERFECT CONTINUOUS**
PRESENT	Do (does), V_1/Vs I, you, we, they **ask/write**. He, she, it **asks/writes**. *every day* *usually* *always* *sometimes* *often*	Am +V(ing) is +V(ing) Are +V(ing) I **amasking/writing.** He, she, it **is asking/writing.** You, we, they **are asking/writing.** *now, at this moment, at present*	Have +V_3 (ed) I, you, we, they**have asked/written**. He, she, it**has asked/written**. *ever, never, just, already,* *yet (в отрицании нет еще; в вопросе уже)* *recently/lately,* *for 2 days* *since 1997* *this year/month/week*	Have/has been+V(ing) I, you, we, they**have been asking/writing**. He, she, it**has been asking/writing**. *since early morning, for … hours, since he came*

Окончание табл. 4

	SIMPLE	CONTINUOUS	PERFECT	PERFECT CONTINUOUS
PAST	**Did**, V_2 (**ed**) *yesterday* *last week* *2 years ago*	**was** +V(**ing**) **were** +V(**ing**) *at 5 o'clock yesterday* *from 3 to 5 o'clock yesterday* *for the whole day*	**had**+V_3 (**ed**) *by 5 o'clock yesterday* *before I came*	**hadbeen**+V(**ing**) *by the time* *for two hours when i came*
FUTURE	**will** +V1 *tomorrow*	**will b**e+ V(**ing**) *at5o'clock tomorrow*	**will have** +V3(**ed**) *by 5 o'clock tomorrow*	**will have been**+V(**ing**) *for two hours when I come*

EXERCISES

1. Open the brackets and put the verbs in the Present Simple. Translate the sentences.

1. The department of heat-power engineering (to train) qualified heat-power engineers capable to operate the most complicated up-to-date technological processes.

2. The first-year students (to have) lectures, classes and (to work) in the laboratories.

3. The students (to take) notes at the lectures as it will help them to read up for their examinations.

4. Water (to circulate) from the steam drum to the lower drum through six rows of tubes and the comparatively low gas temperature results.

5. The steam (to pass) on its way through the turbine.

6. Simple impulse turbine (to have) a considerable number of pressure stages.

7. The engineer closely (to examine) the results of the operation.

8. The arrangement of the tubes (to permit) to reduce the length of the turbine to be reduced.

2. Open the brackets and put the verbs in the Past Simple. Translate the sentences.

1. Last year I (graduate) from the secondary school and I (enter) this university.

2. I (get) interested in mathematics when I (be) at school.

3. Yesterday it (take) me an hour to get to the university. I (not miss) the first lecture and (arrive) in time.

4. For three days they (carry out) this interesting work.

5. They speak English rather well, but last year they (speak) poorly.

6. Modern hydroelectric power stations (begin) to use water power to turn the machines which generate electricity.

7. The construction of the steam engine (involve) great difficulties.

8. A boiler feed pump (deliver) the water to economizer.

9. As furnace input (increase), the entire floor was water-cooled.

10. They (provide) the boiler with a steel frame and with brick setting.

3. Open the brackets and put the verbs in the Future Simple. Translate the sentences.

1. My elder sister (graduate) from our university next year. Her speciality (be) engineer economist.

2. We usually take notes at the lectures as it (be) easier to read up for exams.

3. We (have) our exams in January and then we (have) vacation.

4. Tomorrow the lecture on physics (begin) at 9.30.

5. The design of machines for using water power greatly (depend) on the nature of the available water supply.

6. In order to keep surface to a minimum and thus reduce the cost of the superheater, it should be located where high-temperature gases (flow) around the tubes.

7. In conventional boiler the theoretical minimum flue-gas temperature (be) the saturation temperature of the water in the boiler tubes.

8. The expansion of the steam (take place) in the fixed nozzle passages.

9. Because of the great efficiency of large units turbine manufacturers (continue) to raise the upper limit of speed and capacity.

10. The water level in the drum (permit) separation of the steam from the water.

4. Open the brackets and put the verbs in the Present Continuous or Past Continuous. Translate the sentences.

1. Electronics (become) increasingly important in all branches of production.

2. The Russian scientists (solve) successfully important problems in mathematics, chemistry, electronics, medicine and biology.

3. During the flight the astronauts (observe) the earth and the sky.

4. During the work on his discovery the scientist observed that a small electric current (flow). He rightly concluded that some electrons (move) through the vacuum.

5. The spacecraft (circle) the globe when the newspapers all over the world began to comment its flight.

6. Within several years nuclear power plants (generate) great amount of electrical power.

7. The time will come when spacecrafts (fly) to the planets in the solar system.

8. Large installations with mighty turbogenerators (operate) at a number of thermal power-stations in this country.

9. One of the world's largest heating-and-power installations (operate) at the Moskovskaya thermal power-station-25.

10. Let us suppose now that a small current (flow) along a thick metal conductor.

11. Hydropower engineering (develop) mainly by constructing high capacity stations integrated into river systems known as cascades.

5. Open the brackets and put the verbs in the Present Perfect. Translate the sentences.

1. This year I (enter) the Saint-Petersburg state technological university of plant polymers.

2. They (solve) recently many important problems in the field of artificial radioactivity.

3. It is necessary to point out that the power machine building industry (start) to manufacture greater capacity installations for thermal power stations.

4. This method (find) universal recognition and application in a short period of time.

5. These countries (develop) large hydroelectric power stations for the past years.

6. If you (not see) a power station it will be difficult for you to imagine its enormous size.

7. Steam must be condensed after it (pass) through the turbine, and this requires large quantities of cooling water.

8. Science (solve) a lot of important problems and will solve still more in future.

9. They (solve) recently many important problems in the field of radioactivity.

10. They (complete) already their investigation.

6. Open the brackets and put the verbs in the Past Perfect. Translate the sentences.

1. My friend told me that he (see) already the new film.

2. Another problem which he (solve) by that time was important and interesting for researchers.

3. When he came into the laboratory, they (finish) already their experiment.

4. He (collect) some information about modern discoveries in the branch of biology by the end of last year.

5. After Becquerel (make) a great number of experiments, he discovered the phenomenon of radioactivity.

6. In 1898 the Curies discovered a new substance which they (receive) during their experiment. They found that it was much more active.

7. After we (construct) a number of new power stations, our country got cheap electric power.

8. By 1910 the steam turbine (replace) the reciprocating steam engine in the central station industry.

7. Open the brackets and put the verbs in the correct form. Translate the sentences.

1. Every day he (attend) lectures on mathematics.

2. Yesterday they (not work) in the laboratory as there was no electricity.

3. He (pass) his exams well, and now he (rest).

4. They (get) good results, which helped them in their work.

5. Many students (graduate) from the university last year.

6. When they (heat) water to 100 degrees it (begin) to boil.

7. Next year he (graduate) from the university and (leave) Saint-Petersburg for his native town.

8. They (use) this new device in their work soon.

9. Recently scientists and engineers (find) an increasing number of ways in which electronic conduction can be guided and controlled for useful purposes.

10. Interplanetary travel (become) a reality in our epoch.

11. The future of astronautics (be) a logical continuation of what has already been achieved.

12. The development of science and technology (open up) infinite possibilities for conquering the forces of nature.

13. The increase of the amount of air supplied to the cylinder (permit) burning more fuel and obtaining more power from a given size of cylinder.

14. The students (read up) for examinations.

15. Nuclear power stations on floating platforms (produce) not only great amounts of fresh water from the sea, but (help) on weather control.

6. ВРЕМЕНА ГЛАГОЛА В ПАССИВНОМ ЗАЛОГЕ

Таблица 5

Образуется: tobe (в соответствующем времени)+V_3/-ed (ParticipleII)			
	SIMPLE	**CONTINUOUS**	**PERFECT**
PRESENT	am is + V_3/-ed are I **amasked/written**. He, she, it**is asked/written**. You, we, they **areasked/written.**	am is + being+V_3/- ed are I **am beingasked/written**. He, she, it**is being asked/written**. You, we, they **are beingasked/written**.	have/has +been +V_3 /-ed I, you, we, they**have been asked/written**. He, she, it**has been asked/written**.
PAST	Was were + V_3/-ed I **wasasked/written**. He, she, it**was asked/written**. You, we, they **wereasked/written.**	Was were + being+V_3/- ed I **was beingasked/written**. He, she, it**was being asked/written**. You, we, they **were beingasked/written**.	have/has +been +V_3 /-ed I, you, we, they**had been asked/written**. He, she, it**had been asked/written**.
FUTURE	shall/will be + V_3/-ed I **will beasked/written**. He, she, it**will be asked/written**. You, we, they **will beasked/written.**	_	will have +been+V_3/- ed I **will have beenasked/written**. He, she, it**will have been asked/written**. You, we, they **will have beenasked/written**

7. СПОСОБЫ ПЕРЕВОДА СТРАДАТЕЛЬНОГО ЗАЛОГА

Таблица 6

Правила и способы перевода	Пример	Перевод
1. Страдательный залог показывает, что действие глагола-сказуемого направлено на лицо или предмет, выраженный подлежащим. В ряде случаев подлежащее переводится прямым или косвенным дополнением и ставится, соответственно, в форме винительного или дательного падежа.	**He** was given a task.	**Ему** дали задание.
	We were informed that a new idea had been advanced recently.	**Нас** информировали, что новая идея была выдвинута недавно.
2. Если после глагола в пассиве есть дополнение с предлогом **by**или **with**, то оно указывает, кем или чем производится действие. Предлоги переводятся «путём», «при помощи», «посредством» либо соответствуют творительному падежу и не переводятся.	Steam is produced **by three stream generators** .	Пар вырабатывается **тремя парогенераторами** (**при помощи** трёх парогенераторов).
	The boiler is supplied **withsteam**.	Котёл снабжается **паром**.

EXERCISES

1. Translate the sentences paying attention to the verbs in the Passive voice.

1. The attraction between molecules is being neglected.

2. The positive particle in the nucleus of the atom was given the name of "proton".

3. Some pressing problems will be discussed at the symposium.

4. Any deduction is usually preceded by a number of experiments and observations.

5. The gas turbines are used in such applications as electric power generation, natural gas transmission pumping and locomotives.

6. The high-pressure, high-temperature steam is expanded in a steam turbine which is generally connected to an electric generator.

7. The furnaces were first partly, then completely water-cooled to overcome the slagging of the boiler surfaces.

8. Some boilers are bottom supported, and others are suspended from the upper drums.

9. The passage of the water through small diameter tubes in the furnace is followed by its conversion into steam.

10. The increase of overall efficiency of the cycle is affected by efficiency of the feedwater heater.

11. The amount of steam pressure is influenced by the stress limitations of the heater shell.

12. The reduction of the amount of boiler feedwater is affected by condensing the steam in order that it can be returned to the boiler.

13. The choice of material for condenser tubes is influenced by cooling water, corrosive in nature.

14. Expansion and contraction of the condenser shell may be taken care of by providing an expansion joint in the shell wall at one end.

15. If noncondensable gases are permitted to collect in the condenser, the vacuum in the condenser will decrease.

16. A large energy drop can be dealt with in the first pressure stage of the impulse turbine.

2. Translate the sentences paying attention to that the verbs are in the Passive or Active Voice.

1. The stoker design aims at different purposes: maximum rates of burning, highest continuous efficiency and the unlimited choice of fuels.

2. Proper treatment of the coal at the correct time is realized on its passage through the furnace.

3. All pulverized coal-fired furnaces are partially or completely watercooled.

4. The feedwater entering the boiler at high temperature affects the reduction of temperature stresses within the boiler.

5. The design of heat exchangers is influenced by different functions which they perform and different conditions under which they operate.

6. If the furnace region is completely surrounded by water-cooled surfaces, the furnace is internally fired.

7. The turbine efficiency is adversely affected by a decrease in the pressure drop through the turbine.

8. The reduction of the size and the cost of the turbine are influenced by the high rotative speeds with relatively little vibration.

9. The construction of the steam engine involved great difficulties.

10. The water was delivered to economizer by a boiler feed pump.

11. The rotation of the wheels is affected by the steam which impinges on the wheel blades.

12. The high pressure drives the piston downward and rotates the shaft.

13. In the impulse turbines the expansion of the steam is carried out on stages which are referred to as "pressure stages".

14. The number of pressure stages in the impulse turbines is affected by the available heat drop.

15. The nuclear reactor, heat exchanger and pump replace the fuel burning equipment and the steam generator of the conventional steam power plant.

16. In the reaction turbines expansion in the stationary and rotating passages is followed by development of pressure at the entrance to the rotor blades.

8. МОДАЛЬНЫЕ ГЛАГОЛЫ

Таблица 7

Модальные глаголы и их эквиваленты	**Значение**	**Времена**		
		PRESENT	**PAST**	**FUTURE**
Can be able to	могу, умею	can work am (is, are) able to work – могу /может /умеет работать	could work was (were) able to work – мог /умел работать	— shall (will) be able to work – сможет / сумеет работать
may be allowed to	могу, можно, разрешено	may work am (is, are) allowed to work – могу/ можно/ разрешено работать	might work was (were) allowed to work – мог / было разрешено работать	— shall (will) be allowed to work – смогу / будет можно работать
must have to	должен, надо, нужно	must work have (has) to work – должен / приходится работать	— hadtowork – дол- жен был работать	— shall (will) have to work – должен буду работать
be to	должен, предстоит (обусловлено заранее намеченным планом)	am (is, are) to work – должен работать	was (were) to work – должен был рабо- тать	—
should	должен, должен бы, следует, следовало бы (наставление)	This equipment should be handled carefully. – С этим оборудованием следует обращаться осторожно.		
ought to	должен, следует (совет, моральный долг)	The results of this experiment ought to be checked.Результат этогоэкспериментанадо проверить.		

EXERCISES

1. Translate sentences paying attention to the equivalents of modal verbs.

1. They were allowed to provide us with all the necessary data.
2. The engineer will be able to discuss this problem with you next week.
3. We are able to obtain various fuels from the crude oil.
4. Before the designer begins his work he is to know the specifications of the future device.
5. You are allowed to use this computer for calculations which are necessary to you.
6. You have not to put so much fuel into the boiler.
7. In order to raise the productivity of labour we are to replace old machines with new ones.
8. On Monday he has to get up very early as his lectures begin at 8 o'clock.
9. You will have to come here again.
10. The student had to be sent to the hospital as he was badly hurt.

2. Translate sentences:

1. The length of the turbine is to be reduced.
2. All the heat must be transferred through the heating surfaces to reach water.
3. It should be noted that the hot end of the superheater is next to the furnace.
4. The steam has to pass on its way through the turbine.
5. Superheaters are to be classified as convection or radiant superheaters.
6. The feedwater can be converted into saturated steam of high quality of some desired pressure.
7. To maintain a high heat transfer for the heater the water velocity should be high.
8. The feedwater is able to be converted into saturated steam.
9. After the convection the heated or cooled fluid may flow to some other region.
10. A power plant has to be built on this river.
11. The expansion of the steam must take place in the fixed nozzle passages.

12. The products of combustion have to be cooled sufficiently before they enter the superheater tubes.

13. The temperature of cooling water has to vary only with atmospheric conditions.

14. The noncondensable gases being highly corrosive have to be removed from the condenser.

15. A power plant cycle has to convert a portion of the stored energy of a fuel into work.

16. The steam generation unit has to add energy to the fluid in the form of heat transfer from the burning fuel.

17. There may be two, three of four drums and one lower drum at the top of the boiler.

18. The bent tube allows great flexibility in design, particularly with regard to drum arrangement, as it may enter the drum radially.

19. Generally the pressure in a furnace should be slightly less than atmospheric pressure.

20. Electricity can be used to make magnets. One has to place a steel bar inside a wire coil and pass direct current through the coil.

21. The spring supports have to permit the condenser to rise or fall without overloading the turbine exhaust line.

22. Steam turbines may be broadly grouped into three types in accordance with the conditions of operation of the steam on the rotor blades.

23. It should be noted that the superheaters and reheaters occupy a major part at the total volume of the installation.

9. МНОГОФУНКЦИОНАЛЬНОЕ СЛОВО “ONE”

Таблица 8

Функция, значение	**Приме ры**	**Перевод**
1. Числительное «один», «одна», «одно».	This power plant is **one** of the oldest.	Эта электростанция – **одна** из старей- ших.
2. Формальное подлежащее в неопределенно-личных предложениях, самостоятельно и не переводится.	**One knows** (известно) **One believes** (считают) **One can** (можно) expect **One must** (нужно) expect **One may** (можно) expect that this mill makes good profits.	Известно, Считают, что этот завод Можно ожидать, имеет большие Нужно ожидать, прибыли. Можно ожидать,
3. Слово-заменитель. Перево- дится тем существительным, которое заменяет, или опуска- ется в переводе.	The new way of transporting fuel differs from the old **one**.	Новый путь перевозки топлива отли- чается от старого (**пути**).

EXERCISE

Translate the sentences, taking into account the translation features of the multifunctional word "one".

1. At the seminar he solved his problem and the one of his friend.

2. To measure the temperature one uses the thermometer.

3. The problem was a very difficult one.

4. One can say that heat is the form of energy.

5. Unknown and undiscovered phenomena can be found more effective than familiar ones.

6. One should pay attention to his work.

7. This component is similar to that one.

8. One must develop this method.

9. One might mention two kinds of mechanical energy: potential and kinetic.

10. The assertion is one which can be justified by a detailed proof.

11. Fahrenheit's construction is the one often used for the household thermometres.

12. One of the most important problems the engineer has to take into consideration is the efficient and controlled transfer of fluids from one point to another.

13. One can cool the exhaust gases leaving the turbine in the regenerator before they are discharged to the atmosphere.

14. This industrial nuclear power station was put into operation two years earlier than the British one and a half year earlier than the American nuclear power station.

15. At present gas is one of the most important fuels and our basic source of energy.

16. A noncondensing plant discharges the steam from the prime mover at an exhaust pressure equal or greater than atmospheric one.

10. МНОГОФУНКЦИОНАЛЬНЫЕ СЛОВА THAT, THOSE

Таблица 9

Функция, значение	Примеры	Перевод
1. Местоимения «этот», «эти», «тот», «те».	**Those** fuels are the most popular in our region.	**Эти** виды топлива наиболее популяр- ны в нашем районе.
2. Слова-заменители. Переводятся тем существительным, которое они заме- няют, или опускаются при переводе.	The efficiency of the old turbine is low compared with **that** of our new plant.	Производительность старой турбины низкая по сравнению с **производи- тельностью** турбины нашей новой электростанции.
3. “that” – союзное слово «который».	The new turbine **that** was installed in our plant is efficient.	Новая турбина, **которая** была уста- новлена на нашей электростанции, эффективна.
4. “that” – союз «что», «чтобы».	One can say **that** this fan is the most useful.	Можно сказать, **что** этот вентилятор самый нужный.
5. Часть выделительной конструкции «**Itis... that/which/who...**».	**It was** in our laboratory **that** the new experiment was carried out.	**Именно** в нашей лаборатории прове- ли новый эксперимент.

Переводится «именно», «это» и т. д.		

EXERCISE

Translate the sentences, taking into account the translation features of the multifunctional words “that/those”

1. We used materials that contained lead.

2. It is now generally recognized: one of the most important problems of modern natural sciences is that of photosynthesis.

3. The sun's mass is 750 times that of all the planets together.

4. If the steam generating unit is a boiler only, the steam that it deliveries will be wet.

5. Theory alone left Lomonosov dissatisfied, he knew by experience that it was useless and unreliable if it did not find practical application.

6. It is the ash covering the surface of the stoker that acts as protective blanket.

7. It is the difference in density or specific weight of steam and water that makes the steam rise through the water in a boiler.

8. It is the heat exchanger that removes the energy absorbed by the engine from the cooling water.

9. The electron temperature is much greater than that of the gas as a whole.

10. The diameter of Neptune is four times greater than that of the Earth.

11. Molecules moving from hot regions to cool carry more energy than those moving in the reverse direction.

12. The technique used has some advantages over that suggested by Palm.

13. The results are in good agreement with those calculated from the mobility data of Green.

14. Carbon dioxide cannot support life; its properties are different from those of the oxygen which it contains.

15. It is the axial-flow fan that occupies a small space, that is light in weight, easy to install and includes large volumes of air.

11. МНОГОФУНКЦИОНАЛЬНОЕ СЛОВО “IT”

Таблица 10

Функция, значение	Примеры	Перевод
1. Личное местоимение «он», «она», «оно» (заменяет неодушевленное существительное).	Natural gas is used for steam generating. **It** also burns extremely in coal and oil fired units.	Природный газ используется для образования пара. **Он** также широко применяется в агрегатах, работающих на угле и нефти.
2. Указательное местоимение «это» (заменяет предыдущее предложение).	The temperature is rising slowly. **It** means that…	Температура поднимается медленно. **Это** означает, что…
3. Формальное подлежащее безличного предложения. Самостоятельно не переводится.	**It** is impossible **It** is important to use **It** is expected this fuel. **It** is common practice	Невозможно Важно использовать это Ожидается топливо Обычно принято (использование).
4. Формальное дополнение после некоторых глаголов. Самостоятельно не переводится.	The method makes **it** possible to obtain good productivity.	Метод делает возможным получение хорошей производительности.
5. Часть выделительной конструкции **“itis…that (which)”.** Переводится «именно», «это» и т.д. (См. табл. 8).	**It is** at our plant **that** the new turbine was installed. **It was** not until 1950 **that** the new equip-ment entered into practice.	**Именно** (**это**) на нашей электростанции установили новую турбину. **Только** в 1950 году новое оборудова ние вошло в употребление.

EXERCISE

Translate the sentences, taking into account the translation features of the multifunctional word “it”.

1. It is copper which is the most widely used conductor.

2. The cyclone furnace is adjunct (зд. помощник) to the boiler circulation system. It is attached to the steam generating unit.

3. It is only recently that ways have been found for synthesizing this material.

4. It is our students that work at this power plant.

5. It is necessary to decompose these substances.

6. Electric current finds its most important use in industry. It finds wide application at every mill and factory. As for electric crane, it can easily lift objects weighing hundreds of tons.

7. The Newcomen steam engine was invented in 1705. It was fairly well developed later and for 50 years remained in extensive use.

8. It is not necessary to pulverize the coal in the cyclone furnace.

9. It is well known that electric current is necessary for everyday life.

10. It is the temperature of gas supplied to the turbine and the pressure ratio that influence the efficiency of a simple gas-turbine power plant.

11. It is known that some hypotheses were put forward in the last decade.

12. It is believed the method described should be of most utility in the determination of these phenomena types.

13. When dealing with a gas it is common practice to consider it under a pressure of 1 atmosphere.

14. The law makes it easy to understand the relation of two values.

15. Rutherford's picture of an atom as a miniature solar system made it easier to explain some difficulties.

16. It is not entirely out of question that certain intensity fluctuation were due to scintillation.

APPENDIX

ПРИЛОЖЕНИЕ

ОСОБЕННОСТИ АНГЛИЙСКОГО ПРОИЗНОШЕНИЯ

Звуки передаются на письме **фонетическими знаками** (**символами**), которые пишутся **в квадратных скобках**. Каждый фонетический символ передаёт **один звук** и в любом слове всегда **читается одинаково**. Вот почему, зная эти фонетические знаки, вы сможете прочесть по словарю любое незнакомое слово.

1. Фонетические знаки для гласных звуков

Краткие звуки

[ɪ] – it, his, big, film

[e] – pen, ten, 'pencil, 'letter

[æ] – bag, cat, map, bad

[ɔ] = [ɒ] – not, hot, dog, loss

[ʌ] – bus, cut, but, 'mother, sun

[u] = [ʊ] – book, look, put

[ə] – безударный гласный или нейтральный звук: 'sister, 'letter, 'doctor, a'bout, 'teacher

Долгие звуки

[i:] – see, me, eat, sleep, green, meet, meat

[ɑ:] – car, star, 'father, park, garden

[ɔ:] – sport, all, ball, small

[u:] – school, too, soon, tooth, moon

[ə:] = [ɜ:] – bird, girl, her, first, firm, serve

Дифтонги (сложные гласные звуки, состоящие из двух звуков, которые произносятся слитно)

[eɪ] – day, make, train, rain

[aɪ] – my, by, five, life, I, nine

[au] = [aʊ] – now, how, house, town, brown

[ɔɪ] – boy, oil, boil

[ou] = [əʊ] – go, no, snow, know

[ɪə] – here, real, near

[eə] = [ɛə] – air, chair, hair, their

[uə] = [ʊə] – poor, sure

2. Фонетические знаки для согласных звуков

[b] – book, be, black

[p] – pen, paper, please

[k] – cake, speak, take

[g] – go, green, give, big, gas

[f] – five, flat, free

[d] day, do, did

[t] кончикязыканаальвеолахtea, ten, take

[l] (бугорок за верхними зубами) letter, little, will

[n] sun, no, nine, not

[m] – me, meet, man

[v] – very, have, visit

[w] – we, well, white, when

[r] – red, read, tree

[j] – yes, yellow, you, your (как первый звук русских букв е, ё, ю, я)

[ʃ] – she, ship, fish, shake

[ʧ] – teach, watch, match, children

[ʒ] – measure, pleasure, usual

[ʤ] – June, jump, just, 'engine, gym

[ŋ] – носовой согласный – sing, song, ring, going, doing

[θ] – глухой межзубный – three, thin, thick, thing, thank, month

[ð] – звонкий межзубный – this, they, then, with, brother

[s] – see, so, speak

[z] – zoo, has, zero, zone, size, sisters, lazy

Чтение согласных букв

b[b] – big, brother

d[d] – day, drive

[s] – перед **e, i, y** – cinema, per'cent, city, center, nice, decide, place

c [ʃ] – перед **i** + суффикс (любой) – official, social, special, ˌspeci'ality,

[k] – во всех остальных случаях – can, clean, come, ˌeco'nomic, cold, 'cycle, re'spect, a'tomic

[ʤ] – перед **e, i, y** – page, large, age, huge, 'register, gym, stage, 'generate, 'general, gel

g Исключения: get, give, girl, begin, 'target, together, gift, forget

[g] – во всех остальных случаях – go, grow, big, de'gree, game, garden, gap

f[f] – five, life, free

h[h] – he, has, help, hope, here, home, hand

j[ʤ] – just, job, jump, June, Ju'ly, en'joy, 'object, joke, jet

k[k] – cake, coke, take

l[l] – large, low, sleep, letter

m[m] – my, mother, mill

n[n] – no, nine, never

p[p] – paper, pulp, play

q– всегда употребляется в сочетании:

qu[kw] – quite, quickly, question, 'equal, 'liquid, re'quire

Реже **qu** [k] – unique [ju:'ni:k], cheque [ʧek], opaque

[əʊ'peɪk](непрозрачный)

r[r] – red, read, rain, sorry

s[s] – 1) в начале слова – see, same, size, six, so, 'solid, stone,

2) в конце слова, после глухой согласной – takes, likes, types,

pulps, stops, speaks;

[z] – 1) в конце слова после гласных и звонких согласных – sees, papers, his, plans, reads, plays, steels, studies

2) между двумя гласными (есть исключения) – re'sult, resort, houses, easy, re'serve, re'sume

t[t] – take, skate

tперед **i** + суфф. [ʃ] – e'ssential, 'patient, po'tential, i'nitial, 'partial, 'ratio

v[v] – very, visit, vegetable

w[w] – we, wet, wave, twelve

[gz] – перед***ударной*** гласной: e'xam, e'xact, e'xample, e'xist, e'xotic, e'xaggerate (преувеличивать)

x[ks] – в подавляющем большинстве других случаев: box, six, text, next, expect, exercise, mix

z[z] – zoo, zero, lazy

В отличие от русского языка в английском языке звонкие согласные звуки ***не оглушаются*** в конце слова:

Звонкие

bag – сумка

bad – плохой

led – руководил, привел

side – сторона

leave – уезжать, уходить

eyes – глаза

aid – помощь

prize – премия, награда

need – нужно

Глухие:

back – спина, назад

bat – летучая мышь

let – разрешать, позволять

sight – зрение, вид

leaf – лист

ice – лёд

eight – восемь

price – цена

neat – аккуратный

Типы слогов и чтение гласных букв

Английский алфавит состоит из 26 букв. Они передают 44 звука (20 гласных и 24 согласных). Гласные буквы: **a, e, i, o, u, y**. Чтение гласной буквы зависит от того: 1) стоит ли она в ударном или безударном слоге; 2) находится ли она в открытом или закрытом слоге; 3) входит ли она в буквосочетания с другими гласными или согласными буквами.

Ударение

Если в слове более одного слога, всегда необходимо указать ударный слог. Ударение ставится **перед**ударным слогом: percent [pə'sent], control [kən'trəʊl], hydrogen ['haɪdrədʒ(ə)n], capillary [kə'pɪlərɪ], chlorine ['klɔ:ri:n], responsible [rɪ'spɒnsɪbl], substance ['sʌbstəns], molecule ['mɒlɪkju:l], reduce [rɪ'dju:s], cellulose ['seljʊləʊs], softwood ['sɒftwʊd], contribute [kən'trɪbju:t], complete [kəm'pli:t].

Иногда в слове могут быть два ударения, тогда **основное** (более сильное) ударение ставится **сверху**, а **вспомогательное** (слабое) – **внизу** (тоже **перед** ударным слогом): transportation [ˌtrænspɔ:'teɪʃn], semiautomatic [ˌsemɪɔ:tə'mætɪk], contribution [ˌkɒntrɪ'bju:ʃn], communication [kəˌmju:nɪ'keɪʃ(ə)n], manufacture [ˌmænju'fæktʃə],

composition[ˌkɒmpə'zɪʃ(ə)n], non-oxidizing [ˌnɔn'ɒksɪdaɪzɪŋ], engineer [ˌenʤɪ'nɪə], university [ˌju:nɪ'vɜ:sɪtɪ].

Открытый слог – это слог: а) оканчивающийся на гласную букву (my, me, no) или б) оканчивающийся на одну согласную букву с последующей **непроизносимой («немой»)** буквой **e**(take, mine, note, tube, type). **Любая гласная буква в открытом ударном слоге читается так, как она называется в алфавите**.

Закрытый слог – это слог, в котором **за ударной гласной**буквой стоит **одна или несколько согласных**букв (кроме буквы **r**). Гласные буквы в закрытом ударном слоге читаются по-разному, но это всегда **краткий**гласный звук. Буква **e** на конце слова **не читается**(«немая»), если в слове есть другая гласная (take, note, tube, 'simple, com'plete). Буква **e** («немая») очень важна, так как она делает слог **открытым**для предыдущей гласной.

Чтение гласных букв в четырех типах ударных слогов

Гласная буква	**Открытый слог**	**Закрытый слог**	**Гласная + r**	**Гласная + r + гласная**
1	2	3	4	5
a [eɪ]	**[eɪ]** name, take, lake *Исключения:* ate [et] any ['eni] have [hæv]	**[æ]** cat, bad, flat, plan, gas, map, fact, hand	**ar [ɑ:]** car, park, star, far, 'carbon, mark, hard, large	**ar+гласная [ɛə] = [eə]** care, fare, parent, pre'pare – подготовить, com'pare – сравнивать
e [i:]	**[i:]** he, be, me, these, theme [θi:m]	**[e]** pen, ten, best	**er [ə:] = [з:]** her, serve, German	**er + гласная [ıə]** here, 'atmosphere, sphere, se'vere *Исключения:* were [wə:], there [ðɛə], where [wɛə]

1	2	3	4	5
i [aɪ] **y[waɪ]**	**[aɪ]** time, five, try, like, nine, my, type, re'ly, dye *Исключения:* give [gɪv], 'city ['sɪtɪ], live [lɪv], 'pity ['pɪtɪ]	**[ɪ]** him, his, big, film, 'system	**ir [ə:] =** **yr [з:]** bird, girl, first, firm, third	**ir + гласный =** **yr [аɪə]** fire, tired, tyre (шина), wire (проволочная сетка)
u [ju:]	**1. [ju:]** student, tube, cube **2. После r, l, j [u:]** rule, true, blue, in'clude, June *Исключение*: busy ['bɪzɪ]	**[ʌ]** but, bus, run, must, sun *Исключения*: put [pʊt], pull [pʊl], push [pʊʃ], full [fʊl], truth [tru:θ] – правда	**ur [ə:] = [з:]** turn, re'turn, burn	**ur + гласная [juə]** pure – чистый, cure – вылечить, se'cure – обеспечивать безопасность, охранять, гарантировать
o [ou]=[əʊ]	**[ou] = [əʊ]** no, go, note *Исключения*: do [du:], does [dʌz], two [tu:]	**[ɔ] = [ɒ]** not, hot, long, job *Исключения*: both [bəʊθ], don’t [dəʊnt], won’t [wəʊnt]	**or [ɔ:]** or, sport, form, force, north	**or + гласная=**[ɔ:] more, before, re'store – восстанавливать, реставрировать, explore [ɪk'splɔ:] – исследовать

Задание 1. Прочитайте гласную **a** в открытом и закрытом слоге в следующих словах:

add, shade, rare, pre'pare, start, fare, farm, large, part, map, save, act, sap,'agent, dark, sand, card, fact, came, 'grammar, bark, than, 'carbon, age, land, paper,plastics, 'matter, spare, handle, art, 'artist, bank, re'gard, harm, candle, market,de'partment, pare, share, ban, tape, fan, pale, sale, 'tannin, rags, fact, case, 'article,rate, hardly, trash

Задание 2. Прочитайте гласную **e** в открытом и закрытом слоге в следующих словах:

less, let, nerve, here, melt, term, verb, mere, left, herb, 'eve, cell, pre'fer, dense,spell, these, ob'serve, 'vessel, e'lect, tense, sense, fed, pre'vent, i'nert, merge, wet,sphere, serve, stem, press, co'llect, net, ad'here

Задание 3. Прочитайте гласную **i, y** в открытом и закрытом слоге в следующих словах:

mill, mile, try, mine, style, still, hide, 'timber, hire, lime, type, fire, en'tire, dye, wire, ad'mire, wide, tip, birch, line, fir, cycle, re'cycle, 'system, dry, pine, in'spire, 'instant, third, gym, split, shine, 'final, dirt, price, fly, de'sire, rise, re'ly, wide, inch, fill, size, trip, twice, print, circle

Задание 4. Прочитайте гласную **u** в открытом и закрытом слоге в следующих словах:

'cubic, cut, se'cure, such, true, fuse, glue, dust, po'llute, in'clude, rude, pulp,'structure, much, 'furnish, due, 'furnace, ma'ture, fun, 'urgent, music, us, burner,con'sume, re'duce, spruce, 'unit, u'nite, pump, fume, so'lution, rub, 'lumber, rust, further, tune, burn, jute, pure, curve, burst, fund, must, re'sult

Задание 5. Прочитайте гласную **o** в открытом и закрытом слоге в следующих словах:

ore, drop, shore, cost, stone, top, hole, 'orbit, ex'plore, more, crop, forty, so, 'bottom, before, north, odd, tone, torn, short, phone, cone, 'cotton, corn, cross, form, slot, storm, stock, sort, dome, stove, mole, strong, re'port, store, pro'mote, in'form, log, sort

Правила чтения гласных в безударном слоге

1. Буквы **e, i, y**в безударном слоге чаще всего читаются **[ɪ]:** divide [dɪ'vaɪd], planet ['plænɪt], synthetic [sɪn'θetɪk], repeat [rɪ'pi:t], recycle [rɪ'saɪkl], difficult ['dɪfɪkəlt], polymer ['pɒlɪmə], reduce [rɪ'dju:s], depend [dɪ'pend], granite ['grænɪt].

2. Буква **y**в **безударном** слоге **на конце** слов читается **[ɪ]:** very, many, army, easy, dirty, happy, twenty, party, fifty, carry.

3. Буквы **a, o, u**в безударном слоге – **[ə]:** common ['kɒmən], provide [prə'vaɪd], construct [kən'strʌkt], album ['ælbəm], data ['deɪtə], support [sə'pɔ:t], seldom ['seldəm], about [ə'baut], obtain [əb'teɪn], bottom ['bɒtəm], ago [ə'gəʊ], success [sək'ses], campus ['kæmpəs], protect [prə'tekt].

4. Сочетания **er(=re), or, ar**в безударном слоге – **[ə]:** paper ['peɪpə], metre = meter ['mi:tə], doctor ['dɒktə] centre = center ['sentə], actor ['æktə] grammar ['græmə], reader ['ri:də], poplar ['pɒplə], summer ['sʌmə] factor ['fæktə], fiber = fibre ['faɪbə], number ['nʌmbə], persist [pə'sɪst], banner ['bænə], property ['prɒpətɪ], cedar ['si:də].

ПРАВИЛА ЧТЕНИЯ БУКВОСОЧЕТАНИЙ

Сочетания согласных

ch	[tʃ]	much, chess, teach, teacher
	[k]	school, character, chemistry, technical, chemist
ck	[k]	back, clock, cock, black
gh	[-]	high, night, daughter, flight, light
kn	[n]	know, knife, knock, knit, knee
ng	[ŋ]	ring, sing, young, thine, wing
nk	[ŋk]	ink, thank, monkey, sink, bank
ph	[f]	telephone, phonetics, phrase
sh	[ʃ]	she, bush, short, dish, fish, sheep, shook
tch	[tʃ]	catch, kitchen, watch, switch, stretch
th	[ð]	вначалеслужебныхслов; междугласными: these, that, there, mother, they, with, them, then
	[θ]	всочетанииth вначалеивконцезнаменательныхслов, thick, thin, thanks, three, think, throw, fifth, tooth
wh	[w]	what, why, when, while, white, where
wh+o	[h]	who, whom, whose, whole, wholly
wr	[r]	write, wrong, wrist, итар, wrest, wrap

Непроизносимые согласные

Сочетание	Транскрипция	Пример	Позиция
wr	[r]	write [rait]	любая
kn	[n]	knee [ni:]	в начале слова
gn	[n]	resign	любая
pn, ps	[p]	pneumatic [nju´mæwetik]	
gh	не читается	high [hai] straight [streit]	в середине и часто в конце слова
ng	[n]	sing [sɪ ŋ]	в конце слова
bt	[t]	debt [det]	любая
mb	[m]	bomb [bom]	любая
wh	[w]	when [wen]	1.Перед всеми гласными, кроме Oo
	[h]	who [hu:]	2. Перед буквой Oo

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 тепловаяединица
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 (избыточное давление)

Температура читается:

25 °C – twenty-fivedegreesCentigrade ['sentɪgreɪd] (по шкале Цельсия);

34°F – thirty-four degrees Fahrenheit ['færənhaɪt] (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

GLOSSARY OF TERMS

СЛОВАРЬ ТЕРМИНОВ

A		
ability	[ə'bɪlɪtɪ]	n способность
absorb	[əb'zɔ:b]	v поглощать
accessibility	[ək,sesə'bɪlɪtɪ]	n доступность
achieve	[ə'tʃi:v]	v достигать
act	[ækt]	v действовать
addition in addition to	[ə’dɪʃn]	n вдобавок
additional	[əd’ɪʃnəl]	a дополнительный
admission	[əd’mɪʃn]	n доступ
advantageous	[,ædvən’teɪdʒəs]	a выгодный

Продолжение

adversaly	[‘ædvɜ:slı]	adv обратно
affect	[ə’fekt]	v влиять (на)
airfoil	[‘eəfoıl]	n крыло
alternately	[ɔ:l’tɜ:nıtlı]	adv попеременно
amber	[‘æmbə]	n янтарь
amount	[ə’maunt]	n количество
application	[,æplı’keıʃn]	n применение
area	[‘eərıə]	n область, площадь
artificial	[,a:tı’fıʃəl]	a искусственный
asphyxiating	[,æs’fıksıeıtıŋ]	a удушающий
assistant	[ə’sıstənt]	n помощник
assumption	[ə’sʌmpʃən]	n допущение
attach	[ə’tætʃ]	v присоединять
attract	[ə’trækt]	v притягивать
available	[ə’veıləbl]	a доступный
B		
bank	[bæŋk]	n батарея, пучок
barge	[ba:dʒ]	n баржа
bed	[bed]	n слой
blade	[bleıd]	n лопасть
blow	[bləʊ]	v дуть
boil	[boıl]	v кипеть
boiler fire tube boiler	[‘boılə]	n котел жаротрубный котел
bottom	[‘botəm]	n дно
boundary	[‘baʊndərı]	n граница
break (broke, broken)	[breık]	v разбивать
bunker	[‘bʌŋkə]	n бункер
burn	[bɜ:n]	v сжигать, гореть
burner	[‘bɜ:nə]	n горелка
C		
capacity	[kə’pæsıtı]	n производительность

Продолжение

carry carry out	[‘kærı]	v нести проводить, выполнять
casing	[‘keısıŋ]	n оболочка
cast iron	[,ka:st’aıən]	n чугун
centrifugal	[,sentrıfju:gəl]	a центробежный
chamber	[‘tʃæmbə]	n камера
charge	[tʃa:dʒ]	v заряжать
chimney	[‘tʃımnı]	n дымоходная труба
circuit short circuit	[‘sɜ:kıt]	 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	[kəm’bʌstʃən]	n сгорание
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

Продолжение

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	[,dı:kəm’pəʊz]	v разлагать
decrease	[‘dı:krı:s] [dı:’kr ı:s]	1) n уменьшение 2) v уменьшать
deliver	[dı’lıvə]	v подавать, поставлять
demand	[dı’ma:nd]	n спрос
density	[‘densıtı]	n плотность
depend	[dı’pend]	v зависеть
depth	[depθ]	n глубина
determine	[dı’tɜ:mın]	v определять
device	[dı’vaıs]	n прибор
diffuser	[dı’fju:zə]	n диффузор
dimension	[dı’menʃn]	n размер
direct	[daı’rekt]	v направлять
direction	[daı’rekʃn]	n направление
discharge	[dıs’tʃa:dʒ]	1) n разряд 2) v разряжать, разгружать

Продолжение

distribution	[,dıstrı'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	['draıŋ]	n сушка
dust	[dʌst]	n пыль
E		
economizer non steamingeconomizer 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	[ı'kwıpmənt]	n оборудование
essential	[ı'senʃl]	a важный
evolve	[ı'volv]	v выделять
evaporate	[ı'vəæpəreıt]	v испарить(ся)
exchanger heat exchanger	[ıks'tʃeındʒə]	n обменник теплообменник

Продолжение

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	[‘flu: ɪd]	n жидкость, жидкая среда
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

Продолжение

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

Продолжение

I		
ignition	[ɪg’nɪʃn]	n зажигание, воспламенение
impeller	[ɪm’pelə]	n рабочее колесо
impinge	[ɪm’pɪnʤ]	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
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

Продолжение

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	[,mænju:’fæktʃə]	v производство
mean	[mi:n]	v означать
means by means of	[mi:nz]	n средства prep посредством
measure	[‘meʒə]	v измерять
melt	[melt]	v расплавлять(ся)
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

Продолжение

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	[paıp]	n труба
piping	[‘paıpıŋ]	n трубопровод
piston	[‘pıstn]	n поршень
plate	[pleıt]	n пластина
plant	[pla:nt]	n завод, электростанция
plunger	[‘plʌndʒə]	n плунжер

Продолжение

power	[‘paʊə]	n мощность v снабжать энергией
preliminary	[prɪ’lɪmɪnərɪ]	a предварительный
pressu re 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 reciprocating pump rotary pump	[pʌmp]	n насос центробежный насос жидкостный насос конденсатный насос многоступенчатый насос поршневой насос поршневой насос ротационный насос
put put into operation	[pʊt]	v ставить, класть пустить в эксплуатацию
Q		
quantity	[‘kwontɪtɪ]	n количество
R		
radial	[‘reɪdɪəl]	a радиальный
rarefied	[,reərɪ’faɪd]	a разряженный
rate	[reɪt]	n скорость
ratio	[‘reɪʃɪəʊ]	n отношение
ration	[‘ræʃən]	n порция
raw	[rɔ:]	a сырой

Продолжение

reach	[ri:tʃ]	v достигать
rear	[rɪə]	n задняя сторона
reciprocating	[rɪ'siprəkeɪtɪŋ]	a поршневой
recover	[rɪ'kʌvə]	v восстановить
reduce	[rɪ'dju:s]	v уменьшать
reheater	[ri:'hi:tə]	n подогреватель
release	[rɪ'li:s]	v освобождать, выделять
relieve	[rɪ'li:v]	v освобождать(ся)
remain	[rɪ'meɪn]	v оставаться
removal	[rɪ'mu:vəl]	n удаление
remove	[rɪ'mu:v]	v удалять
renewable	[rɪ'nju:əbl]	a восстановимый
require	[rɪ'kwaɪə]	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 резуль- тате 3) v приводить к
return	[rɪ'tɜ:n]	v возвращаться
revolve	[rɪ'volv]	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)

Продолжение

row	[rəʊ]	n ряд
rub	[rʌb]	v натирать
runoff	[‘rʌnof]	n отходы
S		
saturated	[‘sætʃəreɪtɪd]	a насыщенный
savings	[‘seɪvɪŋgz]	n pl экономия
scale	[skeɪl]	n масштаб
semiconductor	[,semɪkən’dʌktə]	n полупроводник
separation	[,sepə’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

Продолжение

steam	[sti:m]	n пар
stocker chain-grate stocker	[‘stokə]	nмеханический погрузчик механическая топка с цепной решеткой
store	[stɔ:]	v хранить
streamline	[‘stri:mlaın]	n направление потока
subject	[‘sʌbʤıkt] [‘sʌbʤıkt] [səb’ʤekt]	n тема, предмет аподчиненный v подчинять
substance	[‘sʌbstəns]	n вещество
suction	[‘sʌkʃən]	n отсос
suit	[sju:t]	v подходить
superheater	[,sju:pə’hi:tə]	n перегреватель
superheating	[,sju: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

Продолжение

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 от- бором 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	[‘veərɪ]	v меняться, различаться
velocity	[vɪ’losɪtɪ]	n скорость
vented	[‘ventɪd]	a вентилированный

Продолжение

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

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