

**МИНИСТЕРСТВО ОБРАЗОВАНИЯ
РОССИЙСКОЙ ФЕДЕРАЦИИ**

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АНГЛИЙСКИЙ ЯЗЫК

**Методические указания для студентов I курса
дневного отделения**

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Данные указания предназначены для студентов неязыковых вузов и содержат грамматические упражнения по основным темам грамматики английского языка. Цель указаний - научить студентов чтению технической литературы по специальности.

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LESSON 1

Moscow Technological Institutes

FERROUS METALS

GRAMMAR: Indefinite Active, Passive

Порядок слов в предложении

1. Поставьте следующие предложения в Past Indefinite или Future Indefinite, добавляя, где необходимо, слова *last/next week. last/next year. tomorrow, yesterday* и т. д.:

1. I am very busy today. 2. They are in the reading-room now. 3. It is a cold day today. 4. Students have four exams in January. 5. The book has many diagrams. 6. She has a map of England.

2. Поставьте следующие предложения в Past or Future Indefinite, добавляя слова *last/next year, yesterday, tomorrow, last/next week, last/next summer* и т. д.:

1. We study six days a week. 2. I go to the institute every day. 3. My friend lives in a hostel. 4. Usually I get up at 7 o'clock. 5. My studies begin at half past eight. 6. We have four lectures every day. 7. After lectures we go to the dining room. 8. We do our home-work for the next day. 9. At night I read and watch T.V. 10. On Sunday I visit my friends.

3. Составьте предложения из следующих слов в соответствии с порядком слов в английском предложении:

1. has, buildings, our, several, institute. 2. subjects, students, many, first-year, study. 3. third-year, had, last, students, training, industrial, summer. 4. carry out, students, practical, work, in, laboratories, well-equipped. 5. problems, many, scientists, important, solve, our. 6. texts, difficult, Petrov, technical, translated. 7. his, will, the teacher, translation, correct. 8. next, dean, a lecture, deliver, our, week, will. 9. students, more, institutes, this, entered, one, a million, than, year.

4. Сравните предложения в действительном и страдательном залоге, переведите их:

1. Students asked the lecturer many questions. The lecturer was asked many questions. 2. The monitor told the first-year students to come to the laboratory. The first-year students were told to come to the laboratory. 3. Usually a lab assistant shows the equipment to the students. Usually the equipment is shown to the students by a lab assistant. 4. Students watched the process with great attention. The process was watched with great attention. 5. Tomorrow our teacher will give us a new task. A new task will be given tomorrow. We shall be given a new task tomorrow. 6. Practice accompanies theory. Theory is accompanied by practice. 7. He asked me to bring a dictionary. He was asked to bring a dictionary. 8. The teacher told the students to sign their drawings. The students were told to sign their drawings. 9. The dean will send the students to a big plant in summer. The students will be sent to a big plant in summer. 10. He taught us to use the lab equipment. We were taught to use the lab equipment.

5. Прочитайте и переведите текст.

Moscow Technological Institutes

There are many technological institutes in Moscow. There are such institutes as Moscow Power Engineering Institute, Electromechanical Institute, Aviation Institute, Moscow State University of Technology named after Bauman, Civil Engineering Institute and many others. The head of each institute is Rector. As a rule there are several faculties in an institute. Each faculty has a number of specialized departments and is headed by a dean. The course of studies usually lasts (продолжается) 5-6 years.

The academic year in this country's higher schools begins on the 1st of September and is divided into two semesters. Students take exams at the end of each semester. If the results of the

examinations are good students get grants. Twice a year students have vacations - two weeks in winter and two months in summer.

Our university is one of the oldest technological institutes in Moscow. It has several buildings, old and new ones. There are many various laboratories. There is a very good library and a computer center in the main building.

It is interesting but difficult to study at our university, especially for the first-year students as they do not know yet how to organize their work and time.

Useful Terms and Phrases:

| | |
|-------------------|----------------|
| 1. iron | железо |
| 2. carbon | углерод |
| 3. silicon | кремний |
| 4. alloy | сплав |
| 5. to use | использовать |
| 6. steel | сталь |
| 7. cast iron | чугун |
| 8. quantity | количество |
| 9. pig iron | чугун |
| 10. blast furnace | домна |
| 11. to melt | плавить |
| 12. to pour | лить |
| 13. mould | литейная форма |
| 14. casting | литье |
| 15. to solidify | затвердевать |
| 16. shop | цех |
| 17. foundry | литейный |

I. Find Russian equivalents for the following English words:

| | |
|------------------|-------------|
| 1. iron | 1. домна |
| 2. alloy | 2. литье |
| 3. steel | 3. плавить |
| 4. cast iron | 4. железо |
| 5. blast furnace | 5. литейный |
| 6. casting | 6. сталь |
| 7. to melt | 7. чугун |
| 8. foundry | 8. сплав |

II. Change the predicates in the Passive form into Active:

Example: Metals are usually melted and poured by founders into a form which is called a "mould".

Founders usually melt and pour- metals into a form which is called a "mould".

1. Different metals are now produced by people in different ways. 2. Three methods are now used by us for producing pig iron. 3. Castings are used by specialists in building engines, automobiles and airplanes, and different types of machinery.

III. Translate into Russian:

1. Ferrous metals are used in industry in two general forms: steel and cast iron which differ in the quantity of carbon content. 2. Production of casting made from different metals requires different types of melting furnaces. 3. The cupola furnace is usually used for melting grey iron.

IV. Answer the following questions:

1. What elements do ferrous metals consist of?

2. What is the difference between iron and steel?
3. What is casting?
4. What do we call the shop where metals are cast?

V. Read and translate the text:

Ferrous metals consist of iron combined with carbon, silicon, phosphorus and other elements. Carbon is the most important of all elements present in ferrous alloys. Ferrous metals are used in industry in two general forms: steel and cast iron, which differ in the quantity of carbon content. These two ferrous alloys are derived from pig iron which is produced in the blast furnace in the form of pigs. Metals are usually melted and poured into a form which is called a "mould". This process is known as casting. The cast metal is shaped in the mould where it cools and solidifies. Thus one can cast different objects known as castings. The shop where metals are cast is called a "foundry". Castings are used in building engines, automobiles and airplanes, and different types of machinery.

L E S S O N 2

Environment Protection must be Global STEEL

GRAMMAR: Continuous Active, Passive

Степени сравнения прилагательных

1. Объясните употребление времен группы Continuous, переведите предложения:

1. I am at my English lesson. I am sitting and doing my exercises. My friend is not sitting, he is standing at the blackboard and looking at me. 2. It is getting cold now, isn't it? Look out. Is it raining now? 3. You are late. What were you doing? I was translating a text. 4. When I came home my parents were having supper and at the same time they were watching TV. 5. What was he doing when I rang up an hour ago? He was looking through a newspaper when I rang up. 6. Tomorrow we shall be preparing for a test for the whole evening. 7. In July they will be taking their exams for the whole month. 8. What will you be doing tonight at 10 o'clock? Will you be working? No, I shall be reading a book at this hour.

2. Выберите правильную форму глагола:

1. We (are translating, translate) a technical text now. 2. We usually (are not translating, do not translate) stories. 3. She (does not look, is not looking) through all the newspapers every evening. 4. He (looked, was looking) through a newspaper when the telephone rang. 5. What (were, was) you doing a minute ago? I (was watching, watched) television. 6. I (watch, am watching) television every day. 7. I had a late night, I (worked, was working) until midnight. 8. Yesterday he (worked, was working) a lot. 9. The students (had, were having) an interesting discussion when the teacher came in. 10. The students often (have, are having) interesting discussions after lectures. 11. When he comes they (will be taking, will take) a test. 12. They (will be taking, will take) a test next week. 13. Where is Ann? She is in the coffee shop. She (has, is having) a cup of coffee. She always (has, is having) a cup of coffee in the evening.

3. Поставьте прилагательные в сравнительной или превосходной степени:

1. Moscow University is (large) University in Europe. 2. Strength of materials is (difficult) than chemistry. 3. Is it (interesting) to study at the Institute than at school? 4. My friend works (hard) at his English than I. 5. My brother is (old) than I but he is (short). 6. The University is one of the (tall) buildings in Moscow. 7. Days in summer are (long) than in winter. 8. This group studies (good) than that one.

4. Ответьте на следующие вопросы:

1. Which is the most difficult subject for you? 2. Which is the easiest subject? 3. Which of the subjects is more difficult: physics or mathematics? 4. Who is the tallest in your group? 5. Which is the most interesting subject for you? 6. Is English as difficult as mathematics?

5. Прочитайте текст и ответьте, какие меры необходимы для успешного решения проблемы защиты окружающей среды в глобальном масштабе. Переведите.

Environment Protection must be Global

That the problem of pollution and ecology has become the most important one for mankind is evident to all. The more civilization is developing, the greater the ecological problems are becoming. Air and water pollution by industry is now reaching tremendous proportions. In our era it is changing from a national to an international problem, especially in territories where rivers cross several countries. The seas and oceans are also becoming seriously polluted. A similar situation is developing in the atmosphere. It is known that many cities throughout the world suffer from air pollution.

At present scientists in industrially developed countries are working on the theory of interaction of all the atmospheric and oceanic global processes that determine the climate and weather of the world. Increasing growth of population, industrialization and the use of resources are slowly but surely changing the global climate and water balance. This can be described as a great experiment, one that may bring about changes in the environment more serious than ever before.

The essential feature in the environment protection is that many problems can be solved only on the level of world community. Therefore the planning of protection against pollution by human society as a whole is imperative today and in the nearest future. It is necessary to develop an international program to study data on land, forest, atmospheric and oceanic resources, both renewable and non-renewable. It is the joint efforts of many scientists and special public organizations that can deal with the problem and take necessary measures to protect the environment.

Useful Terms and Phrases:

| | |
|-------------|------------|
| 1. content | содержание |
| 2. widely | широко |
| 3. brittle | хрупкий |
| 4. reduce | снижать |
| 5. strength | прочность |
| 6. contain | содержать |
| 7. cheap | дешевый |

I. Find equivalents for the following English words:

| | |
|-------------|---------------|
| 1. Strength | 1. дешевый |
| 2. cheap | 2. снижать |
| 3. widely | 3. хрупкий |
| 4. brittle | 4. содержать |
| 5. reduce | 5. прочность |
| 6. content | 6. широко |
| 7. contain | 7. содержание |

II. Make up sentences, using these words, translate them into Russian:

1. a carbon content, with, from 0.1% to 1.0%, is, material, ferrous, steel.
2. steel, more expensive, are, stronger, but, tougher, and, castings.
3. of, metals, used, in, the form, engineering, are, in, alloys, industry

III. Fill in the blanks with prepositions: because of, of, for, in, with.

1. Metals are ... great importance ... our life ... their useful properties. 2. They are widely used ... industrial purposes. 3. There are two large groups ... metals: simple metals and alloys. 4. Alloys consist ... a simple metal combined ... some other elements.

IV. Read the text and answer the question:

Why is steel widely used in machine-building? Steel is iron with a very little carbon content (from 0.05% to 1.7%), which makes it much stronger than iron and is therefore widely used in machine-building. But very much carbon makes steel brittle, which reduces its strength. Therefore the carbon content in steel is confined to certain limits. Cast iron contains a higher percentage of carbon than steel does (more than 2.0%). It is the cheapest of all the engineering metals used in machine-building.

LESSON 3

GREY IRON

GRAMMAR: Perfect Active, Passive

1. Объясните употребление времен группы Perfect, переведите:

1. This is a very good book, I have just read it with pleasure. 2. He has been absent this week. He has been ill. 3. I haven't seen you for a long time. Where have you been all this time? 4. We haven't heard about her since 1989. 5. By the beginning of the lecture the laboratory assistant had brought all the necessary diagrams. 6. Before we came to the next lecture we had studied the material of the first one. 7. Have you already finished your diploma work? No, I shall have finished it by the end of June. 8. They will not have passed their exams by the time you return. 9. Many students have been enrolled into universities this year. 10. The translation has not been finished yet. It will have been finished by the end of the month. 11. Have you brought these journals with you? No, these journals had been brought by my sister before I returned from St. Petersburg. Don't you know that?

2. Прочитайте и объясните употребление времен:

At the Institute

Vera: Hello, Mike! What are you doing here?
Mike: Hello, Vera! I am reading for my mathematics exam.
V.: But your group has passed it already, hasn't it?
M.: Yes, it has, but I was absent at this time. So I'll take this exam tomorrow.
V.: Is it difficult for you to take this exam? M.: No, it is not. I have finished a specialized mathematical school where mathematics was studied more thoroughly (тщательно) than at other schools. Besides, I have taken part in a mathematics contest of our city.
V.: Really? Have you? When was it?
M.: It was last year.
V.: Were you the first at this contest?
M.: No, I was the second. The first one was the boy from one of the Novosibirsk mathematical schools.
V.: Have you ever been to Novosibirsk?
M.: Yes, I have been there this year with a group of students of our faculty.
V.: What have you seen there?
M.: Oh, I have seen a lot. But now I have no time to tell you about it. Well, Vera, what are you doing here? Are you reading for your exams too?
V.: No, I am not. I've passed all my exams with good marks this term and so my holidays have already started. I'm waiting for my friend here. Good luck,

Mike.

3. Определите, чем выражено сказуемое в каждом предложении, переведите:

1. The electronic industry produces several types of minicomputers. 2. The air in many cities has been polluted by traffic and industry. 3. The lecture on environment protection was very interesting. 4. Mankind has never experienced changes in life and work on such a scale. 5. The task of the world community is to improve the ecological situation in the world. 6. In six years we shall become engineers. 7. It is possible to take measures to protect environment on a global level by the joint efforts of all countries. 8. Professor N. is the dean of our faculty. 9. The important feature of our education is that it combines theory with practical training. 10. The main tendency of our life is that computers are being used in all spheres of technology, science and everyday life. 11. The essential feature in environment protection is that most of it is done by public initiative. 12. What is necessary today is that the protection of global natural resources must be planned. 13. Today one of the most important problems is that big cities are polluted.

4. Вставьте предлоги *to, with, about, at, for, on*:

This morning father spoke ... my brother and me ... going to see our aunt this evening. It is our aunt's birthday. We wanted to surprise her family. Our mother was going to go ... us. We had to be ready ... seven o'clock. We wanted to be ... our aunt's house ... seven thirty. We left ... my aunt's house ... seven ... our mother and father. But the aunt was not ... home. Her children had taken her and the uncle ... the theater. We laughed: we had a surprise party, but it was on us. We left the presents and went ... a show ourselves.

Useful Terms and Phrases:

| | |
|---------------------|---------------------------------|
| 1. grey iron | серый чугун |
| 2. conceivable | задуманный, представленный себе |
| 3. shape | форма |
| 4. size | размер |
| 5. variety | множество, разнообразие |
| 6. bed—plate | опорная плита |
| 7. stove | плита |
| 8. gear | шестерня |
| 9. tool steel | инструментальная сталь |
| 10. in comparison в | в сравнении |
| 11. shock | удар |
| 12. hence | следовательно, потому |
| 13. specify | определять |
| 14. to require | требовать |
| 15. manganese | марганец |
| 16. sulphur | сера |
| 17. depend on | зависеть от |
| 18. grade | качество |

I. Find Russian equivalents for the following English words:

1. grey iron, 2. shape, 3. size, 4. bed-plate, 5. shock, 6. tool steel, 7. manganese, 8. depend on, 9. sulphur.

1. марганец, 2. размер, 3. зависеть, 4. удар, 5. инструментальная сталь, 6. сера, 7. серый чугун, 8. форма, 9. опорная плита.

II. Change the predicates in Passive into Active:

Model: The heat in the electric furnace was produced by electricity.

Electricity produced the heat in the electric furnace.

1. The iron ore charged into the furnace has been melted by the coke burning in the blast of hot air. 2. Malleable iron castings are being increasingly used in industry. 3. Cast iron and steel are produced from pig iron by us.

III. Change Active constructions into Passive. Mind the tenses.

Model: We use iron, carbon, silicon, phosphorus, manganese and sulphur in different proportions depending on the grade of castings. Iron, carbon, silicon, phosphorus, manganese and sulphur are used in different proportions depending on the grade of castings.

1. We use various grades of copper for engineering purposes. 2. We employ three types of smelting equipment for steelmaking in modern industry. 3. Metallurgists seldom use pure metals in engineering.

IV. Ask questions an all the parts of the sentence:

The cupola is used to remelt pig iron.

V. Read the text and answer the question:

Why are grey iron foundries the most numerous? Grey iron foundries are the most numerous because grey iron can be cast into almost any conceivable shape and size. Grey iron is also adapted to a great variety of castings, such as automobile gas, steam, and hydraulic engine cylinders; bed-plates for machines, car wheels, agricultural machinery parts, furnace and stove parts, water pipes, gear's and general machinery parts. The nature of the metal used for grey iron castings is such that castings can be made so hard that ordinary tool steel will not cut them or, on the other hand, so soft that they can be readily machined. However in comparison with other casting metals grey iron is weak and will not stand great shock. Hence, the engineer must allow a large factor of safety when specifying the use of grey iron castings, especially where great strength is required, or specify that the castings must be made from some other metal.

VI. Find in the text nouns for the following verbs: to cast, to alloy, to compare, to machine.

LESSON 4

Telephone

ALLOY GREY IRON

GRAMMAR: Согласование времен

1. Поставьте глаголы в скобках в правильную форму согласно правилу согласования времен:

1. The engineer was told that he (may) test the device in the afternoon. 2. It was known that the head of our laboratory (to be) a graduate of Moscow University. 3. They thought that she (to graduate) from a technical institute. 4. Our professor informed us that he (to give) the following lecture on quantum mechanics on Monday. 5. At the meeting it was said that our lecturer (to work) at a new program of laboratory work. 6. The teacher told us that the term "engineering" (to have) many Russian equivalents. 7. The chief engineer believed that we (to work) at that problem for a month the following summer.

2. Обратите внимание на перевод предлога *by* в следующих предложениях :

1. By 3 o'clock I shall be free and go with you to the library. 2. By the end of the second year we shall have finished studying the main engineering subjects. 3. By the beginning of the lecture the laboratory assistant had brought all the necessary diagrams. 4. By the year 2000 cable television will have been used more widely. 5. By the spring of 1945 World War II was over.

3. Прочитайте текст и ответьте на следующие вопросы:

1. Какие биографические факты из жизни изобретателя телефона приведены в тексте?
2. Какие другие факты, кроме приведенных, вы знаете об изобретателе телефона?
3. Что нового вы узнали из текста? Соотнесите факты, относящиеся к истории развития телефонной связи, со следующими датами: 1877 г. и 1915 г.

Telephone

Alexander Graham Bell never planned to be an inventor, he wanted to be a musician or a teacher of deaf people (глухих). The subjects that he studied at school included music, art, literature, Latin and Greek. They did not include German which all scientists used in their books. Alexander's mother was a painter and a musician. His father was a well-known teacher of deaf people.

When Alexander was only sixteen, he became a teacher in boy's school in Scotland. He liked teaching there, but he still wanted to become a teacher of deaf people as his father.

He read all the books about sound that he could find and started to work on some of his own experiments.

At twenty five Alexander became interested in finding a way to send human voice through an electric wire. The parents of his pupils contributed money for the equipment. He found an assistant, Tom Watson, who worked in an electrical shop. For two years Tom and Alexander were working together to build a machine that people could use to talk to one another over long distances. After two years, the two young men were becoming discouraged (опустились руки). Then, one day, when they were working on a new transmitter Alexander spilled some acid (пролить кислоту) on himself. Tom Watson, who was alone in another room, heard a voice. The voice was coming through a wire to a receiver on the table! The voice was Alexander Bell's! It was saying: "Come here, Mr. Watson. I need you!"

The first telephone line was built in Germany in 1877. By 1915 a telephone line was opened in the United States - 5,440 kilometers from New York to San Francisco.

Now design bureaus all over the world are conducting experiments to develop video-phone or picture phone. A young man in Moscow wants to speak to his friend in Vladivostok. He lifts his telephone receiver, dials a number. After a very short time his friend answers. As he picks up his receiver his picture appears on the screen. They can speak to each other face to face because they are using a new kind of telephone which may be called "a video-phone". In addition to the usual telephone, the equipment includes a small television screen (14cm by 13cm) and, combined with the screen, a television camera. The camera tube will allow the user to switch from a wide view of the room to the face of the person speaking. The focus can be changed to give clear pictures of objects 0.3, 0.9 and 6.0 meters away from the camera. There is also a mirror attachment, which allows the camera to scan documents which may be lying on the table. The camera adjusts itself automatically to different lighting conditions.

Useful Terms and Phrases:

- | | |
|----------------------|--------------------------------|
| 1. alloy grey iron | специальный легированный чугун |
| 2. manufacture | производство |
| 3. wearing qualities | изнашивание |
| 4. to machine | обрабатывать |
| 5. malleable | ковкий |

I. Find Russian equivalents for the following English words:

- | | |
|----------------------|-----------------------|
| 1. malleable | 1. производство |
| 2. to machine | 2. изнашивание |
| 3. alloy grey iron | 3. ковкий |
| 4. manufacture | 4. обрабатывать |
| 5. wearing qualities | 5. легированный чугун |

II. Use the following words and phrases in sentences of your own: foundry, to cast, engineering metals, tool steel, to machine, alloy grey iron, to furnish, malleable iron.

III. State the function of the "-ing" forms and translate the following sentences into Russian:

1. The work of casting metals is performed in foundries. 2. Metals consisting of iron with some other elements are known as ferrous metals. 3. Engineering metals are used in industry in the form of alloys because the properties of alloys are much better than those of pure metals.

IV. Make the noun by adding "-ing". Translate into Russian:

| | |
|------------|-------------|
| to cast | to wear |
| to depend | to make |
| to promise | to increase |

V. Translate into Russian using a dictionary:

Production of castings made from different metals requires different types of melting furnaces. The cupola furnace is usually for melting grey iron. The air cupola and electric furnaces are used to melt the metal for making malleable iron castings. For melting steel the open-hearth, crucible or electric furnaces are used.

TEXT

The alloy of grey castings is composed of iron, carbon, silicon, phosphorus, manganese and sulphur. These elements are used in different proportions depending on the grade of castings.

In many lines of manufacture and engineering, common grey iron castings have lacked in strength and wearing qualities, so that many experiments have been conducted with a view to overcome this shortcoming. This has been accomplished, and the alloy is known as alloy grey iron, which is easy to machine because most of the carbon present is in free or uncombined state. It is used much, if not entirely, for making steam and gas-engine cylinders, also for many other castings that require greater strength and wearing qualities than are furnished by common grey iron. Alloy grey iron is one of the latest alloys developed and has promising future. It has a tensile strength of 40,000 to 60,000 lbs per square inch as it comes from the mould, and when it is heat-treated, a much greater strength is produced. Malleable iron castings are being increasingly used every year in the manufacture of machinery.

LESSON 5

Computers

ALLOY GREY IRON

GRAMMAR: Определительные придаточные предложения

1. Укажите предложения, где подчеркнутое слово является определением:

1. Complex systems of **radio** transmission networks have been set up throughout the world. 2. Scientists all over the world were quick to realize the importance of **radio** and contributed much to its further development. 3. The Russian scientist A.S. Popov worked much at the problem of **radio** communication. 4. It is necessary to **radio** the latest news to distant parts of the country. 5. The system of **communication** in any country is unthinkable today without satellites. 6. Electronic technology has made it possible to set up automatic communication systems. 7. A new international orbital system provides telephone, telegraph and telex **communication** with ships practically in every part of the World Ocean. 8. It is known that a **photon** is a particle of light. 9. Some specialists

expect that a **photon** can greatly increase the operation of a computer. 10. **Photon** computers are quite possible in the not so far future.

2. Найдите бессоюзные определительные придаточные предложения, переведите их:

1. The building our students live in is not far from the institute. 2. Bell was making his experiment in a room next to the room Watson worked in. 3. For a long time Bell couldn't get the results he was looking for. 4. The discovery of Newton's mistake we shall read about was made by a young physicist. 5. When Rontgen made his discovery the room he was experimenting in was dark. 6. The plant this material is produced at is in the Urals. 7. The problem this article deals with is connected with the subject we study. 8. It is difficult to imagine the world we live in without radio, television and telephone.

3. Read and learn:

Computers

Mary: Have you seen an interesting advertisement (реклама) in the last issue of "The Economist" ?

John: I have not read it yet.

M.: The School of Engineering offers a new programme in information system. Applications are invited for jobs in this field.

J.: Professor Smith has told me about it. This programme is interesting. It is designed to meet the needs of persons with a computing background for their work in management and industry.

M.: Don't you think that our son can lecture on this new programme?

J.: Why not? He graduated from the Department of Computer Science and for some years was taking part in the research project connected with the problems of supercomputers and their manufacturing.

M.: As far as I remember his research interests cover software (программное обеспечение) and application.

J.: And what do they say about the contract?

M.: It is a three years contract and it may be extended for further two years. I'll write Mike a letter.

J.: It's too long. You'd better call him.

Useful Terms and Phrases:

- | | |
|---------------------|-----------------------|
| 1. instead of | вместо |
| 2. resisting shock | сопротивление на удар |
| 3. seldom | редко |
| 4. annealing | отжиг |
| 5. tensile strength | прочность на разрыв |

I. Use the following words and phrases in sentences of your own: malleable iron, to anneal, tensile strength, non-ferrous metals, on account of, grade, to elongate, range, shop.

II. Translate into Russian, state the function of the "-ing" forms:

1. Steel is iron containing from 0.05 to 1.7% of carbon. 2. The blast furnace is called so because a blast of hot air is forced into it, while producing the pig iron. 3. Malleable iron before annealing is usually called "white iron". 4. For separating iron from impurities the iron ore must be melted at a very high temperature produced by burning coke in a blast furnace.

III. Translate into Russian using a dictionary:

Non-ferrous metals are generally melted in crucibles or electric furnaces. The fuels mostly used for melting are coke, coal, oil and gas. Besides the different types of furnaces, different kinds

of moulding sand are also required for making the moulds for different metals. In many cases it is necessary as well to treat either the metals or the castings in some special way before the castings can be used.

IV. Read the text and find the answers to these questions in the text:

1. What are the reasons for using malleable iron instead of grey iron?
2. How is spoken of malleable iron before annealing?
3. Why is white iron difficult to machine?
4. Where are malleable iron castings used?

Text. Part II.

Many castings that were formerly made of grey cast iron are now made of malleable iron. One of the reasons for using malleable iron instead of grey iron is that malleable iron is much stronger than grey iron castings, particularly in the matter of resisting shock.

Malleable iron castings can be made much thinner in section. However, they are seldom used, in the form they come from the moulds, as they are hard and brittle, and therefore they should be annealed. Malleable iron before annealing is usually spoken of as white iron. White iron is difficult to machine because most of the carbon present is in chemical combination with the iron. Malleable iron can be cast into very large bodies on account of its high shrinkage and because of the difficulty of annealing. It is the most easily machined of all ferrous alloys. It has to be melted very hot and poured very rapidly, because it solidifies quickly. Malleable iron castings are used in agricultural machinery, railroad equipment automobile parts and many other products.

The metal is usually tested for tensile strength and elongation. The tensile strength ranges from 38,000 to 55,000 lbs per square inch and the elongation is usually about 20 to 25%.

V. Find in the text nouns for the following verbs:

- to anneal
- to manufacture
- to equip
- to produce

LESSON 6

The British Museum

STEEL

GRAMMAR: Модальные глаголы и их эквиваленты

1. Замените модальные глаголы соответствующими эквивалентами:

1. Students must take exams in January. 2. She can speak French well. 3. You may take this book till tomorrow. 4. We must learn new words every week. 5. I live not far from my work. I can go by bus or I can walk. 6. You may come in. 7. We can take this book from the library. 8. She cannot do this work in time. 9. He must go to St. Petersburg for a few days. 10. We can see electrical devices everywhere.

2. Переведите:

1. Он может читать и писать по-английски. 2. Она должна сделать эту работу в конце месяца. 3. Теперь студенты могут войти в аудиторию. 4. Она может заниматься здесь. 5. Он должен прочитать эту статью, б. Можно мне взять ваш учебник? 7. Я должен пойти в библиотеку и взять книги. 8. Можно мне поехать с вами? 9. Умеет (может) этот ребенок ходить? 10. Вы должны вернуть книгу завтра.

3. Найдите предложения с эквивалентами модальных глаголов *to have to, to be to*:

1. Television has a great number of uses nowadays. 2. Morse discovered that telegraph messages did not have to be written, they could be sent as a sound. 3. That part of this country has become a highly industrial one. 4. Why couldn't you do it yesterday? - Because I had to go home earlier than usual. 5. This important problem had been solved by the end of 1980. 6. In the past messages to and from Europe had to be sent by ship. 7. Some materials with useful qualities will have to be produced in space. 8. A historian has to study a lot of various facts to be able to reconstruct the far past.

4. Прочитайте текст. Расскажите по-английски, чем примечателен читальный зал Библиотеки Британского музея и какие отделы имеются в Британском музее.

The British Museum

The British Museum consisting of the National Museum of Archeology and Ethnography and the National Library is the largest and richest of its kind in the world. Built in the middle of the last century it is situated in central London which consists of quiet squares and streets.

The British Museum was founded by Act of Parliament in 1753 to bring together the collection of Sir Robert Cotton, some others and future addition to them.

Anthony Panizzi designed the famous circular Reading Room at the British Museum. The first thing that strikes a visitor on entering the Reading Room is its unusual shape. It is a perfect circle. The superintendent (управляющий) and his assistant sit in the centre of the room and they issue (выдавать) and collect books. Long rows of reading desks radiate to the outer walls, like the spokes (спицы) of the wheel.

Many famous people have used the Reading Room at the British Museum. Of the many distinguished people who have used the Reading Room no one was perhaps more regular and more intent (целеустремленный) than the German philosopher and socialist Karl Marx. Soon after he arrived in England in 1849, Marx became a daily visitor of the Reading Room, where he used to remain from nine in the morning till closing time.

The British Museum has a department of ethnography. Ethnography is concerned with primitive people and their cultures in various stages of development as revealed by their tools, ritual objects and various crafts (ремесло). This collection is so vast that only a tiny percentage is on show to the general public. Then there is a department of prints and drawings. There are also departments devoted to maps, coins and medals. Visitors interested in chronology can see a large collection of clocks and watches. Those who are interested in philately can find a magnificent collection of postage stamps.

Useful Terms and Phrases:

1. to divide
2. machine steel
3. medium carbon steel
4. soft
5. machine part
6. hardness

I. Read the following fractions:

0.1; 1.0; 0.07; 0.25; 0.70; 0.8; 1.40; 5.7; 0.372; 0.006.

II. Use the words and phrases in sentences of your own:

alloying elements, carbon steel, machine steel, alloy steel, carbon, a ferrous material.

III. Find the "-ing" forms in the text, name their functions.

Text

Steel is a ferrous material with some carbon content. There are two kinds of steel: carbon and alloy steel. The content of carbon in steel may vary from 0.1 to 1.0 per cent. Carbon steel

should contain only iron and carbon without any other alloying elements and is divided into:

- 1) Machine steel with a carbon (low) content from 0.05 to 0.15%.
- 2) Medium carbon steel with a carbon content from 0.15 to 0.60%.
- 3) Tool steel with a high carbon content from 0.6 to 1.50%.

Carbon steels are the most common steels used in industry, their properties depending only on the percentage of carbon they contain. Machine steels are very soft and can be used for making machine parts that do not need strength. Medium carbon steel are better grade and stronger than machine steels. Tool steel may be used for manufacturing tools and making parts of machines because of its high strength and hardness.

IV. Unswer the following questions:

1. What is steel?
2. What are the main types of steel depending on the carbon content?
3. What steels are most widely used in industry?
4. What manufacturing purposes may tool steel be used for?

V. What are the opposites of:

low-carbon steel, strong, resistant, hard, heating, ferrous, tight, steel.

VI. Underline the suffixes and translate into Russian the following groups of words:

strong, strength, appreciation, define, definite, definition, form, formation, former, formely.

LESSON 7

MARIE CURIE AND THE DISCOVERY OF RADIUM ALLOY STEELS

GRAMMAR: Причастия. Независимый причастный оборот.

1. Переведите следующие словосочетания с причастиями I и II:

developing industry, developed industry;
changing distances, changed distances;
a controlling device, a controlled device;
an increasing speed, an increased speed;
a transmitting signal, a transmitted signal;
a reducing noise, a reduced noise;
a moving object, a moved object;
heating parts, heated parts.

2. Переведите выделенные словосочетания:

1. When completed in 1897, Gefferson's building was the largest and costliest library in the world. **2. Though being** a school teacher of mathematics all his life, Tsiolkovsky concentrated his attention on man's travel into space. **3. If compared** to today's TV program, the first black-and-white pictures were not very good. **4. While being** a teacher of deaf people Bell became interested in sound and its transmission. **5. Though discovered**, Newton's mistake had no influence on his theory. **6. While working at** a new transmitter for deaf people Bell invented a telephone. **7. If heated** to 100° C water turns into steam.

3. Укажите подлежащее независимого причастного оборота, переведите предложения:

1. Numerous experiments having been carried out at the orbital stations, it became possible to develop new methods of industrial production of new materials. 2. President Jefferson having offered his personal library, the foundation of the Library of Congress was laid. 3. Anthony Panizzi designed the Reading Room of the British Museum, the Reading Room being a perfect circle. 4. A beam of light being transmitted forwards, it is possible to measure the distance between the car and the other cars in front of it. 5. The distance having been measured, the computer adjusts the car's speed. 6. Two metallurgists produced a new superplastic metal, the new steel showing properties identical to Damascus steel. 7. The young physicist having discovered Newton's error, other scientists confirmed it. 8. The first TV sets having been shown in 1939, the news about it spread throughout the world.

4. Ответьте на следующие вопросы к тексту:

1. In what country was Marie born? 2. Who was her first teacher in science? 3. How old was Marie when she left her native land? 4. In what country did she study when a student? 5. How did she work? 6. How old was Marie when she met Pierre Curie? 7. How many years was Pierre older? 8. What can you tell about Pierre's youth? 9. What was he famous for? 10. What was Marie interested in? 11. What did Becquerel discover? 12. What was the subject for Marie's Doctor's thesis? 13. What did the scientists declare? 14. Why did Marie call the new element "radium"? 15. How old was Pierre when he tragically died? 16. How many children did the Curies have?

5. Прочитайте и переведите текст:

MARIE CURIE AND THE DISCOVERY OF RADIUM

1. Madame Curie was born in Warsaw on 7 November, 1867. Her father was a teacher of science and mathematics in a school in the town, and from him little Marya Sklodovska – which was her Polish name – learned her first lessons in science. Marya's wish was to study at the Sorbonne in Paris, and after many years of waiting she finally left her native land in 1891.

2. In Paris Marya began a course of hard study and simple living. She determined to work for two Master's degrees—one in Physics, the other in Mathematics. Thus she had to work twice as hard as the ordinary student. Yet she had scarcely enough money to live on. She lived in the poorest quarter of Paris. Night after night, after her hard day's work at the University, she got to her poorly furnished room and worked at her books steadily for hours. Sometimes she had no more than a bag of cherries. Though she was often weak and ill, she worked in this way for four years. She had chosen her course and nothing could turn her from it.

3. Among the many scientists Marya met and worked with in Paris was Pierre Curie. Pierre Curie, born in 1859 in Paris, was the son of a doctor, and from early childhood he had been fascinated by science.

At sixteen he was a Bachelor of Science, and he took his Master's degree in Physics when he was eighteen. When he met Marya Sklodovska he was thirty-five years old and was famous throughout Europe for his discoveries in magnetism. But in spite of the honour he had brought to France by his discoveries, the French Government could only give him a very little salary as a reward, and the University of Paris refused him a laboratory of his own for his researches.

4. Pierre Curie and Marya Sklodovska, both of whom loved science more than anything else, very soon became the closest friends. They worked together constantly and discussed the many problems of their researches. After little more than a year they fell in love with each other, and in 1895 Marya Sklodovska became Mme Curie. Theirs was not only to be a very happy marriage but also one of the greatest scientific partnerships.

Marie has been the greatest woman scientist of her day but she was a mother too, a very loving one. There were their two little girls Irene and Eve.

5. By this time Mme Curie had obtained her Master's degree in Physics and Mathematics, and was busy with researches on steel. She now wished to obtain a Doctor's degree. For this it was

necessary to offer to the examiners a special study, called a thesis, which would add to the world's scientific knowledge.

6. For some time Pierre and Marie Curie had been interested in the work of a French scientist named Becquerel. There is a rare metal called uranium which, Becquerel discovered, emits rays very much like X-rays. These rays made marks on a photographic plate when it was wrapped in black paper. The Curies kept wondering about these rays of uranium. What caused them? How strong were they? There were many such questions that puzzled Marie Curie and her husband. Here, they decided, was the very subject for Marie's Doctor's thesis.

7. The research was carried out under great difficulty. Mme Curie had to use an old stored-room at the University as her laboratory—she was refused a better room. It was cold, there was no proper apparatus and very little space for research work. Soon she discovered that the rays of uranium were like no other known rays.

8. Marie Curie began to wonder if other chemical substances might not emit similar rays. So she began to examine every known chemical body. Once after repeating her experiments time after time she found that a mineral called pitchblende emitted much more powerful rays than any she had yet found.

9. Now, an element is a chemical substance which so far as is known cannot be split up into other substances. As Mme Curie had examined every known chemical element and none of them had emitted such powerful rays as pitchblende, she could only decide that this mineral must contain some new element.

Scientists had declared that every element was already known to them. But all Mme Curie's experiments pointed one way. Pitchblende must contain some new and unknown element. There was no other explanation for the powerful rays which it emitted.

Scientists call the property of giving out such rays "radioactivity", and Mme Curie decided to call the new element "radium", because it was more strongly radioactive than any known metal.

In 1903 Marie and Pierre together with Henry Becquerel were awarded the Nobel Prize in Physics.

In 1911 Marie received the Nobel Prize in Chemistry. But the second prize went to her alone for in 1906 Pierre had died tragically in a traffic accident.

Useful Terms and Phrases:

- | | |
|-------------------------|------------------------|
| 1. in addition to | к тому же, кроме того |
| 2. to present | присутствовать |
| 3. appreciable | значительный |
| 4. high-speed steel | быстрорежущая сталь |
| 5. self-hardening steel | самозакаляющаяся сталь |
| 6. tungsten | вольфрам |
| 7. rust-resistant | коррозийная стойкость |
| 8. stainless steel | нержавеющая сталь |

I. Find Russian equivalents for the following English words:

- | | |
|-------------------------|---------------------------|
| 1. high-speed steel | 1. нержавеющая сталь |
| 2. self-hardening steel | 2. вольфрам |
| 3. in addition to | 3. быстрорежущая сталь |
| 4. appreciable | 4. самозакаляющаяся сталь |
| 5. tungsten | 5. кроме того |
| 6. rust-resistant | 6. значительный |
| 7. stainless steel | 7. коррозийная стойкость |

II. Translate the following sentences into Russian and observe the different ways of expressing obligation:

1. Steel has to be widely used in machine-building because of its high strength.
2. Alloy steel must be made by adding some alloying elements.

3. Tools made of high-speed steel may do the work at much higher speeds than carbon tool steels.

III. Make up sentences using these words, translate them into Russian:

1. nickel, chromium, manganese, molybdenum, tungsten, of, the, steels, alloying elements, are.
2. strength, hardness, of, the, steel, increases, nickel.
3. corrosion, steel, shock, resistant, makes, vanadium.

IV. Translate into Russian, make up questions to underlined words:

1. The metal is poured at an extremely high temperature.
2. Steel is a very strong material.
3. Heat-resistant steel is made by adding some tungsten and molybdenum.
4. Steel and cast iron differ in carbon content.

V. Read the text and answer the questions:

1. What is alloy steel?
2. What alloying elements can change the properties of alloy steel?

Alloy steels are those in which in addition to carbon an alloying element is present in some appreciable quantity. They are divided into special alloy steels and high-speed steels which, in turn, are called "self-hardening steels". Alloying elements of these steels are: nickel, chromium, manganese, molybdenum, vanadium, etc. These alloying elements have a definite effect on the characteristic of the steel; nickel increases its strength and hardness, a high percentage of chromium makes steel rust-resistant and in this case it is called "stainless steel". The addition of some tungsten and molybdenum gives heat-resistant steel. Vanadium makes steel corrosion, shock and vibration-resistant.

LESSON 8

ALLOY STEELS Part II A WONDER METAL GRAMMAR: Passive Voice

TEXT

The sand used for making moulds for steel casting differs greatly from that used in other branches of moulding. It must be much refractory and open grained, because the metal is poured at an extremely high temperature and solidifies very rapidly. If the sand is not refractory enough, it will fuse with the metal. The sand being not open grained, the gases will not escape from the mould rapidly enough, and blow holes will be formed in the casting. Many good steel castings are obtained with green sand moulds. Sand moulds are made by shaping the moulding sand around a pattern which is to have the same shape as the finished object, but their size should be a little larger as the steel casting shrinks while cooling. Moulding sand is to be mixed with water in a certain proportion. Many of the smaller steel castings are used as they come from the moulds, but most of the larger ones have to be annealed to relieve the cooling strains formed when the metal solidifies. Steel can be used for a great variety of castings, and it can be cast into very large bodies.

Useful Terms and Phrases:

- | | | |
|----|------------------|----------------------|
| 1. | sand | песок |
| 2. | mould | литейная форма |
| 3. | fuse | сплавлять |
| 4. | green sand mould | сырая литейная форма |
| 5. | pattern | модель |

| | | |
|----|-----------|------------|
| 6. | to anneal | отжигать |
| 7. | strain | напряжение |

I. Answer the following questions:

1. What sand is used for making steel castings? 2. Why must the pattern be a little larger than the casting which is to be produced?

II. Find verb in the text for the following nouns: difference, fusion, solidification, annealing.

III. Fill in the blanks with prepositions: in, at, for, of, by. Translate into Russian.

1. Alloy steels are ever wider used ... industry. 2. The metal is poured ... an extremely high temperature. 3. The sand ... making moulds ... steel castings should be refractory. 4. We find wide application ... steel ... engineering. 5. Heat-resistant steel is made ... adding some tungsten and molybdenum. 6. Steel and cast iron differ ... carbon content. 7. The carbon content ... steel is little, while that ... cast iron is much greater.

IV. Find sentences in Passive Voice in the text.

V. Прочитайте текст.

A Wonder Metal

The story of titanium is extraordinary. To begin with, it was discovered twice: by a British scientist William Gregor and six years later, in 1797, M. H. Klaproth, a German chemist, also found it and gave it its present name.

For many years, titanium was of interest only to research chemists – it was considered too brittle to be of any practical value. Yet it was the impurities with which it was usually associated (it forms compounds easily with nearly every known element) that made it brittle.

It cost the chemists in many countries endless efforts to isolate pure titanium and even more to start producing it commercially.

Titanium has one surprising property – it is completely inert in biological media, something the medical community was quick to notice. It is being used to make artificial joints and many other things necessary in surgery. Titanium instruments do not corrode, and are thirty per cent lighter than instruments made of stainless steel.

Titanium's high standard of corrosion resistance, lightness, tensile strength, and the ease of forging, rolling and stamping are finding it more and more uses. Titanium alloys are very useful in mechanical engineering, and for chemical and refractory apparatus. Titanium helped design engineers to surmount the sound and heat barriers in supersonic and high-altitude aircraft designing.

Titanium and its alloys are coming out in the commercial field – they have already made quite a name for themselves as structural materials.

VI. Отметьте, какие из нижеприведенных утверждений соответствуют содержанию текста.

1. Titanium was discovered twice. 2. Pure titanium is found in nature. 3. Titanium forms compounds with many elements. 4. To isolate pure titanium isn't difficult. 5. Titanium is light, strong and corrosion resistant. 6. It is active in biological media. 7. Titanium can be used in surgery. 8. Titanium alloys can't be used as structural materials.

LESSON 9

ALLOY STEELS Part III. CORROSION

Cast steel parts enter into the make-up of railroad equipment, agricultural machinery, and many other products where great strength is required. The tensile strength of steel castings is from 55,000 to 70,000 lbs per square inch. Alloy steel castings are coming into more general use with each year, and they are influencing the manufacturing methods. It has been found possible to cast with this alloy some shapes that formerly were necessarily made in other ways. It is used in castings where the greatest strength is needed. Much research is being done to improve not only its strength, but also its wearing qualities. Castings are now produced that have a tensile strength from 70,000 to 150,000 lbs per square inch, the strength depending upon the composition of the alloy and the method of heat treatment.

I. Answer the following question:

What does the tensile strength of steel depend on?

II. Form nouns using suffix "-ity". Translate into Russian.

| | |
|--------------|--|
| The metal is | fluid plastic elastic ductile |
| It possesses | Fluidity |

III. State the forms and functions of Infinitives and translate into Russian:

1. it is common practice to divide metallurgical materials into ferrous and non-ferrous ones.
2. Some metals possess special properties, one of which is power to conduct electric current.
3. The ability of a material to take deformation without breaking is known as plasticity.
4. Engineering materials have large applications and their mechanical properties to be studied required much attention.

IV. Read and translate the following text without using a dictionary:

Production of Steel

Converter steel is made from molten pig iron by forcing a blast of cold air under great pressure through the metal. The converter represents a large tank made of steel and covered with refractory bricks with an open top through which the molten metal is poured into the converter and out of it. When forcing the blast of cold air through the melted metal, the oxygen contained in the air combines with the carbon of the pig iron, and almost all the carbon in the metal is burned out. Steel made by this method is very cheap, but it is low grade steel because this method of producing steel cannot be well controlled.

Steel made in this way is called "Bessemer steel". One ton of such steel can be made in one minute.

V. Make up questions to which the underlined words are the answers:

1. The deformation test of a metal property is performed **in a laboratory**. 2. By a testing metal one can define its **mechanical properties**. 3. In **some materials, such as stone or iron**, the possible elastic deformation may be very small. 4. **Elasticity** is the capacity of the material to resist produced deformation without permanent change of form.

VI. Заполните пропуски в следующем тексте модальными глаголами. Переведите получившийся вариант текста. Уточните, насколько вероятно действие, которое вводит модальный глагол.

Corrosion

Corrosion attacks all engineering materials, especially metals.

No material ... be completely corrosion-resistant. Even stainless steels ... corrode. Engineers ..., however, fight corrosion. For example, they ... use high-purity metals because these metals are more resistant than alloys. They ... also make sure that two dissimilar metals are not allowed to touch each other. Finally engineers ... protect the surfaces of the metals in many different ways. One of the most common methods ... be to paint them.

LESSON 10

NON-FERROUS METALS

WORKING WITH NEW MATERIALS

GRAMMAR: Infinitive constructions

Non-ferrous metals are more expensive than ferrous metals and are used only when some characteristic not possessed by iron or steel is essential or desirable in application. These characteristics are: high electrical and thermal conductivity, high corrosion resistance, non-magnetic qualities, light weight, etc.

The metals most frequently used to make non-ferrous metal castings are copper, tin, zinc, lead, nickel, gold and aluminium. Some of the basic non-ferrous metals and their characteristics will be described.

Useful Terms and Phrases:

| | | |
|----|-------------|----------|
| 1. | non-ferrous | цветной |
| 2. | quality | качество |
| 3. | copper | медь |
| 4. | tin | олово |
| 5. | lead | свинец |

I. State the function of Infinitives. Translate the following sentences into Russian:

1. To prepare metals for practical use requires much knowledge and experience. 2. To prevent corrosion metals to be used in industry must be covered with special paint. 3. Engineering hope to improve greatly the properties of modern metals. 4. This metal is too brittle to be hammered. 5. In order to define the suitability of the alloy let's analyse the properties to be required for the process.

II. Translate the following word combinations. Pay attention to the words of the same stem:

To resist very high temperatures; to possess resistance to corrosion; to be resistant to deformation.

III. Change Passive constructions into Active according to the model. Mind the tenses:

Model: Cast iron and steel are produced from pig iron.

We produce cast iron and steel from pig iron.

1. Ferrous metals are used in industry in two general forms. 2. Manganese can be separated from oxides by the use of carbon and carbon monoxide. 3. Many naturally occurring compounds have been used as industrial sources of metals. 4. The definite chemical compound of the metal in the ore is termed a mineral.

IV. Change Active constructions into Passive according to the model. Mind the tenses:

Model: We use various grades of copper for engineering purposes.

Various grades of copper are used for engineering purposes.

1. We use some metals in the native state. 2. Ancient people have employed bronze since the prehistoric times. 3. Metallurgists extract aluminium from rock with high alumina content.

V. Прочитайте текст.

Working With New Materials

A successful design is almost always a compromise among highest performance, attractive appearance, efficient production, and lowest cost. Achieving the best compromise requires satisfying the mechanical requirements of the part, utilizing the most economical material that will perform satisfactorily, and choosing a manufacturing process compatible with the part design and material choice. Stating realistic requirements for each of these areas is of the utmost importance.

The rapidity of change in materials technology is typified by the fact that plastics, a curiosity at the turn of the century, are now being used in volumes which have for many years exceeded those of all the non-ferrous metals put together, and which are beginning to rival steel.

The changes which are taking place are, of course, not only quantitative. They are associated with radical changes in technology—in the range and nature of the materials and processes available to the engineer.

The highest specific strength (i. e. the strength available from unit weight of material) now available comes from non-metals, such as fibreglass, and from metals, such as berillium and titanium, and new ultra-high strength steels.

LESSON 11

NON-FERROUS METALS Part II. SUPERHARD MATERIAL FROM POWDER GRAMMAR: INFINITIVES

Copper is a reddish–brown, tough metal. It has very high electric conductivity and high corrosion–resistant qualities. Copper is used for making electrical contacts and wires, pipes, telephone cables, tanks, water heaters, etc.

Zinc is a hard, brittle, bluish–white metal that is employed in the pure form as sheet zinc.

Lead is a very heavy bluish–grey metal which is very soft. This metal is highly resistant to corrosion, but its strength is so low that it must be supported by a core of some other metal. Lead is used for lining pipes, acid tanks and coating electrical cables.

Aluminium is a soft, silvery white metal. It is light in weight, has high corrosion-resistant qualities and is used for automobile and airplane parts as well as for making different light-weight objects used in everyday life such as: frames, cooking utensils, chairs, etc.

Tin is a silvery, corrosion-resistant metal. Tin is hardly used in pure form, but is employed as an alloying element.

Nickel is a hard, tough, silvery metal. It has high corrosion-resistant qualities and is used for plating other metals such as iron or brass.

Useful Terms and Phrases:

| | | |
|----|-----------------------|---------------------|
| 1. | tough | прочный |
| 2. | electric conductivity | электропроводимость |
| 3. | to employ | применять |
| 4. | to support | поддерживать |
| 5. | silvery | серебристый |
| 6. | part | часть, деталь |
| 7. | as well as | так же как |
| 8. | alloying | легированный |

I. Answer the following questions:

1. What are the properties of copper and what is it used for?
2. What do you know about lead?
3. What purposes is aluminium used for?

II. State the forms and functions of Infinitives and translate the following sentences into Russian:

1. Some metals have to be melted at very high temperatures. 2. To make non-ferrous castings, such metals as zinc, lead, aluminium and others are melted together. 3. To line pipes and electrical cables such metal as lead is used. 4. One must add some tin to make brasses stronger.

III. Translate the following groups of words of the same stem:

1. a strong man; a strong metal; the strength of knowledge; the strength of materials; to strengthen the resistance; to strengthen a structure.

2. to conduct electricity; to conduct a research; a conductor of electricity; the conductivity of heat.

IV. Translate the following sentences paying attention to the meaning of the words "only", "too":

1. Metallic aluminium is one of the newest industrial metals, which was produced in useful amounts only a little more than fifty years ago. 2. Most of the metals are silvery white or grey in colour. Copper is the only red metal and gold is the only yellow one. 3. Hardened steel is too brittle because of internal strain. 4. Aluminium has light weight and it has considerable resistance to corrosion too. 5. Iridium, a valuable metal, is too rare free in nature to be used for industrial purposes in large quantities. It is important for alloys and is used for points of fountain pens too.

V. Make the sentences interrogative and give short answers:

1. In many cases, one liquid will mix completely with another. 2. Hydrogen can be prepared by the action of certain metals on the base. 3. Magnesium, iron and zinc are able to take the oxygen from water. 4. Pure metals are seldom used in engineering. 5. Electric furnaces have been used in making steel. 6. They produced steel by two principal methods.

VI. Make up as many questions as possible on the basis of the following sentences:

1. Aluminium possesses high corrosion-resistant qualities. 2. Copper is used for making electrical contacts and wire because of its high electrical conductivity.

VII. Прочитайте и переведите текст.

Superhard Material from Powder

The development of the engineering, electronic, radio-technical and electrotechnical industries is unthinkable without materials with special properties. They include, in particular, composite materials, i. e., materials that combine incompatible properties, plastics, etc.

Powder metallurgy figures prominently in obtaining these and other materials. Composite materials have been produced by the hot compaction methods, which are better in their properties, especially in durability, than similar materials obtained abroad. The antivibration alloys of the "iron-copper" type made it possible to double the durability of drilling tools. This increased labour productivity by 20 percent. Welding electrodes made of powders used for resistance welding are 9-12 times more durable than those made by conventional methods.

The operational principle of powder metallurgy is very well known — an item of necessary size is modeled, in a mould, out of very small metal grains. After that the item is put into an electrothermic furnace where the grains get sintered together.

The coefficient of the use of metal grows by five times. True, powders more often than not cost more than metal-rolling. But labour input is much smaller and labour productivity — higher. As a result of that, an item made of powder is over three times cheaper. This saving is achieved on account of a complete or partial liquidation of machining the item, the reduction of metal consumption by half or more, and automation of pressing and sintering.

The time of operation of powder articles increases considerably. The sintered articles have already proved their advantages working in outer space, in deep sea conditions and inside various machines.

It has been estimated that the output of 1,000 tons of powder articles saves the labour of 190 workers, frees 80 metal-cutting machine tools and saves 2,000 tons of ferrous and non-ferrous rolled stock and some 1.5 million roubles.

Russian scientists have attained considerable success in powder metallurgy. They were the first in the world to develop, using high-energy moulding methods, a new superhard material out of boron nitride.

LESSON 12

NON-FERROUS METALS Part II.

PROPERTIES OF ENGINEERING MATERIALS AND METHODS

OF TESTING THEM Part I.

GRAMMAR: INFINITIVES

There are many applications of non-ferrous metals in the unalloyed state, but in most cases, some alloying element is added.

Non-ferrous metals may be mixed in various proportions to form many alloys, chief among them being brasses, bronzes and aluminium alloys. There is a wide range of use for non-ferrous alloys. Their nature differs greatly from that of the ferrous group. By varying the proportions of non-ferrous metals, alloys that are hard or soft, weak or strong, can be produced. When alloying, the metal with the highest melting point should be melted first, then the one with the next highest melting point, and so on until all the metals that are to make up the alloy are melted together. For example, to make a red-brass alloy the copper is melted first, then the zinc, then the lead and at last

the tin. As soon as the mixture is not enough to run the castings, it should be taken out of the furnace, otherwise the zinc, tin and lead may burn away.

Useful Terms and Phrases:

| | | |
|----|---------------|-------------------------|
| 1. | to mix | смешивать |
| 2. | various | различный |
| 3. | brass | латунь |
| 4. | to produce | вырабатывать, создавать |
| 5. | melting point | точка плавления |
| 6. | mixture | смесь |
| 7. | to burn | гореть |

I. Translate the following groups of words of the same stem:

Red, reddish, silver, silvery, to possess, possessive, possession, to plate, plating, to alloy, alloying, hard, hardness, to harden, hardening, pure, impure, purity, impurity to purity.

II. Translate the following sentences into Russian, state the function of the Infinitive:

1. Steel is the metal to be formed from iron with a definite amount of carbon. 2. If steel is heated above critical temperature it becomes softer and much easier to be machined. 3. This alloy is not tough enough to be used in this process. 4. There exists a large number of metals to be found free in nature.

III. Change the sentences according to the model. Mind the group of tenses:

Model: Carbon resists the action of air and moisture.

Carbon resisted the action of air and moisture.

Carbon will resist the action of air and moisture.

1. Carbon does not melt at ordinary pressures. 2. Diamonds must be cut and polished for this purpose. 3. We can separate manganese from its oxide by the use of chemical reducing agents.

IV. Change the sentences according to the model. Mind the group of tenses:

Model: Gold is mined in the native state.

Gold was mined in the native state.

Gold will be mined in the native state.

1. Such minerals must be concentrated. 2. Rich ores of certain of the heavy metals have been exhausted. 3. New steel plants are constructed in our country.

V. Translate the following sentences paying attention to the different meanings of the word "make":

1. Addition of copper, zinc and iron makes aluminium stronger. 2. Our makers of new cranes are well known all over the world. 3. The foreman makes the learners pay attention to the casting process.

VI. Прочитайте и переведите текст.

Properties of engineering materials and methods of testing them Part I.

While using engineering materials in practice we must know their properties because they affect manufacture and application of materials. All engineering materials have definite characteristics which determine their abilities to assume external *loads* because of which materials change their shape. When a metal is treated or when machine parts and tools are in the process of work the metals which they are made of are *subjected* to the influence of *external forces*. These

forces are called "loads" and may have different characteristics: *according to* their value they may be small or large; according to the duration and character of their action they may be *constant and impact*. According to the influence of the loads upon the metal *causing* different changes of its shape, loads are distinguished as *compression, tensile, torsional, shearing, and bending* ones. By testing a metal under a load one can define what mechanical properties it has. In other words, one can determine strength, elasticity, plasticity, hardness and other properties of the metal. In order to have a clear conception of the metal properties it is subjected to tests on special devices and machines. The determination of these properties is made in the laboratory using a *specimen* from the metal to be tested.

LESSON 13

BRASSES, BRONZE STRENGTH OF METALS Part II.

Brasses are yellowish or reddish alloys of copper and zinc in different proportions (about 60 % copper and 40 % zinc, but some brasses contain as high as 90 % copper with only 10 % zinc). An addition of tin makes brasses stronger. Brasses are very ductile and may be treated without heating them. They are corrosion-resistant and are used for making musical instruments, bearings, etc.

Bronze is an alloy containing primarily copper and tin, but other elements may be added to the alloy to increase its properties such as hardness and resistance to wear. The most common bronzes are known as straight bronze, phosphor bronze, and manganese bronze. Straight bronze is usually mixture of copper and tin, but there are many bronzes that contain zinc and lead, especially the cheap mixtures. Phosphor bronze may be made by adding a little phosphorus to the mixture.

If phosphor tin is used and alloyed with the copper, better results will be obtained than if the phosphorus is mixed with the copper. Manganese bronze alloys are usually made by using both copper that contains from 5 to 15% of manganese and copper that contains no manganese.

I. Answer the following questions:

1. What do you know about bronzes?
2. What do you know about brasses?

II. Use the following words and phrases in the sentences of your own:

thermal, mixture, copper, coating, non-magnetic quality, tin, sheet zinc, lining, to support, lead, core, brass, bronze.

III. State the forms and functions of Infinitives and translate the following sentences into Russian:

1. Very few objects are made of pure tin, but it is used to make bronze, babbitt, and other alloy metals. 2. Nickel is used for covering iron and brasses to make them look better. 3. Nickel does not rust and can be polished to a very bright, silvery finish. 4. To increase hardness and strength of cast copper some cold-working operations are performed.

IV. Translate in to Russian:

1. Resembling one another in their general chemical behaviour, the metals differ markedly in activity. 2. The machines produced by our plant are exported to many countries. 3. These iron ores being almost entirely free from phosphorus and sulphur, the iron and steel produced is of high purity. 4. Certain metals showing a high valence, form oxides in which they function as acid-forming elements.

V. Translate into Russian, paying attention to the words–substitutes:

1. The most useful alloys are those with either copper or silver or both. 2. Scientists develop new processes and improve old ones to produce better kinds of steel. 3. Our research gave better results than theirs. 4. The most important properties of the metals are the ones grouped together as mechanical properties. 5. The temperature at which a metal melts is called the melting point, the metals of lower melting points are generally the soft metals and those of high melting points – the hard metals.

VI. Прочитайте и переведите текст.

Strength of metals

Strength of metals is the property of hard materials to be subjected to the influence of external forces without incurring damage and without changing their shape. The *ultimate tensile strength* of a material is that *unit stress* developed in the material by maximum slowly applied load that the material can resist without rupturing in a tensile test. A *stress* is the force within a body which resists deformation *due to* an externally applied load. If this load acts upon a *surface* of *unit area*, it is called a "unit force", and the stress resisting it is called a "unit stress". An external force acting upon an elastic material, the material is deformed and the deformation is in proportion to the load. This distortion or deformation is called "strain".

Special machines, called "*rupture machines*", are used to test metals for strength.

LESSON 14

ALUMINIUM ALLOYS

ELASTICITY, PLASTICITY, HARDNESS Part III.

Aluminium is used extensively for castings that are to be light in weight, light in colour, or that must not rust. Since aluminium is too soft for making castings, it is necessary to mix some other metals with it. The metals that alloy freely with aluminium are copper, zinc and iron. Usually, where aluminium alloys are made, the aluminium predominates.

All non–ferrous castings will take a high polish and will not rust so easily as the ferrous metals, a characteristic that makes them especially useful in wet or damp places. Non–ferrous metals are rather expensive and therefore nowadays scientists try to replace them with some ferrous alloys of lower cost possessing the same properties.

I. Answer the following questions on the text:

1. What are the main properties of non–ferrous castings?
2. Why are attempts made to replace non–ferrous metals by ferrous ones?

II. Make up questions to which the underlined words are the answers:

1. The deformation test of a metal property is performed **in a laboratory**.
2. **By testing** a metal one can define its **mechanical properties**.
3. **Elasticity** is the capacity of the material to resist produced deformation without permanent change of form.

III. Translate the following text in written form without using a dictionary:

Non–Ferrous Metals

The metals most frequently used to make non–ferrous castings are copper, tin, zinc, lead and aluminium. These non–ferrous metals have better resistance to corrosion than steel and they are usually easier cast and worked. There are many applications of non–ferrous metals and only few manufactures or machines are made that do not require the service of some or other non–ferrous

component. For most purposes the pure non-ferrous metals are too soft and other alloying elements have to be added to create particular physical properties as required by each application. For this purpose non-ferrous metals are mixed in various proportions to form different alloys, such as brasses, bronzes and aluminium alloys, which can be strong, weak, hard or soft. Their cost is considerably greater than that of carbon steel but less than that of some of the alloy steels.

IV. Прочитайте и переведите текст.

Elasticity, Plasticity, Hardness Part III.

Elasticity is the ability of a material to change its shape under the influence of external loads and return to its original form upon removal of the loads. All materials are elastic but the range of elasticity varies for different materials. Elasticity is *evaluated* by means of the modulus of elasticity. The modulus of elasticity is the ratio of the unit stress S to the unit deformation Δl within the proportional limit of the material to be tested

$$E = \frac{S}{\Delta l}$$

Plasticity is that property of a material when under the influence of loads, specimens of different materials may elongate while their cross-section decreases. Plasticity is the opposite of elasticity. So, plasticity is the ability of material to change its form without breaking under the influence of load and preserve this changed form after removal of the load. For determining the plasticity of metals a rupture machine may be used too.

Hardness of material is the property to resist deformation under applied load. Hardness is the most important mechanical property of metals. Hardness may also be defined as the ability of metals to resist *penetration* of other harder materials or as resistance to wear.

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