МИНИСТЕРСТВО ОБРАЗОВАНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ

Учреждение образования
«Брестский государственный технический университет»

Кафедра иностранных языков технических специальностей

МЕТОДИЧЕСКИЕ РЕКОМЕНДАЦИИ

по изучающему чтению на английском языке
для студентов специальности
«Технология машиностроения»
заочной формы обучения

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Методические рекомендации для студентов 1-2 курсов заочной формы обучения, специальности 1-36 01 01 «Технология машиностроения».

Содержит текстовый материал и упражнения на английском языке для обучения чтению специальной литературы в техническом вузе.

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Учреждение образования

ПРЕДИСЛОВИЕ

Данные «Методические рекомендации» предназначены для студентов-заочников 1-2 курсов специальности «Технология машиностроения».

«Методические рекомендации» составлены в соответствии с требованиями ПРОГРАММЫ по иностранным языкам для студентов неязыковых вузов заочной формы обучения.

Соответственно целью «Методических рекомендаций» является совершенствование навыков чтения и понимания оригинальной научно-технической литературы по специальности, развитие навыков перевода, а также помощь студентам в их самостоятельной работе. Автор рекомендует студентам предварительно повторить основные особенности английского языка и использовать предложенный материал, применяя знания по специальности и общетехническим предметам в качестве основы смысловой и языковой догадки, обязательно использовать англо-русский и русско-английский словари, а также другую справочную литературу. Работая над текстами, рекомендуется вести терминологический словарь.

В «Рекомендации» включены тексты из оригинальной технической литературы, имеющие познавательный характер и практическую направленность. 20 текстов с упражнениями предназначены для изучающего чтения, а также приложения «Меры измерений» и «Шкала температурных соответствий».

Автор выражает признательность к.п.н., доценту кафедры английского языка с методикой преподавания Брестского государственного университета им. А.С. Пушкина Л.Я. Дмитрачковой за ценные предложения, сделанные в процессе рецензирования.

1. Прочитайте новые слова, переведите их на русский язык, используя словарь:

steam engine	heat expert
internal combustion engine	production engineering expert
turbine	engineering designer
pump	tool designer
machine-tool	mathematician
generator	economist
motor	mechanical engineering
radio	electrical engineering
metallurgist	civil engineering
strength of materials expert	structural engineering
mechanics	chemical engineering

2. Прочитайте текст. Выпишите из текста интернациональные слова, переведите их, используя словарь.

TEXT 1. ENGINEERING

Today machines have to withstand such tremendous stresses and to be able of such complex motions that complicated and specialized calculations taking hundreds of factors into account are needed in the design of even quite a simple machine like a motor-car engine.

So, as engineering progresses, engineers must become ever more scientific and specialized. Today the branches of engineering are so wide that it is impossible to classify them satisfactorily. But we may try to divide them into uses. The main divisions of engineering may be listed as follows:

1. Mechanical engineering:
Steam engines, internal combustion engines, turbines (steam, gas, water), pumps; compressors; machine-tools; mechanisms.
2. Electronics engineering:
a) Power: generators; motors; transformers; transmission (power lines and so on).
b) Electronics: radio; radar; television.
3. Civil engineering:
Dams; tunnels; roads, and so on.
4. Structural engineering:
The structural details of all large buildings and bridges.
5. Chemical engineering:

Any of these branches of engineering may require the special services of the following specialists: the metallurgist, the strength of materials expert, the thermodynamics of heat expert, the mechanics or machines experts, the various production engineering experts such as the engineering designer or the tool designer, the mathematician specializing in engineering problems and many more.

The engineer must also deal with the economists to assure himself that he is producing what is wanted, and economically.

3. Переведите следующие предложения на русский язык:

1. Any branch of engineering requires the special services of the metallurgist to select the proper materials. ... 2. A mechanical engineer should know thermodynamics to calculate heat process.... 3. A production engineer takes part in the manufacturing processes.... 4. A tool designer cooperates with an engineering designer to select machinery.

4. Прочитайте текст еще раз и дополните следующие предложения в соответствии с содержанием текста:

1. At present there are ...
2. It is very difficult ...
3. The main division of engineering are ...
4. So, engineers must become ...
5. In designing even a simple machine ...
6. Thus, any branch of engineering may require ...

5. Найдите в тексте ответы на вопросы:

1. What is engineering?
2. What are engineering divisions?
3. Name engineering specialists.
4. The engineer deals with the economists, doesn/t he?
5. Does engineering industry make most of the essential and useful things?

1. Прочитайте и переведите следующие новые слова, используя словарь:

robot
manipulator
welding equipment
transfer line
machine-tool
module installation
continuous casting
treatment strengthening
treatment reinforcing
manufacturing
machining
vacuum plasma method
to trace the process
to take up a workpiece
to identify an object
unmanned industry
flexible industry
advanced technology
intense work

2. Прочитайте текст и составьте список интернациональных слов, переведите их на русский язык:

TEXT 2. TRENDS IN THE MODERN MACHINE-BUILDING INDUSTRY

The scientific and technological progress will continue in engineering along two main headlines. Firstly, it is automation, including the creation of "unmanned" industries. Secondly, raising the reliability and extending the service life of machines.

This certainly requires new technology. The machine modules on a large scale are well suited for "unmanned" industries.

Intense work is being carried out on new robots. What we need is not merely manipulators which can take up a workpiece and pass it on, but robots which can identify objects, their position in space, etc.

We also need machines that would trace the entire process of machining. Some have been designed and are manufactured. Modern engineering thinking has created new automated coal-digging complexes and machine systems, installations for the continuous casting of steel, machine-tools for electrophysical and electrochemical treatment of metals, unique welding equipment, automatic rotor transfer lines and machine-tool modules for flexible industries.

New technologies and equipment have been designed for most branches of engineering.

In the shortest time possible the engineers are to start producing new generations of machines and equipment which would allow manufacturers to increase productivity several times and to find a way for the application of advanced technologies.

Large reserves in extending service life for machines can be found in the process of designing. At present, advanced methods have been evolved for designing machines proceeding from a number of criteria. Automatic design systems allow for an optimizing of the solutions in design and technology when new machines are still in the blueprint stage.

A promising reserve in increasing the life of parts is strengthening treatment. In recent years new highly efficient methods have been found.

First and foremost of them is the vacuum plasma methods for coating components with hard alloy compounds, such as nitrides and carbides of titanium, tungsten and boron. Methods have been designed for reinforcing machine parts most vulnerable to wear and tear, such as in grain harvesters, to make them last several times longer.

Thus, it is not merely quantity engineers and scientists are after, rather it is a matter of major characteristics. In other words, this is a matter of quality, and not of the mere number of new machines, apparatuses and materials.

3. Переведите следующие словосочетания на русский язык:

electrophysical treatment, unmanned industry, service life, advanced technology, flexible production, design system, vacuum plasma method, hard alloy compounds, reinforcing machine parts, machine modules.

4. Какие высказывания соответствуют содержанию текста?

1. There are two main trends in modern machine-building: automation and raising of the reliability of machines. 2. The creation of "unmanned" industries is included into automation. 3. Machine modules and robots are not suited for "unmanned industries". 4. Automation and raising of the reliability of machines require new technologies. 5. Advanced technologies are applied in most branches of engineering. 6. The service life of machine parts can't be increased by strengthening treatment. 7. Hard alloy compounds are employed for coating components. 8. The process of designing can also be automated. This gives the advantage of optimizing solutions in design and technology.

5. Продолжите следующие предложения, используя текст:

1. The scientific and technological progress will continue in ...
2. Intense work is being carried out on ...
3. We need machines that would trace ...

1. Прочитайте и переведите следующие новые слова, используя словарь:

to move	responsibility for the product
to assemble	chain drive
to perform	automatic valve
to increase	steam engine
to produce	continuous process
to work	computer-controlled automation
assembly line	quality control
conveyer belt	development monotony

2. Прочитайте текст и составьте список интернациональных слов, переведите их на русский язык:

TEXT 3. INDUSTRIAL ENGINEERING AND AUTOMATION

A major advance in the twentieth century manufacturing was the development of mass production techniques. Mass production refers to manufacturing processes in which an assembly line, usually a conveyer belt, moves the product to stations where each worker performs a limited number of operations until the product is assembled. In the automobile assembly plant such systems have reached a highly-developed form. A complex system of conveyer belts and chain drives moves car parts to workers who perform the thousands of necessary assembling tasks.

Mass production increases efficiency and productivity to a point beyond which the monotony of repeating an operation over and over slows down the workers. Many ways have been tried to increase productivity on assembly lines: some of them are as superficial as piping music into the plant or painting the industrial apparatus in bright colors; others entail giving workers more variety in their tasks and more responsibility for the product.

These human factors are important considerations for industrial engineers who must try to balance an efficient system of manufacturing with the complex needs of workers.

Another factor for the industrial engineer to consider is whether each manufacturing process can be automated in whole or in part. Automation is a word coined in the 1940s to describe processes by which machines do tasks previously performed by people. The word was new but the idea was not. We know of the advance in the development of steam engines that produced automatic valves. Long before that, during the Middle Ages, windmills had been made to turn by taking advantage of changes in the wind by means of devices that worked automatically.

Automation was first applied to industry in continuous-process manufacturing such as refining petroleum, making petrochemicals, and refining steel. A later development was computer-controlled automation of assembly line manufacturing, especially those in which quality control was an important factor.

3. Прочитайте текст еще раз, найдите в тексте синонимичные данным выражения:

1. ...manufacturing of large quantities of similar products with each worker in the plant performing only a limited number of operations on the product... 2. ...an arrangement of equipment, machines and workers so that work passes in line until the product is assembled... 3. ...the process of operating and controlling mechanical devices by automatic means without action by human beings...

4. Ответьте на вопросы:

1. What is a major development in manufacturing in the twentieth century? 2. How is mass production often exemplified by the assembly of automobiles? 3. Discuss efficiency and productivity in mass production. 4. Describe some experiments to increase productivity on assembly lines. 5. When and why was the word "automation" coined? 6. Give some examples of automation that were in use before the world itself was created. 7. To what kinds of industries was automation first applied? 8. What was a later development in industrial automation?

5. Опишите производственные процессы, используя начало предложений:

1. Mass production refers to manufacturing processes in which an assembly line...
2. Many ways have been tried to increase productivity on assembly line...3. These human factors are important considerations for...4. Another factor for the industrial engineer to consider is...
5. We know of the advance in the development of steam engines... 6.A later development was...

1. Прочитайте и переведите следующие новые слова, используя словарь:

to resist/to withstand corrosion
to improve the properties, to undergo changes
to classify, to divide into
to shape
to add elements
cast iron
steel
alloy
ferrous metal
non-ferrous metal
tungsten
copper
brass
thermosets
thermoplastics
corrosion hardness

2. Прочитайте текст и составьте список интернациональных слов. Переведите их на русский язык.

TEXT 4. ENGINEERING MATERIALS

Engineers have to know the best and most economical materials to use. Engineers must also understand the properties of these materials and how they can be worked. There are two kinds of materials used in engineering – metals and non-metals. We can divide metals into ferrous and non-ferrous. The former contain iron and the latter do not contain iron. Cast iron and steel, which are both alloys, or mixtures of iron and carbon, are the two most important ferrous metals. Steel contains a smaller proportion of carbon than cast iron. Certain elements can improve the properties of steel and are therefore added to it. For example, chromium may be included to resist corrosion and tungsten to increase hardness. Aluminium, copper, and the alloys (bronze and brass) are common non-ferrous metals.

Plastics and ceramics are non-metals; however, plastics may be machined like metals. Plastics are classified into two types – thermoplastics and thermosets. Thermoplastics can be shaped and reshaped by heat and pressure but thermosets cannot be reshaped because they undergo chemical changes as they harden. Ceramics are often employed by engineers when materials which can withstand high temperatures are needed.

3. Прочитайте текст еще раз и выберите из текста синонимичные выделенным в предложениях слова:

Model: There are two kinds of *engineering materials.*

There are two kinds of *materials used in engineering.*

1. Nickel steel is *a mixture* of iron, carbon and nickel. 2. Chromium *can be added to* steel to provide a good cutting edge. 3. There are many *kinds* of steel used in industry. 4. Ceramics *are used* by engineers where heat-resistant materials are needed. 5. Chromium steels *resist* corrosion.

4. Ответьте на следующие вопросы:

1. What kinds of materials are used in engineering? 2. How are metals classified? 3. What's the difference between ferrous and non-ferrous metals? 4. For what purpose are some elements (such as chromium and tungsten) added to steel? 5. What kinds of non-metals do you know? 6. What can you say about classification and properties of plastics? 7. In what cases are ceramics used?

5.В каком абзаце говорится о делении металлов на два типа? Какие неметаллы вы можете назвать, исходя из содержания текста?

1. Прочитайте следующие новые слова и переведите их, используя словарь:

specific strength
toughness
workability
high grade
weight
property
performance
cost
durability
uniform quality
structural metal
hybrid
amorphous metal
to be mass-produced
to reduce cost

2. Прочитайте текст. Переведите следующие словосочетания, опираясь на содержание текста и используя словарь:

structural *material, application,* **critical** properties, **uniform** properties, **popular** *material, steel product, to classify,* **specific** strength, *hybrid material,* **specific** application, **automotive** *industry*

TEXT 5. NEW STEELS MEET CHANGING NEEDS

As a structural material steel has two drawbacks: its weight and its susceptibility to rust. However, due to its advantages, steel has long been used, and in great quantities, in structural applications from bridges and buildings to ships, automobiles and household appliances. Steel is superior to other structural materials in strength, toughness, workability and other properties that are critical for such applications, and it is mass-produced with uniform, reliable quality and at low cost.

Since steel is the most popular structural material available, steelmakers make every effort to meet the changing needs of these markets. New, more sophisticated processes for steel-making and treatment have led to steel products of higher grade and greater variety.

Yet, it can no longer be said that a steel product is satisfactory if it is simply a good structural material. Today's market needs can be classified broadly as: 1) the need for lighter weight; 2) the need for new properties; 3) the need for maximum performance; and 4) the need for cost reduction.

The need for lighter weight is really a requirement for materials having higher specific strength (strength/specific gravity). Materials offering new properties not found in conventional materials will include new breeds of steel, hybrid materials and truly novel materials such as amorphous metal. The need for maximum performance calls for materials approaching the limits of durability, toughness and the like. Finally, the need to reduce costs is leading to materials diversification in which steel materials precisely suited to a specific application are developed.

New families of steel products are steadily emerging to meet these needs.

Let us look now at how steel needs have changed in automotive industry and how steelmakers have met these needs.

3. Ответьте на следующие вопросы:

1. What are the two drawbacks of modern steel materials? 2. What are the advantages of steel over other metals? 3. In what fields of engineering has steel been long used? 4. What are the modern needs for steel development? 5. How could these needs be met? 6. How have modern steel needs changed in automotive industry?

4. Конструкционная сталь имеет преимущества и недостатки. Выпишите их, используя текст.

1. Прочитайте текст. Выпишите из текста незнакомые слова, переведите их, используя словарь.

2. Прочитайте текст еще раз и составьте список неметаллов. Дайте их характеристику.

TEXT 6. NON-FERROUS METALS

Although ferrous alloys are specified for more engineering applications than all non-ferrous metals combined, the large family of non-ferrous metals offers a wider variety of characteristics and mechanical properties. For example, the lightest metal is lithium, 0.53 g/cm^3, the heaviest, osmium, weighs 22.5 g/cm^3 – nearly twice the weight of lead. Mercury melts at around – 38°F, and tungsten, the metal with the highest melting point, liquefies at 6,170°F.

Availability, abundance, and the cost of converting the metal into useful forms – all play important parts in selecting a non-ferrous metal. One ton of earth contains about 81,000 g of the most abundant metal of land, aluminium. One ton of sea water, on the other hand, contains more magnesium than any other metal (about 1,272 g). All sources combined, magnesium is the most abundant metal on earth. But because magnesium is difficult to convert to a useful metal, it may cost several times that of the least expensive and most easily produced metal, iron billet.

Although nearly 80% of all elements are called "metals", only about two dozen of these are used as structural engineering materials. Of the balance, however, many are used as coatings, in electronic devices, as nuclear materials, and as minor constituents in other systems.

Aluminium

Aluminium is lightweight, strong, and readily formable. Aluminium and its alloys, numbering in the hundreds, are available in all common commercial forms. Because of their high thermal conductivity, many aluminium alloys are used as electrical conductors.

Commercially pure aluminium has a tensile strength of about 13,000 p.s.i. Cold-working the metal approximately doubles its strength. For greater strength aluminium is alloyed with other elements such as manganese, silicon, copper, magnesium or zinc. Some alloys are further strengthened and hardened by heat treatments. Most aluminium alloys lose strength at elevated temperatures, although some retain significant strength to 500°F.

3. Переведите следующие слова и словосочетания,опираясь на содержание текста:

formable alloy, common commercial form, conductivity, electrical conductors, tensile strength, heat treatment, elevated temperature, silicon, copper, manganese, magnesium, zinc.

4. Прочитайте текст еще раз и ответьте на следующие вопросы:

1. Which of the non-ferrous metals is the most abundant metal on earth? 2. Which is the most abundant metal of land? 3. What factors define the selection of materials? 4. Why is magnesium so expensive? 5. Name the properties of pure aluminium. 6. How are the properties of pure aluminium improved?

5. Какие сокращения используются в тексте для обозначения веса и температуры плавления?

1. Прочитайте текст и переведите следующие новые слова, используя словарь:

corrosion resistance
strength
lightness
toughness
forming
heat
pressure
carbon
oxygen hydrogen
nitrogen
organic element
inorganic element
plastics

2. Прочитайте текст. Распределите следующие слова в соответствии с видами материалов, их характеристиками, применениями, новыми разработками материалов, преимуществами материалов:

а) carbon, forming, manufacture, performance, production, appearance, resin, compound, oxygen, hydrogen, inorganic element, polymer technology, rubber, silk, wool, toughness, nitrogen, transportation, consumer goods, lightness, corrosion resistance, strength, heat, pressure, commercial use

б) to achieve, to require, to satisfy, to outgrow, to keep up, to become, to replace, to meet demands, to increase demands, to win

в) solid, liquid, satisfactory, high, attractive, efficient, economical, cheap, unreliable, available, significant

TEXT 7. PLASTICS

Plastics are a large and varied group of materials consisting of combinations of carbon and oxygen, hydrogen, nitrogen, and other organic and inorganic elements. While solid in its finished state, a plastic is at some stage in its manufacture, liquid and capable of being formed into various shapes. Forming is most usually done through the application, either singly or together, of heat and pressure. There are over 40 different families of plastics in commercial use today, and each may have dozens of subtypes and variations.

A successful design in plastics is 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 resin or compound that will perform satisfactorily, and choosing a manufacturing process compatible with the part design and material choice.

Most people have now outgrown the impression that plastics are low-cost substitute materials. Those that still view plastics as cheap and unreliable have not kept up with developments in polymer technology for the past ten years.

Many plastics did indeed evolve as replacements for natural products such as rubber, ivory, silk or wool, which became unavailable or on short supply. But the new materials did not necessarily replace the older ones permanently nor made them obsolete. In many cases, they met an increased demand that could not be met by the natural product alone. Today's engineering resins and compounds serve in the most demanding environments. Their toughness, lightness, strength, and corrosion resistance have won many significant applications for these materials in transportation, industrial and consumer products. The engineering plastics are now challenging the domains traditionally held by metals: truly load-bearing, structural parts.

3. Переведите следующие словосочетания, опираясь на содержание текста:

group, combination, organic element, **finished** state, **forming, commercial** use, *compromise, efficient production, mechanical* requirement, *substitute material,* **natural** *product, transportation,* **structural** part

4. Ответьте на следующие вопросы, используя текст:

1. What are plastics? 2. Are there over 40 families of plastics? 3. A successful design in plastics is always a compromise, isn*t it? 4. Are plastics lowcost substitute materials? 5. What are plastics for natural products? 6. Today*s engineering resins and compounds serve in the most demanding environments, do not they?

1. Прочитайте текст, выпишите из него незнакомые слова и переведите их, используя словарь:

2. Прочитайте текст еще раз, составьте список интернациональных слов, переведите их на русский язык.

TEXT 8. FIBERS

Fibers are probably the oldest engineering materials used by man. Jute, flax, and hemp have been used for "engineered" products such as rope, cordage, nets, water hose, and containers since antiquity. Other plant and animal fibers have been used for feits, paper, brushes, and heavy structural cloth.

The fiber industry is clearly divided between natural fibers (from plant, animal, or mineral sources) and synthetic fibers. Many synthetic fibers have been developed specifically to replace natural fibers, because synthetics often behave more predictably and are usually more uniform in size.

For engineering purposes glass metallic, and organically derived synthetic fibers are most significant. Nylon, for example, is used for belting, nets, hose, rope, parachutes, webbing, ballistic cloths, and as reinforcement in tyres.

Metal fibers are used in high-strength, high-temperature, light-weight composite materials for aerospace applications. Fiber composites improve the strength-to-weight ratio of base materials such as titanium and aluminium. Metal-fiber composites are used in turbine compressor blades, heavy-duty bearings, pressure vessels and spacecraft re-entry shields. Boron, carbon, graphite, and refractory oxide fibers are common materials used in high-strength fiber composites.

Glass fibers are probably the most common of all synthetic engineering fibers. These fibers are the finest of all fibers, typically one to four microns in diameter. Glass fibers are used for heat, sound, and electrical insulation; filters; reinforcements for thermoplastics and thermoset resins and for rubber (such as in tyres); fabrics, and fiber optics.

3. Переведите следующие слова и словосочетания на русский язык, опираясь на содержание текста:

fiber, jute, flax, hemp, "engineered" products, cordage, water hose, plant fiber, animal fiber, feints, heavy structural cloth, the strength-to-weight ratio, turbine compressor blades, heavy-duty bearings, pressure vessels, spacecraft re-entry shields, boron, refractory oxide fiber

4. Ответьте на вопросы:

1. What are the two groups of fiber?
2. What are the types of synthetic fibers.

5. Опишите свойства и применение синтетических волокон, используя в качестве плана упр.4 и лексический материал упр.3.

1. Прочитайте и переведите следующие слова и словосочетания, используя словарь:

shaping
treating
finishing
casting
injection
rotational
moulding
powder metallurgy techniques
forging
joining techniques
welding
machining
assembly
to shape
to treat
to finish
to cast
to mould
to forge
to join
to weld
to machine
to assemble
complexity
accuracy
waste
close tolerance
economy
saving
to reduce waste
to avoid waste
to require little machining
to make savings
profound
accurate
efficient
complex
effectively
equally

2. Прочитайте и переведите следующие словосочетания на русский язык, опираясь на содержание текста:

technology, *era,* to have **an effect,** *process,* **finishing,** *traditional* materials, *manufacture, complex component, mechanized* machine, pressform, **accurate** shape, *joining* **technique, assemblies, assembly,** *to indicate*

TEXT 9. CHANGES IN MATERIALS TECHNOLOGY

Since the technology of any age is founded upon the materials of the age, the era of new materials will have a profound effect on engineering of the future.

Not only new materials, but related, and equally important, new and improved and less wasteful processes for the shaping, treating and finishing of both traditional and new materials are continuously being developed. It is important that an engineer should be familiar with them. These include casting, injection molding and rotational molding of components of ever increasing size, complexity and accuracy; manufacture of more complex components by powder metallurgy techniques; steel forming and casting processes based on new, larger and more mechanized machines, giving reduced waste and closer tolerances; the avoidance of waste in forging by the use of powder metallurgy or cast pressforms and new finishing processes for metals and plastics, just to name a few. A high proportion of these processes is aimed at the production of complex, accurate shapes with a much smaller number of operations and with far less waste than the traditional methods of metal manufacture.

Joining techniques have developed to unprecedented level of sophistication and are also providing opportunities for economies. It is necessary to mention that these newer techniques allow the manufacture of complicated parts by welding together simpler sub-units requiring little machining; such assemblies can be made from a variety of materials. The methods can also be used effectively for assembly, allowing savings to be made in both materials and machine utilization.

The brief review of new processes above has indicated that a new materials technology is rapidly emerging, providing new opportunities and challenges for imaginative product design and for more efficient manufacture.

3. Соответствуют ли данные утверждения тексту?

1. Joining techniques *have developed to* the high level of sophistication. Joining techniques *are developing* to a high level of sophistication. 2. The review of new processes *has indicated* that a new materials technology is rapidly developing. The review of new processes *is indicating* that a new materials technology is rapidly developing. 3. The avoidance of waste in forging *has been achieved* by the use of powder metallurgy. The avoidance of waste in forging *is being achieved* by the use of powder metallurgy.

4. Ответьте на следующие вопросы:

1. Is materials technology changing nowadays? 2. What do new manufacturing processes include? 3. What are they aimed at? 4. Can complicated parts be manufactured by welding together simpler sub-units? 5. Can these assemblies be made from a variety of materials? 6. What has the brief review of new materials and processes indicated? 7. Why is it necessary for an engineer to know these processes?

5. Опишите новые тенденции в разработках технологии материалов, используя упр.4 в качестве плана.

1. Прочитайте текст и выпишите незнакомые слова. Переведите их, используя словарь:

2. Прочитайте текст. Составьте список интернациональных слов. Переведите их, используя словарь и опираясь на содержание текста.

TEXT 10. 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 fiberglass, and from metals, such as berillium and titanium, and new ultra-high strength steels.

Fiber technology, in its modern form, is of more recent origin than plastics, but composites based on glass and/or on carbon fibers are already being applied to pressure vessels, to lorry cabs and to aircraft engines, and may well replace aluminium for the skin and structure of aircraft. An all plastic car has been exhibited: nearly the whole car, except the engine and transmission is of plastics or reinforced plastics.

It is not only plastics and their reinforcement which are changing the materials scene. Ceramics too are gaining an increasing foothold. Their impact as tooling materials in the form of carbides, nitrides and oxides is also well known – cutting tools made of these materials are

allowing machining rates which had previously been considered quite impossible. Silicon nitride seems to offer particular promise for a wide variety of applications. Among these is liquid metal handling. Pumps for conveying liquid aluminium are now on trial which could revolutionize the foundry industry. Silicon nitride is also being tested for the bearing surfaces of the Wankel rotary engines which are being developed as potential replacements for the conventional piston engines of our motor cars. And ceramic magnets have replaced the traditional steel pole-piece plus copper field coil for providing the engineering field for many electric motors.

It is clear that the number of combinations of all kinds of original trends in the production of new materials is practically unlimited. This, in turn, opens new realms for the designing of still cheaper, effective and unthinkably perfected, compared to that we have today, machines and mechanisms.

3. Прочитайте текст еще раз. Выберите из текста английские эквиваленты:

оптимальные, конструирование, требование механики, экономичные материалы, соответствующий производственный процесс, выбор материала, изменение в технологии материалов, цветные металлы, удельная прочность, инструментальные материалы, двигатель Венкеля, новая область разработки

4. Опишите характеристики станков и материалов будущего, используя начало следующих предложений:

A successful design is always a compromise... .The best compromise requires... . Utilising the most economical material... . Choosing a manufacturing process compatible with ... .

1. Прочитайте и переведите следующие новые слова, используя словарь:

foundry	quality
(sand) casting mould	shape
mould cavity	to define
furnace pattern	to determine
molten	to specify
suitable	to melt
proper	to pour
rapid	to solidify
complex	to form
easy	to machine
tolerance	to finish

2.Прочитайте текст и выберите английские эквиваленты:

быстро развиваться, обрабатывать механически, качественные отливки, правильная сборка, до установленных допусков, служить деталями, сложные модели, обрабатывать начисто, литейное производство

TEXT 11. METAL CASTING – A BASIC MANUFACTURING PROCESS

One of the basic processes of the metal-working industry is the production of metal castings. A casting may be defined as "a metal object obtained by allowing molten metal to solidify in a mold", the shape of the object being determined by the shape of the mold cavity. A foundry is a commercial establishment for producing castings.

Numerous methods have been developed through the ages for producing metal castings but the oldest method is that of making sand castings in the foundry. Primarily, work consists of melting metal in a furnace and pouring it into suitable sand molds where it solidifies and assumes the shape of the mold.

Most castings serve as details or component parts of complex machines and products. In most cases they are used only when they are machined and finished to specified manufacturing tolerances providing easy and proper assembly of the product.

At present the foundry industry is going through a process of rapid transformation, owing to modern development of new technological methods, new machines and new materials. Because of the fact that casting methods have advanced rapidly owing to the general mechanical progress of recent years there is today no comparison between the quality of castings, the complexity of the patterns produced and the speed of manufacture with the work of a few years ago.

3. Переведите следующие словосочетания в соответствии с содержанием текста:

basic *process, metal object,* **commercial** establishment, numerous *methods,* to serve as *details* and *component* parts, **complex** *machines* and *products,* proper **assembly,** rapid *transformation, technological methods,* **general** *mechanical progress*

4. Выберите синонимы из текста:

to define, to progress, nowadays, proper, parts, to produce, quick, details, to advance, to manufacture, rapid, to determine, suitable, at present

5. Дополните следующие предложения в соответствии с содержанием текста:

1. A foundry is a commercial establishment for...	a) the shape of the mold cavity.
2. A casting is a metal object obtained by...	b) one of the oldest methods for producing metal castings.
3. The shape of the casting is determined by...	c) the shape of the sand mold.
4. Sand casting production is ...	d) allowing molten metal to solidify in a mold.
5. This method consists of...	e) complex machines and products.
6. Then the metal solidifies and assumes...	f) producing castings,
7. Most castings serve as details or component parts of...	g) specified tolerances.
8. But at first they are machined and finished to...	h) melting metal in a furnace and pouring it into sand molds.

6. Опишите основных процессы изготовления отливок, используя текст и план:

1. Production of metal castings. 2. Casting methods. 3. The use of the castings. 4. The foundry industry.

1. Прочитайте и переведите следующие новые слова, используя словарь:

forging	grain boundary
metalworking process	to minimize the grain size
blacksmith	a coarse-grain structure
hammering	forging end-use application
individual crystal	part configuration

2. Прочитайте текст. Составьте список интернациональных слов.

TEXT 12. THE FUNDAMENTALS OF FORGING

Forging is the oldest known metalworking process. It is believed to have begun when early man discovered he could beat pieces of ore into useful shapes. History tells us that forging was widely practised at the time when written records first appeared.

The blacksmith was one of the first to realize the advantages of forging. Although he did not know why, he knew that hammering a piece of hot metal not only resulted in a usable shape, it improved its strength. It is this inherent improvement in strength of metal that has placed forgings in the most highly stressed applications in machines.

To understand why forging improves the mechanical properties of metal, it is important to recognize that metal is made up of grains. Each grain is an individual crystal, and when the grains are large, cracks can occur and propagate along the grain boundaries. Therefore, it is desirable to minimize the grain size in a metal.

Reducing the metal's grain size is one of the things forging does so well. Forging breaks down a coarse-grained structure producing a chemically homogeneous wrought structure with much smaller grains by controlled plastic deformation. In forging, controlled plastic deformation whether at elevated temperature or cold (at room temperature) results in greater metallurgical soundness and improved mechanical properties of the metal.

Metal shaping by controlled plastic deformation is the basis for all forging operations. Because of the diversity of forging end-use applications, however, a wide range of processes and equipment have been developed to produce forgings. Some processes are ideally suited to make large parts, others, small parts, and still others, rings. Modern forging is not only carried out in virtually all metals, it is done at temperatures ranging from more than 2500 °F to room temperature. Part configuration generally determines the forging method chosen.

3. Ответьте на следующие вопросы:

1. What can you say about the history of forging? 2. Has inherent improvement in strength of metal placed forging in the most highly stressed applications in machines? 3. How does forging improve mechanical properties of metal? 4. What is controlled plastic deformation? 5. How does reducing the metals grain size affect the mechanical properties of the metal? 6. What is metal shaping? 7. Modern forging is not carried out in virtually all metals, is it?

4.Опишите ковочное производство. В качестве плана используйте упр. 3.

1. Прочитайте следующие новые слова, переведите их, используя словарь:

machine part
cam
linkage
bushing
bearing
nut
bolt
stud
shaft
spindle
turret
tool slide
(cutting) tool
bar stock
tubing
machine-shop
machine-tool
turning machine (lathe)
drilling machine
boring machine
milling machine
grinding machine
screw machine
to cut
to machine
to turn
to drill

2. Прочитайте текст. Выберите из текста английские эквиваленты.

срок службы, прутковая заготовка, гладкая поверхность, размерная точность, снимать стружку, удобный (подходящий), массовое производство, достижимый, отделка поверхности.

TEXT 13. METAL CUTTING

Cutting is one of the oldest arts practised in the stone age, but the cutting of metals was not found possible until the 18th century, and its detailed study started about a hundred years ago.

Now in every machine-shop you may find many machines for working metal parts, these cutting machines are generally called machine-tools and are extensively used in many branches of engineering. Fundamentally all machine-tools remove metal and can be divided into the following categories:

1. Turning machines (lathes).
2. Drilling machines.
3. Boring machines.
4. Milling machines.
5. Grinding machines.

Machining of large-volume production parts is best accomplished by screw machines. These machines can do turning, threading, facing, boring and many other operations. Machining can produce symmetrical shapes with smooth surfaces and dimensional accuracies not generally attainable by most fabrication methods.

Screw-machined parts are made from bar stock or tubing fed intermittently and automatically through rapidly rotating hollow spindles. The cutting tools are held on turrets and tool slides convenient to the cutting locations. Operations are controlled by cams or linkages that position the work, feed the tools, hold them in position for the proper time, and then retract the tools. Finished pieces are automatically separated from the raw stock and dropped into a container.

Bushings, bearings, nuts, bolts, studs, shafts and many other simple and complex shapes are among the thousands of products produced on screw machines. Screw machining is also used to finish shapes produced by other forming and shaping processes.

Most materials and their alloys can be machined – some with ease, others with difficulty. Machinability involves three factors: 1. Ease of chip removal. 2. Ease of obtaining a good surface finish. 3. Ease of obtaining good tool life.

3. Переведите следующие словосочетания, опираясь на содержание текста

detailed study, **fundamentally,** *symmetrical* shapes, **generally, fabrication** *methods,* hollow *spindle,* cutting *location,* **to control** *operations, to position* the work, *to separate,* to drop into *a container,* to involve *a factor*

4. Выберите из текста синонимы:

to work, proper, to produce, convenient, location, to fabricate, to machine, position

5. Выберите из текста антонимы:

raw, simple, to feed, difficulty, complex, finished, ease, to retract

6. Соответствуют ли данные утверждения содержанию текста?

1. All machine-tools employed for removing metal are divided into five general categories. 2. Screw-machined parts can't be made from bar stock. 3. Cutting tools held on turrets and tool slides are used for machining metal parts. 4. The workpiece placed on the spindle doesn't rotate. 5. Cams and linkages designed for controlling cutting operations position the work, feed, hold in position and retract the tools. 6. Metal parts worked on machine-tools have smooth surfaces and high dimensional accuracies. 7. Finished parts are of symmetrical shapes.

7. Используя данные вопросы, опишите технологию резания металлов:

1. When did the study of metal cutting start? 2. What is the purpose of metal cutting? 3. What machines are called "machine-tools"? 4. List the general categories of machine-tools. 5. What is the function of the spindle? 6. Where are cutting tools held? 7. By what means are cutting operations controlled? 8. List products produced on screw machines. 9. What are the general advantages of machining over other fabrication methods?

1. Прочитайте текст и выпишите незнакомые слова, переведите их, используя словарь.

2. Прочитайте текст. Используйте следующие слова и словосочетания при переводе текста:

tool edge – режущая кромка инструмента, skin finish = surfacefinish, machining allowance – припуск на обработку, rigidity of setup – жесткость наладки, rate of metal removal – скорость резания, nodular iron – чугун с шаровидным графитом, flake-graphite iron – чугун с чешуйчатым графитом, rather than – а не..., abrasive action – истирающее воздействие

TEXT 14. FACTORS AFFECTING MACHINABILITY

Machinability is generally assumed to be a function of tool edge life. The main factors which influence the behaviour, and thus the life of the edge of a cutting tool, are:
– the mechanical characteristics of the material being machined, such as its strength, hardness and metallurgical structure;
– the state of the casting, involving the skin finish, critical dimensions, machining allowances, slag inclusions, the presence of scabs, rust, dirt, etc.;
– the nature of the machining techniques being used;
– the characteristics of the machine-tool being used, such as machine efficiency, available power, and the rigidity of the setup.

Other factors aside, it is primarily the structure of the metal which determines its resistance to the cutting action of the tool, i. e. the potential rate of metal removal, and the resulting abrasion on the tool, i. e. the life of the cutting edge.

Structure, strength and machinability are interrelated to some extent – in general, increased strength implies reduced machinability. This basic relationship must be understood, otherwise difficulties maybe experienced in the machine shop if the designer has specified a material with a higher strength than is necessary. Nevertheless, care should be taken in rating machinability on the basis of strength. For example, nodular irons are normaliy considerably stronger than flake-graphite types, but are likely to be easier to machine. It is therefore recommended that structure, rather than strength, be adopted as the basis for machining practice. Hardness provides a more reliable guide to machinability than does strength, for hardness depends mainly on the matrix structure of the casting. Again, however, the relation is of a general nature only, for it is possible to have a metal which exhibits a low hardness value, but which has a very abrasive action on the cutting tool. For example, the presence of hard phosphide particles embedded in a soft, ferritic matrix reduces tool life considerably.

3. Прочитайте текст. Составьте список интернациональных слов.

4. Подберите синонимы/антонимы из текста к следующим словам:

strength, hardness, efficiency, rigidity

5. Опишите материалы, подвергающиеся механической обработке. Используйте данные вопросы в качестве плана.

1. What are the main factors influencing the tool edge life? 2. Does the structure of the material influence machinability? In what way? 3. What does increased strength result in? 4. Why is hardness more reliable in determining machinability of a material than strength?

1. Прочитайте и переведите следующие новые слова, используя словарь:

prime-mover
windmill
turbine
generator
steam engine
internal combustion engine
electric motor
wind
water
steam
petroleum
electricity
effort
motion
distance
rate
weight
horsepower
watt
kilowatt
force
work
to produce electricity
to exert effort
to set in motion
to result in motion
to hold up the weight
to exert force
to produce work
to perform work
to result from

2. Прочитайте текст. Какой из данных заголовков отражает содержание текста?

1. Факторы, влияющие на механическую обработку. 2. Станки и механизмы. 3. Работа с материалами.

TEXT 15. MACHINES AND WORK

Defined in the simplest terms a machine is a device that uses force to accomplish something. More technically, it is a device that transmits and changes force or motion into work. This definition implies that a machine must have moving parts. A machine can be very simple, like a block and tackle to raise a heavy weight, or very complex, like a railroad locomotive or the mechanical systems used for industrial processes.

A machine receives input from an energy source and transforms it into output in the form of mechanical or electrical energy. Machines whose input is a natural source of energy are called prime movers. Natural sources of energy include wind, water, steam, and petroleum. Windmills and waterwheels are prime movers; so are the great turbines driven by water or steam that turn the generators that produce electricity; and so are internal combustion engines that use petroleum products as fuel. Electric motors are not prime movers, since an alternating current of electricity which supplies most electrical energy does not exist in nature.

Terms like work, force, and power are frequently used in mechanical engineering, so it is necessary to define them precisely. Force is an effort that results in motion or physical change. If you use your muscles to lift a box you are exerting force on that box. The water which strikes the blades of a turbine is exerting force on those blades, thereby setting them in

motion. In a technical sense work is the combination of the force and the distance through which it is exerted. To produce work, a force must act through a distance. If you stand and hold a twenty-pound weight for any length of time, you may get very tired, but you are not doing work in an engineering sense because the force you exerted to hold up the weight was not acting through a distance. However, if you raised the weight, you would be doing work.

Power is another term used in a special technical sense in speaking of machines. It is the rate at which work is performed. The rate of doing work is sometimes given in terms of horsepower, often abbreviated *hp*. This expression resulted from the desire of the inventor James Watt to describe the work his steam engines performed in terms that his customers could easily understand. After much experimentation, he settled on a rate of 33,000 foot-pounds per minute as one horsepower. In the metric system power is measured in terms of watts and kilowatts. The kilowatt, a more widely used term, equals a thousand watts or approximately 1 1/3 horsepower in the English system.

3. Соотнесите утверждения, опираясь на содержание текста:

Machine		the rate at which work is performed.
Prime mover		a device that uses force to accomplish something..
Force	is	an effort that results in motion or physical change.
Work		a machine whose input is a natural source of energy.
Power		a combination of the force and the distance.
		through which it is exerted.

4. Дайте развернутые ответы на следующие вопросы:

1. What is a simple definition of a machine? What is a more technical definition? What does this definition imply? 2. Describe some very simple machines. Name some complex machines. 3. What do we call machines whose input is a natural source of energy? What natural sources of energy do you know and what machines use them? 4. Why aren't electric motors prime-movers? 5. What is force? Give some examples of force. 6. What is work? How can work be expressed mathematically? Give an example. 7. What is power? 8. How is the rate of doing work usually given in the English-speaking countries? Why was the term invented? 9. In what terms is power measured in the metric system?

5. Используя лексику упр.1 и текст, кратко опишите станки и их работу.

1. Прочитайте текст. Следующие словосочетания переведите на русский язык, используя словарь:

alternators, generators, sources of electromotive force, lead-acid accumulators, cells, solar cells, photoelectric

alternating current, direct current, armature, electromagnet, field coil, pole, winding, brush, brush holder, commutator, generator, motor

alternators, linear machines, electrical machines, motors, d. c. generators, linear motors, rotating machines, generators

a. c. motors, electric motors, compound-wound, synchronous, variable-speed commutator,

d. c. motors, series-wound, induction, shunt-wound

2. Прочитайте текст. Составьте список интернациональных слов, переведите их в соответствии с содержанием следующего текста.

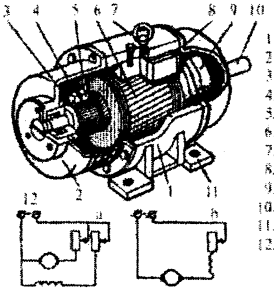
TEXT 16. ELECTRICAL ENERGY AND ELECTRICAL MACHINES

Volta made his experimental cell in 1800, producing for the first time a steady reliable electric current. During the nineteenth century, the development of practical applications of electrical energy advanced rapidly. The first major uses of electricity were in the field of communications – first for the telegraph and the telephone. They used not only electric current but also electromagnetic effects.

Thomas Edison's invention of the electric light bulb was perhaps the most momentous development of all, but not because it was such a unique invention. It was momentous because it led to the creation of an electric power system which has since reached into nearly every corner of the world. Actually, other people were working simultaneously on the same problem, and Edison's claim to the invention was disputed. Perhaps Edison's most important claim to fame is his pioneering work in engineering, which helped to provide electric service for New York City in 1882.

The application of electricity has grown to the point where most of us lead "electrified lives", surrounded by a variety of devices that use electric energy. Less visible, but probably more important, are the thousands of ways industry has put electric energy to work. The direct-current machine is one of the most important ways.

The Direct-Current Machine



1. Steel frame
2. End-shield with ball bearing
3. Commutator
4. Brushholder with brush yoke
5. Carbon current-collecting brushes
6. Armature with main current-carrying winding
7. Lifting eye-bolt
8. Field coil, magnetic field pole
9. Fan
10. Power-transmitting shaft
11. Base with holes for fixing bolts
12. Electrical circuit diagrams for d. c. motors
    a) shunt connection of windings
    b) series connection of windings

Electrical machines are divided into alternating current (a. c.) and direct-current (d. c.) machines. The basic parts of a d. c machine are the armature and electromagnets (or field coils). Coils wound on the pole cores form the excitation field of the machine. The armature is the rotating part of the machine. In its insulated slots is placed a winding connected to the commutator. Carbon brushes are placed in brushholders and contact the rotating commutator.

There are two electric circuits in the d. c machine, the armature circuit and the excitation circuit. A d. c machine is reversible: if the machine is rotated and the magnetic field is excited the machine sends a direct current into the external circuit through the commutator and brushes: the machine operates as a generator. If the armature and excitation winding are joined to a d. c circuit the armature runs and the machine operates as a motor and converts electrical energy into mechanical energy.

3. Выберите из текста соответствующие английские термины:

стальная рама, коммутатор, вентилятор, переменный ток, постоянный ток, подошва, быстро развиваться, область связи, электромагнитный, эффект Эдисона

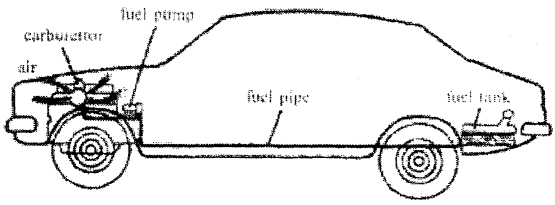
4. Расскажите о великих изобретателях и их изобретениях (Вольта и Т. Эдисон письменно.)

1. Прочитайте следующие новые слова и переведите их, используя словарь:

t.d.c./ top dead centre-the position of the piston at the top of the stroke/
b.d.c./bottom dead centre-the position of the piston at the bottom of the stroke/
piston stroke
induction stroke
compression stroke
power stroke
exhaust stroke
two-stroke cycle
four-stroke cycle
carburettor
fuel pipe
fuel pump
fuel tank
spark plug
piston
cylinder
inlet valve
crankshaft
to produce power
to store fuel
to pump
to mix
to draw
to compress
to ignite
to expand
to push the piston down
to expel
to control
to rotate
to enter the cylinder gas flow
to move upwards (downwards)
to connect

2. Прочитайте текст. Составьте список интернациональных слов, переведите их в соответствии с содержанием текста.

TEXT 17. ENGINE



An engine produces power by burning air and fuel. The fuel is stored in a fuel tank. The fuel tank is connected to a fuel pipe. The fuel pipe carries the fuel to a fuel pump. The fuel pump is connected to the carburettor. The fuel pump pumps the fuel into the carburettor. In the carburettor the fuel is mixed with air. The fuel and air are drawn into the engine cylinder by the piston. Then the fuel and air are compressed by the piston and ignited by the spark plug. They burn and expand very quickly and push the piston down. Thus the power is produced. The burned fuel and air are expelled from the cylinder by the piston.

The flow of gases into and out of the cylinder is controlled by two valves. There is an inlet valve allowing fresh fuel mixture into the cylinder and an exhaust valve which allows the burnt gases to escape.

There are two basic engine operating cycles:

a) the four-stroke cycle;
b) the two-stroke cycle.

The complete four-stroke cycle comprises:

1. the induction stroke (the piston moves downwards);
2. the compression stroke (the piston moves upwards);
3. the power stroke (the piston moves downwards);
4. the exhaust stroke (the piston moves upwards).

3. Закончите предложения в соответствии с содержанием текста:

1. Most automotive engines operate...
2. This cycle comprises:...
3. The first stroke starts with the piston...
4. The fuel mixture in the cylinder is compressed and ignited...
5. The piston is pushed downwards...
6. The crankshaft rotates...
7. Thus power...
8. The burnt gases are expelled...
9. The flow of gases into and out of the cylinder is controlled by two valves: ...

4. Прочитайте текст в качестве дополнительной информации о 4-х тактном цикле, вставьте пропущенные слова:

The Four-Stroke Operating Cycle

The Induction Stroke

The cycle starts with the piston at t. d. c As the inlet valve opens, the piston.....by the rotating crankshaft. The fuel mixture enters .... When the piston comes to the top of the stroke, the inlet valve closes.

The Compression Stroke

The rotation of the crankshaft ... the piston upwards again. During the compression stroke, the fuel.....Both valves are now ... and thus the mixture is prevented from escaping. The compression rapidly heats the mixture before ignition occurs.

The Power Stroke

The spark from the plug ... the heated mixture as the piston comes to the top of its stroke. The burning gases expand and force the piston downwards again. This stroke ... the crankshaft through half a revolution (180°).

The Exhaust Stroke

As the piston comes to b. d. c, the exhaust valve ... . The rotating crankshaft returns the piston to t. d. c again, expelling the burnt gas through the top of the cylinder. When the piston ... to t. d. c, the cycle... ... . In a vehicle engine this cycle is repeated several thousand times a minute.

---

crankshaft коленчатый вал
to expand расширяться
revolution *зд.* оборот
vehicle средство передвижения

1. Прочитайте текст и составьте список незнакомых слов. Переведите их, используя словарь.

2. Прочитайте текст. Переведите следующие слова, опираясь на содержание текста:
rotary, cylinder, stationary, oval, process, eccentric, vibration, diesel, elliptical

TEXT 18. THE WANKEL ENGINE

The Wankel engine is a form of heat engine which has a rotary piston. In other words, instead of going up and down the Wankel piston rotates in the cylinder. Both cylinder and piston are quite different in shape from those of conventional engines. The Wankel piston is triangular with curved sides and the cylinder is roughly oval in shape. The piston has an inner bore which is linked through an eccentric gear to the output shaft. The other end of the bore is toothed and engaged with a stationary gear fixed to the cylinder end. This arrangement ensures that the piston follows an elliptical path round the cylinder so that the apexes of the piston, which carry gastight seals, are always in contact with the inside surface of the cylinder.

The piston thus forms three crescent-shaped spaces between itself and the cylinder wall, which vary in size as the piston rotates. Fuel enters the cylinder through the inlet port when one of these spaces is increasing in size. The fuel trapped in this section is then compressed by the turning piston and ignited by the sparking plug. The expanding gases subject the piston to a twisting moment which makes the piston revolve further until the exhaust gases escape through the exhaust port. A fresh charge is then induced into the cylinder. Meanwhile the same process is being repeated in the other two spaces between the piston and the cylinder.

The Wankel engine has many advantages over the reciprocating piston engine. Fewer moving parts are necessary because it produces a rotary movement without using a connecting rod and a crankshaft. Because of this rotary movement it has no vibration. In addition it has no valves, it is smaller and lighter than conventional engines of the same power, and it runs economically on diesel and several other fuels.

---

up and down movement = reciprocating movement возвратно-поступательное движение
triangular треугольный
inner bore внутреннее отверстие
gear шестерня, зубчатое колесо
apex вершина
gastight seal газонепроницаемая прокладка
crescent-shaped серпообразный, серповидный
to trap улавливать
connecting rod шатун

3 Переведите предложения .Отражают ли данные предложения работу двигателя Венкеля?

1. The expanding gases make the piston revolve further.
2. The fuel is ignited by the spark plug.
3. Fuel enters the cylinder through the inlet port.
4. The exhaust gases are expelled through the exhaust port.
5. The fuel is compressed by the rotating piston.

4. Опишите характеристику и конструктивные особенности традиционного и роторного двигателей, упоминая тип, размер, вес, используемое топливо и их работу.

Используйте упр.3.

1. Прочитайте и переведите следующие новые слова, используя словарь:

open die forging	carbon
tool steel,	stainless steel
anvil	titanium
to form	to work
hammer	flash
press	closed die forging,
die	to deform
flat die	cavity
to machine	to contact
weight	to cool
V-die	resistance
to move	pressure
swaging die	die filling
to force	impression die forging
heat treatment	recrystallization temperature
alloy	net dimension

2. Прочитайте текст и выпишите интернациональные слова, переведите их, опираясь на содержание текста.

TEXT 19A. FORGING PROCESSES AND EQUIPMENT

Open die forging with modern hammers and presses is a technological extension of the pre-industrial blacksmith working with a hammer and anvil. Open die forgings are produced on flat dies, round swaging dies and V-dies, either in pairs or in combination with a flat die. The upper die is attached to the ram, and lower die to the hammer anvil or press bed. The open die process is usually associated with large parts such as shafts, sleeves and disks, weighing up to 1,000,000 lb.

As the workpiece is formed during open die forging it is moved via a manipulator in small increments until hot working forces the metal into the desired dimensions. After forging the part is rough, then finish machined to net dimensions. Heat treatment is often performed either prior to or between machining operations. Materials for open die forging vary from carbon alloy, stainless and tool steels to aluminium, titanium and nickel-based alloys for high temperature applications. Metals are worked above their recrystallization temperature. Impression die forging comprises the majority of commercial forging production. It is carried out in two cavities that are brought together in a hammer or press. The workpiece undergoes plastic deformation until its enlarged sides contact the, side walls of the die, as shown in. Once the die cavity is nearly filled, a small amount of material flows outside the die, forming flash. The flash cools rapidly and presents increased resistance to further metal flow. This increases the pressure in the workpiece, assuring complete die filling.

Closed die forging, a variation of impression die forging, does not depend on the formation of flash to complete die filling. In true closed die forging, the metal is deformed in a cavity that allows little or no escape of excess metal.

3. Прочитайте текст еще раз и переведите следующие словосочетания на английский язык:

кузнечная обработка молотом на наковальне, штамп, заготовка обрабатываемая, штамповка, машинная ковка, полость, пластическая деформация, заданные размеры

4. Соответствуют ли данные утверждения содержанию текста?

1. Open die forging is a technological extension on the post-industrial working with a hammer and anvil. 2. Open die forging are produced on flat dies. 3. The upper die is attached to the ram and lower die to the hammer anvil or press bed. 4. The open die process is associated with small parts such as shafts, sleeves and discs. 5. The workpiece is formed during closed die forging. 6. After forging the part is rough, then finish machined to net dimensions. 7. In true closed die forging, the metal is deformed in a cavity that allows much or no escape of excess metal.

5. Ответьте на вопросы:

1. What is open die forging? 2. What is impression die forging? 3. What is closed die forging?

1. Прочитайте и переведите следующие слова и словосочетания, используя словарь:

furnace	prop
cupola	tuyere
open-hearth	arc
crucible	direct-arc furnace
to melt	induction furnace
coke	resistance furnace
flux	

2. Прочитайте текст. Переведите следующие слова, опираясь на содержание текста:

base, plate, coke, flux, induction, to refine, contact, electrode, to induce, circulation

TEXT 19B. MELTING FURNACES

The metals used in various kinds of castings are melted in several types of furnaces. They are: cupolas, electric furnaces, open-hearth furnaces, crucible furnaces and some others.

A cupola furnace is a vertical type, cylindrical or shaft furnace designed to melt ferrous metals in the production of cast iron castings. The cupola consists of a refractory-lined steel stack resting on a cast iron base plate which is supported by four steel legs. The bottom of the cupola consists of two doors which are supported in closed position by a centre prop.

Iron, coke and flux are charged onto a coke bed and are held above the tuyere openings where the maximum temperature is maintained. Molten metal is tapped through a tap hole at the base of the cupola.

Although the first cupola was built about 1720 cupola melting is still recognized as the most economical melting process and most of grey cast iron produced is melted by this method.

Electric furnaces are used for producing high quality castings. The principle of the electric furnace operation is based on the heating effect obtainable from the passing of electricity. There are three general types: arc, induction and resistance.

Arc furnaces are used for melting or refining ferrous metals. Two types of arc furnaces are in use: direct-arc and indirect-arc.

In the direct-arc furnace the arc comes in direct contact with the metal charge. Indirect-arc furnaces are the type in which the arc is maintained between two electrodes above the charge.

In the induction furnace electric currents are induced in the charge and their circulation through the charge produces heat. This type of furnace is used for producing exact alloys.

In the resistance furnace the electrodes are placed in the charge and the flow of electric current through the charge produces heat. These furnaces are generally used for non-ferrous metals production.

3. Соответствуют ли данные утверждения содержанию текста?

1. The cupola is designed to melt non-ferrous metals. 2. Cupola melting is the most economical melting process. 3. The cupola is a horizontal type furnace. 4. Iron, coke and flux are charged onto a coke bed at the bottom of the furnace. 5. The maximum temperature is maintained under the tuyere openings. 6. Molten metal is tapped through a tap hole.

4. Дополните следующие предложения в соответствии с содержанием текста:

1. Electric furnaces are used for...
2. There are three general types of electric furnaces...
3. Two types of arc furnaces are in use...
4. In the direct-arc furnace the arc...
5. In the indirect-arc furnace the arc...

5. Расскажите письменно о плавильных печах по плану, используя текст:

a. Types of furnaces
b. The application of furnaces

1. Прочитайте текст и выпишите незнакомые слова. Переведите их, используя словарь.

2. Прочитайте следующие слова и переведите их в соответствии с содержанием текстов А, В:

microprocessor, production automation, preparatory production, robotics, robot module, trailer, rotary-conveyer line, enterprise, manipulator

TEXT 20A. FLEXIBLE PRODUCTION AND INDUSTRIAL ROBOTS

This country's machine-building industry is now facing the task of restructing on a large scale engineering production, and developing new methods of organization, new equipment and new technologies. This is a global process. Swift production automation, the introduction of microprocessors, robotics, rotary and rotary-conveyer lines, flexible readjustable production is vital for today's industry.

Industrial robots play an important part in the process. Many institutes are currently engaged in developing them. The concept of designing robot modules is making successful headway.

The task today is to raise their reliability, speed and failure-free operation.

Russian engineers cooperate in the development of flexible production systems with experts from different countries.

Also needed for the operation of flexible systems are robots which will transport billets and parts between machine tools, i. e. transport robots, robot trailers, as well as measuring robots. Experts from the Institute of Machine Studies are developing measuring manipulators and coordinate-measuring machines.

It is hard to enumerate all the problems facing our engineers and designers in the development of flexible productions. Automated systems of adjusting, controlling instruments, machined parts and many other things are needed.

The combination of flexible systems with the general system of programmed production, the spreading of flexibility to the processes of preparatory productions – foundry, forging and welding – are also very complicated problems. The flexible system must embrace all the stages of machine building, all its processes.

TEXT 20B. WHAT CAN ROBOTS DO?

The word "robot" was first used by Czech playwright Karel Capek, who in 1920 wrote a drama about machines that could move like human beings – and do their work. Today this idea has become a reality. Industrial robots now being manufactured perform certain tasks even better than a human being. We are thus at the threshold of the era of robots – what might be called a "robolution".

An industrial robot is a unit which has movement functions with *a* high degree of freedom similar to human arms and hands and is able to move autonomously on the basis of sense and perceptions.

There are six categories of robots: (1) the manual manipulator, remotely controlled by a person, which carries out hand-and-arm functions to hold and move objects; (2) the fixed-sequence robot, which performs a series of operations in a preset order, always in the same series of locations in space; (3) the variable-sequence robot, which operates in the same manner as a fixed-sequence robot but can easily be reprogrammed for a different sequence of operations; (4) the playback robot, which repeats a sequence of movements and operations that are first "taught" by manual movement of a manipulator and stored in the robot's memory unit; (5) the numerically-controlled robot, which moves from one position to another according to numerical instructions in such forms as punched paper tapes or cards; and (6) the intelligent robot, an advanced type that can decide its course of action on the basis of its sensing devices and analytical capability.

Today robots play a major role in welding, press-forming, coating and other operations, particularly in the automotive industry.

3. Прочитайте текст. Переведите следующие словосочетания, используя словарь:

flexible production, automated store-house, adjustable, readjustable, to restruct production, flexible system, to design robot modules

4. Дайте развернутые ответы (письменно):

1. What role play industrial robots in modern engineering productions? 2. There are 6 categories of robots , aren't they?

5. Опишите применение роботов в данных сферах:

1. Manufacturing industries
2. Construction, civil engineering and mining
3. Social welfare
4. Agriculture and fishery
5. Transportation, distribution and service
6. Environment control. Offshore development. Space development

ПРИЛОЖЕНИЕ 1

МЕРЫ ИЗМЕРЕНИЙ (UNITS OF MEASUREMENT)

Length (Длина)

1 inch = 25.4 millimetres	1 mm = 0.04 in
0.016 in = 0.4 mm	1 cm = 0.4 in
0.001 in = 0.025 mm	1 m = 3.3 ft (1.1 yd)
1 foot = 0.3 metres	1 km = 0.62 miles
1 yard = 0.9 m	
1 mile = 1.6 km	

Area (Площадь)

1 sq. inch = 6.45 cm^2	1 mm^2 = 0.0015 in^2
1 sq. foot = 0.09 m^2	1 cm^2 = 0.155 in^2
1 sq. yard = 0.84 m^2	1 m^2 = 10.8 ft^2
1 sq. mile = 2.6 km^2	1 km^2 = 0.4 sq. miles

Volume (Объем)

1 cubic inch = 16.4 era'	1 cm^3 - 0.06 in^3
1 cubic foot = 0.03 m'	lm^3 = 35.3 ft^3
1 cubic yard - 0.8 m^3	

Capacity (Емкость)

1 pint = 0.57 litres	1 litre = 0.22 gallons (GB)
1 quart = 1.14 litres	= 0.26 gallons (US)
1 gallon (GB) = 4.6 litres	
1 gallon (US) = 3.8 litres	

Mass (Масса)

1 ounce (oz) = 28.3 grams	1 kg = 0.04 oz
1 pound (lb) = 0.45 kg	1 kg = 2.2 lbs
1 hundredweight = 50.8 kg	1 tonne = 0.98 tons
1 ton = 1016 kg	

Energy (Энергия)

1 British thermal unit (B.t.u.)	= 1.05 kilojoules (kJ)
1 therm	= 105.5 megajoules (MJ)
1 kilowatt hour (kWh)	= 3.6 MJ
1 calorie	= 42 J

Density (Плотность)

I lb/in^3 = 27.7 g/cm^3	1 kg/m^3 = 0.06 lb/ft^3
I lb/ft^3 =16.02 kg/m^3	

Acceleration (Ускорение)

1 ft/s^2 = 0.3 m/s^2	1 m/s^2 = 3.3 ft/s^2

Torque (Крутящий момент)

1 lb ft = 1.36 newton metres	1 Nm = 0.74 lb ft

Pressure and Stress (Давление и напряжение)

1 p.s.i. (lb/m^2) = 6900 N/m^2	1 N/m^2 = 145*10^6 p.s.i.

Power (Мощность)

1 horsepower (hp) = 746 watts (W) = 736 W
1 metric horsepower

ПРИЛОЖЕНИЕ 2

ШКАЛА ТЕМПЕРАТУРНЫХ СООТВЕТСТВИЙ

по Цельсию	по Фаренгейту
-17,8°	0°
-10°	14°
0°	32°
10°	50°
20°	68°
30°	86°
40°	104°
50°	122°
60°	140°
70°	158°
80°	176°
90°	194°
100°	212°

Перевод температурных соответствий

Ц = 5/9(Ф-32)

Ф = 9/5 Ц + 32

СОДЕРЖАНИЕ

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