**Практическое занятие № 12**

**Тема 3.2 Материаловедение.**

**Часть 1.**

***Прочтите текст и выполните следующие за ним задания:***

**METALS**

1. Mankind has used metals for centuries in gradually increasing quantities but only now they are employed in really great quantities.

2. Today we know more than seventy metals, the majority of which are used in industry.

3. Of all the metals iron is the most important one. Absolutely pure iron is never prepared except for laboratory purposes. The irons and steels in use today are really alloys of iron, carbon and other substances. They can be made elastic, tough, hard, or comparatively soft.

4. Mechanical properties of metals are the result of their atomic structure. They include hardness, ductility and malleability which are of special importance in engineering.

5. Ductility is the capacity of a metal to be permanently deformed in tension without breaking.

Malleability is the capacity of a metal to be permanently deformed by compression without rupture.

6. These properties are similar to each other but not the same. Most metals increase these properties at higher temperatures.

7. The strength of a metal is the property of resistance to external loads and stresses.

8. These mechanical properties are of great importance in industrial purposes because all parts and units made of iron and steel must meet up-to-date demands.

**Задание 1. Найдите в тексте ответы на вопросы:**

**Вопросы**

1. What is the most important metal?
2. What mechanical properties of metals do you know?
3. What is strength?
4. What is ductility?
5. What is malleability?

**Задание 2 Найдите в правой колонке русские эквиваленты слов и словосочетаний:**

|  |  |
| --- | --- |
| 1.lustre  2. property  3. quantity  4. conductivity  5. solid  6. brittle  7. undergo  8. to protect  9. environment  10. alloy  11. poor conductor  12. distinction  13. strength  14. hardness | a. окружающая среда  b. защищать от  c. подвергаться  d. плохой проводник  e. количество  f. блеск  g. сплав  h. свойство  i. проводимость  j. твердое состояние  k. хрупкий  l. прочность  m. жесткость  n. различие |

**Задание 3 Переведите на русский язык в письменной форме абзацы 3,4,5 и 7.**

**Часть 2**

***Прочтите текст и выполните следующие за ним упражнения:***

**METALS AND NONMETALS**

1. There are some distinctions between metals and nonmetal. Metals are distinguished from nonmetals by their high conductivity for electricity, by metallic lustre and by their resistance to electric current. Their use in industry is explained not only by those properties and by the fact that their properties, such as strength and hardness, can be greatly improved by alloying them with other metals.

2. There are several important groups of metals and alloys. The common metals such as iron, copper, zinc, etc. are produced in great quantities.

3. The so-called precious metals include silver, gold, platinum and palladium. The light metals are aluminium, berillium and titanium. They are important in aircraft and rocket construction.

4. Many elements are classified as semimetals (bismuth, for example) because they have much poorer conductivity than common metals.

5. Nonmetals (carbon, silicon, sulphur) in the solid state are usually brittle materials without metallic lustre and are usually poor conductors of electricity. Nonmetals show greater variety of chemical properties than common metals do.

6. Metals can undergo corrosion, changing in this case their chemical and electromechanical properties. In order to protect metals from corrosion the products made of metals and steel are coated by some films (coatings). Organic coatings protect metals and steel from corrosion by forming a corrosion-resistant barrier between metal or steel and the corrosive environment.

**Задание 1. Найдите в тексте ответы на вопросы:**

**Вопросы**

1. By what properties are metals distinguished from nonmetals?
2. What common metals are produced in great quantities?
3. What metals are called light?
4. What properties do nonmetals have?
5. What is done to protect metals from corrosion?

**Задание 2. Закончите предложения, найдя соответствующий вариант окончания в тексте**

1. There are some different groups of metals, such as:
2. Light metals …
3. Common metals: …
4. Precious metals: ...
5. Nonmetals are…

**Часть 3**

**Material types**

**A. Metals and non-metals**

Engineering materials can be divided into:

• metals- examples of metallic materials are iron (Fe) and copper (Cu)

• non-metals- examples of non-metallic materials are carbon (C) and silicon (Si).

**As iron is such a widely used material, metals can be divided into:**

• ferrous metals- those that contain iron

• non-ferrous metals- those that do not contain iron.

**Задание 1. Заполните пропуски словами в рамке, используя текст A**

1. Carbon (C) is a ................................ .
2. Copper (Cu) is a ................................ metal.
3. Aluminium (AI) is a common ................................ .
4. Steel (Fe + C) is a widely used ................................ metal.
5. Although it is used in steel, carbon is ................................ .
6. Aluminium is relatively lightweight for a ................................ material.

**B. Elements, compounds and mixtures**

With regard to the chemical composition of materials -the chemicals they contain, and how

those chemicals are combined- three main categories can be used:

• Elements are pure materials in their most basic form. They cannot be broken down into different constituents ('ingredients'). Examples of elements widely used in engineering materials are iron, carbon and aluminium (AI).

• Compounds consist of two or more elements that are chemically bound - that is, combined by a chemical reaction. An everyday example is water, which is a compound of hydrogen (H) and oxygen (0).

• Mixtures consist of two or more elements or compounds which are mixed together, but which are not chemically bound. In engineering, common examples are alloys -that is, metals which have other metals and/or non-metals mixed with them. A common example is steel, which is an iron-carbon alloy, and can include other alloying metals- metals which are added to alloys, in small quantities relative to the main metal. Examples of widely used alloying metals are chromium (Cr), manganese (Mn) and tungsten (W).

**Задание 2. Прочитайте текст B и напишите, верны данные ниже высказывания или нет (True or False).**

1. The elements that make up a compound are chemically bound.
2. Alloys are chemical compounds that are frequently used in engineering.
3. Alloys can contain both metallic and non-metallic constituents.
4. In an alloy, an alloying metal is the biggest constituent, by percentage.
5. Steel is a metallic element.

**С. Composite materials**

The article below is from an engineering journal.

When you think of examples of hi-tech materials, composite materials come to mind- such as carbon-fibre, used in aerospace and Formula 1 cars.

But although we think of composites as hi-tech and highly expensive, that's not always true. The earliest examples of composite materials were bricks made from mud and straw. Or, to use the correct composite terms, from straw reinforcement- the structural network that reinforces the material inside, and a mud matrix- the material surrounding the reinforcement. These terms explain what a composite material is:  it is a matrix with a reinforcing material inside it. A modern, everyday example is fiberglass  - correctly called glass reinforced plastic (GRP) -which has a plastic matrix reinforced with glass fibres.

**Задание 3. Прочитайте текст С. и ответьте на вопросы:**

1. What hi-tech material is used in aerospace and Formula 1 cars?
2. What is a composite material?
3. What is a modern everyday example of a composite material?

**Задание 4. Используя тексты А, В, С, заполните таблицу и напишите по 2 слова в каждую колонку**

|  |  |  |  |
| --- | --- | --- | --- |
| **Element** | **Compound** | **Alloy** | **Composite** |
|  |  |  |  |

**Практическое занятие № 13**

**Тема 3.3 Детали и инструменты.** Простой ручной инструмент. Крепеж. Станки.

**Прочтите текст и выполните задания после текста:**

**Machine Tools**

1. Machine tools are the machinery used to process various materials in order to get desired shapes and properties.

2. The first generation of modern machine tools was introduced during the industrial revolution in  the 18th century with the invention of steam engines. Machine tools opened an era of automation by providing the means to replace human work with mechanical work. In the early days automation with machine tools was performed using various kinematic mechanisms, but it evolved into programmable automation with the use of computer numerical control. Today, many machine tools are operated with electrical or hydraulic power and controlled by a computer.

3. The major application of automation using machine tools in the early years was in transfer lines. Many special-purpose machines were grouped together with a part-moving system, such as a conveyor, providing the transfer of parts from one machine to another. A specific operation was performed on each station, and the part was moved to the next station until the finished product was obtained. Recently, flexible automationhas been actively pursued to cope with continuous and rapid change of product designs and cycles. In such systems, several numerically controlled machines are clustered together to perform a variety of jobs. Programs are used, instead of inflexible mechanisms, to control the machines, so that the system can easily adapt to different job requirements.

**Задание 1. Переведите 2 абзац текста письменно.**

**Задание 2. Найдите в 3-ем абзаце текста термины, выпишите их и с помощью словаря переведите.**

**Задание 3. Найдите в тексте 4-5 Причастий, выпишите их.**

**Задание 4. Вставьте *to write* в нужной форме.**

1. We often ... letters to our parents.
2. What ... you ... now?
3. Yesterday they ...... tests from 10 till12 o'clock.
4. Who ...... this letter?
5. I ...... some letters last week.
6. What ... you ... tomorrow at 10?
7. When I came to her, she ... ... а letter.
8. .. . you ... letters tomorrow?
9. I ... not ... this letter now. I ..... .it in some days.
10. ... he ... his home task now?
11. What ... she ... in the evening yesterday?
12. As а rule, he ... tests well.

**STEEL**

The most important metal in industry is iron and its **alloy** — steel. Steel is an alloy of iron and carbon. It is strong and **stiff**, but **corrodes** easily through **rusting**, although **stainless** and other special steels **resist** corrosion.

The amount of carbon in a steel influences its properties **considerably**. Steels of low carbon **content** (mild steels) are quite ductile and are used in the manufacture of sheet iron, wire, and pipes. Medium-carbon steels containing from 0.2 to 0.4 per cent carbon are **tougher** and stronger and are used as structural steels. Both mild and medium-carbon steels are suitable for forging and **welding**. High-carbon steels contain from 0.4 to 1.5 per cent carbon, are hard and **brittle** and are used in **cutting tools**, **surgical instruments**, razor **blades** and **springs**.

Tool steel, also called silver steel, contains about 1 per cent carbon and is strengthened and toughened by quenching and tempering.

The **inclusion** of other elements **affects** the properties of the steel. **Manganese** gives extra strength and toughness. Steel containing 4 per cent **silicon** is used for transformer **cores** or electromagnets because it has large grains acting like small magnets. The addition of chromium gives extra strength and corrosion resistance, so we can get **rust-proof** steels. Heating in the presence of carbon **or nitrogen-rich** materials is used to form a hard surface on steel (case-hardening). High-speed steels, which are extremely important in machine-tools, contain chromium and **tungsten** plus smaller amounts of vanadium, molybdenum and other metals.

***Vocabulary:***

**alloy** — сплав

**carbon**— углерод

**stiff** — жесткий

**to corrode** — разъедать, ржаветь

**rusty** — ржавый

**stainless** — нержавеющий

**to resist** — сопротивляться

**considerably** — значительно, гораздо

**tough** — крепкий, жесткий, прочный, выносливый

**forging** — ковка

**welding** — сварка

**brittle** — хрупкий, ломкий

**cutting tools —** режущие инструменты

**surgical instruments** — хирургические инструменты

**blade** — лезвие

**spring** — пружина

**inclusion** — включение

**to affect** — влиять

**manganese** — марганец

**silicon** — кремний

**rust-proof** — нержавеющий

**nitrogen** — азот

**tungsten** — вольфрам

**Задание 1. Ответьте на вопросы по тексту**

1. What is steel?
2. What are the main properties of steel?
3. What are the drawbacks of steel?
4. What kinds of steel do you know? Where are they used?
5. What gives the addition of manganese, silicon and chromium to steel?
6. What can be made of mild steels (medium-carbon steels, high-carbon steels)?
7. What kind of steels can be forged and welded?
8. How can we get rust-proof (stainless) steel?
9. What is used to form a hard surface on steel?
10. What are high-speed steels alloyed with?

**Задание 2. Найдите в тексте перевод слов и словосочетаний**

1. сплав железа и углерода
2. прочный и жесткий
3. легко коррозирует
4. нержавеющая сталь
5. низкое содержание углерода
6. ковкость
7. листовое железо, проволока, трубы
8. конструкционные стали
9. пригодны для ковки и сварки
10. твердый и хрупкий
11. режущие инструменты
12. хирургические инструменты
13. инструментальная сталь 14.упрочнять
14. добавление марганца (кремния, хрома, вольфрама, молибдена, ванадия)

**Задание 3. Прочитайте текст и напишите, верны ли утверждения после текста (Т) или нет (F). Запишите цифру и букву.**

The second main category of steel is alloy steels, which consist of iron, carbon and one or more alloying metals. Specific grades of alloy steel include:

• low alloy steels, which contain 90% or more iron, and up to approximately 10% of alloying metals such as chromium, nickel, manganese, molybdenum and vanadium

• high strength low alloy steels (HSLA), which contain smaller quantities of the above metals (typically less than 2%)

• stainless steels, which contain chromium as well as other metals - such as nickel - and which do not rust.

• tool steels, which are extremely hard, and are used in cutting tools. They contain tungsten and/or cobalt. A widely used grade of tool steel is high-speed steel, which is used in cutting tools that operate at high temperatures, such as drill bits.

1. Steel is an alloy of iron and carbon.
2. Alloy steels contain carbon.
3. Chromium and nickel are used as alloying metals in steel.
4. Low alloy steels contain more chromium than iron.
5. Stainless steel is an alloy steel.
6. Tungsten is added to steel to make it softer.

High-speed steel is suitable for making cutting tools that get very hot.

**Практическое занятие № 14**

**Тема 3.4 Наладка станков.**

***Прочтите текст и выполните задания после текста:***

**MACHINE-TOOLS AND PROCESSES**

Machine-tools are used to shape metals and other materials. The material to be shaped is called the workpiece. Most machine-tools are now electrically driven. Machine-tools with electrical drive are faster and more accurate than hand tools: they were an important element in the development of mass-production processes, as they allowed individual parts to be made in large numbers so as to be interchangeable.

All machine-tools have facilities for holding both the workpiece and the tool, and for accurately controlling the movement of the cutting tool relative to the workpiece. Most machining operations generate large amounts of heat, and use cooling fluids (usually a mixture of water and oils) for cooling and lubrication.

Machine-tools usually work materials mechanically but other machining methods have been developed lately. They include chemical machining, spark erosion to machine very hard materials to any shape by means of a continuous high-voltage spark (discharge) between an electrode and a workpiece. Other machining methods include drilling using ultrasound, and cutting by means of a laser beam. Numerical control of machine-tools and flexible manufacturing systems have made it possible for complete systems of machine-tools to be used flexibly for the manufacture of a range of products.

**Задание 1. Закончите предложения, выбрав соответствующие варианты**

1. Machine-tools are…

А) now electrically driven

В) an important element

С) used to shape metals and other materials

1. The material to be shaped is…

А) allowed individual parts

В) called the workpiece

С) usually work materials mechanically

1. Other machining methods include…

А) drilling using ultrasound, and cutting by means of a laser beam.

В) chemical machining, spark erosion to machine very hard materials to any shape by means of a continuous high-voltage

С) facilities for holding both the workpiece

**Задание 2. Найдите в правой колонке русские эквиваленты английских слов**

1. electrically driven
2. The material to be shaped
3. high-voltage spark
4. more accurate
5. of mass-production processes

1. обрабатываемый материал
2. более точный
3. электропривод
4. процесс массового производства
5. высоковольтный разряд

**Задание 3. Найдите в правой колонке русские эквиваленты слов и словосочетаний:**

|  |  |
| --- | --- |
| 1. non-ferrous metal 2. turning mill 3. roughing operations 4. finishing operations 5. turret head 6. side head 7. facing 8. drilling 9. high rigidity 10. gearbox 11. multidisk friction clutch 12. work feed 13. table speed 14. cross-rail 15. V-belt | 1. зубчатая передача 2. многодисковая фрикционная муфта 3. скорость движения стола 4. черновая обточка 5. токарный станок 6. высокая жесткость 7. чистовая обточка 8. торцевое точение 9. револьверная головка 10. боковой суппорт 11. сверление 12. клинообразный ремень 13. цветные металлы *(не железистые)* 14. поперечина (траверса) 15. подача заготовки |

**Прочитайте текст и выполните задание после него.**

**3D component features**

**A. 3D forms of edges and joints**

The plan and sections below show the end of a stainless steel pipe and an access plate, which are part of a production line at a chemicals manufacturing plant. The top edge of the plate is chamfered- at an angle of 45 degrees with the sides of the plate. All the other edges are square (90 degrees). Around the bottom of the plate is a rebate – an internal corner. The top of the pipe is also rebated around the inside, so that the bottom of the plate can slot into the top of the pipe. In the rebate on the pipe, there is a ridge - a long, thin, raised surface. On the plate, a groove or channel is cut into the metal. The ridge on the pipe slots into this groove to form

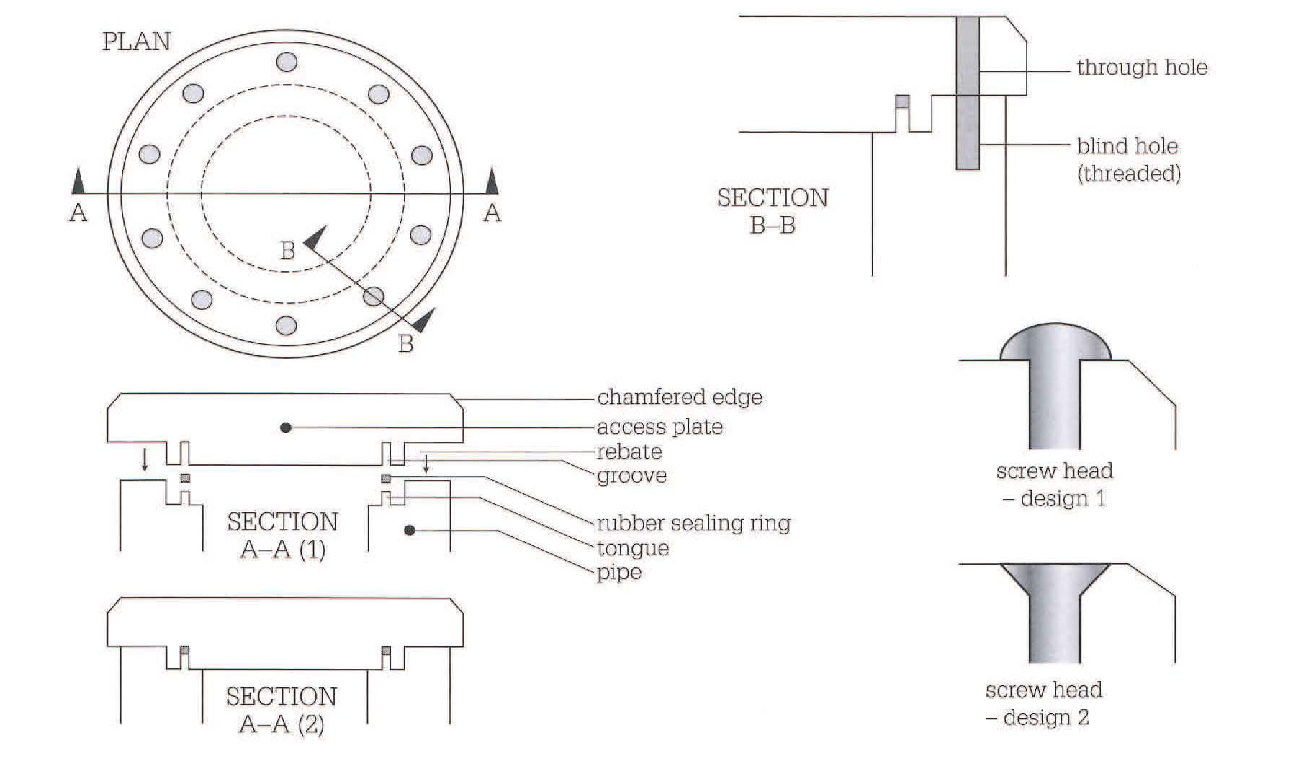
a tongue and- groove joint (the ridge is the tongue). When the two are slotted together there is a cavity or void (a hollow space) between the top of the tongue and the end of the groove. This is to accommodate (provide a space for) a rubber sealing ring.

**B. 3D forms of holes and fasteners**

• The holes in the plate, for screws, are through holes- they go through the metal. The  holes in the pipe wall are blind holes - they do not go all the way through. The screws which are intended to be screwed into these holes (by a turning action) have threads (helical grooves). The internal surfaces of the holes in the pipe walls are also threaded.

• The screws are machine screws, which have a constant thickness - their thickness is the same along their length. Many other screws are tapered - their thickness decreases towards the tip of the screw (the narrower end). Many screws are also pointed- the thickness of their tip reduces to zero.

• Two design options are shown for the screw heads. In Design 1, the screw has a round head, which is raised or proud - it is at a higher level than the surface of the plate. In Design 2, the screw has a flat head and is fully recessed - the head is within the thickness of the plate. The head is flush with (at the same level as) the top of the plate. To make the screw heads flush, the top of the hole and the sides of the screw head are chamfered. Recessing screws in this way is called countersinking - the screws are countersunk.



**Задание 4. Найдите соответствия между предложениями 1)-5) и предложениями а) – е). Используйте информацию из текстов А и В.**

|  |  |
| --- | --- |
| 1. According to the drawing, we cut to a depth of 40 mm in a 60 mm thick plate. 2. The edge of the die is cut off at 45 degrees. 3. The tool is used as a scribe for scratching lines on the surfaces of ceramics. 4. It's important to ensure the joint fits together properly. 5. The surface needs to be flat. | 1. So the inside of the (groove/tongue) must be perfectly smooth. 2. So the screw heads must be (raised/flush). 3. It's a (blind/through) hole. 4. That's why the end is (rounded/pointed), to make it sharp. 5. It's (chamfered/rebated). |