ТОВ «ТЕХНІЧНИЙ УНІВЕРСИТЕТ
«МЕТІНВЕСТ ПОЛІТЕХНІКА»

«Англійська мова для інженерів та технологів (English for Engineers and Technologists)»

методичні вказівки до практичних занять

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У методичних вказівках наведені завдання до практичних занять, які виконуються у процесі вивчення дисципліни. Рекомендовано для студентів першого (бакалаврського) рівня освіти спеціальності 136 Металургія.

Зміст

стор.

ВСТУП

На сучасному етапі розвитку суспільства вивчення іноземної мови набуло особливого значення для фахівців у різних сферах діяльності. Вивчення іноземних мов має велике значення для підготовки фахівців міжнародного рівня та для отримання доступу до сучасних технологій.

Методичні вказівки до практичних занять з дисципліни «Англійська мова для інженерів та технологів (English for Engineers and Technologists)» розраховані для здобувачів освіти, які навчаються за ОПП «Металургія». Теми практичних занять відповідають навчальному плану підготовки бакалаврів спеціальності 136 Металургія і є необхідною складовою частиною вивчення англійської мови.

Методичні вказівки складаються з 12 тем, що дозволяють здійснювати поетапне, цілеспрямоване формування мовних навичок і умінь за допомогою системи завдань і вправ для професійно-спрямованого іншомовного читання.

Кожна тема містить тексти, пов’язані з металургійними процесами та лексико-граматичні вправи. Лексичний матеріал тем сприятиме успішному оволодінню англійською мовою та формуванню професійних навичок металургів, розвитку їх когнітивних здібностей.

Завдання, які подані в методичних вказівках, спрямовані на формування необхідної комунікативної спроможності в сфері професійного, ситуативного усного і письмового спілкування, навичок практичного володіння іноземною мовою в різних видах мовленнєвої діяльності в обсязі тематики, що пов'язана з металургійним виробництвом.

TEMA 1. Metallurgical Engineering.

Text: Metallurgical Engineering.

Metallurgical engineers conduct testing to ensure the safety of materials, develop sustainable materials and processes for recycling existing materials, investigate material failures, and create testing procedures to ensure materials can withstand extreme environments.

The demand for metallurgical engineers is projected to grow by 5% in the coming years. With advancements in technology and increasing industrial requirements, skilled metallurgical engineers are in high demand.

A metallurgical engineer operates various machines and welding equipment. Some machines they use include electron microscopes, spectrographs and X-ray devices. This equipment helps them to determine metals' properties and perform thorough research and development.

Extractive metallurgical engineers usually work in ore treatment plants, refineries, smelter plants, or steel mills. They may also work at remote mining sites. Those working in physical metallurgy are usually located in labs or manufacturing plants, doing research and conducting studies on extracted metals.

Metallurgical production processes are underpinned by a complex interplay of physical, chemical, and thermodynamic principles. Understanding these fundamental concepts is crucial for optimizing processes, improving product quality, and developing innovative techniques. By understanding these fundamental principles, metallurgists can optimize processes, improve product quality, and develop innovative materials and technologies.

Metallurgical technologies and equipment are essential for extracting metals from ores and transforming them into various products. Here's a brief overview of some key technologies used in the metallurgical industry:

Primary Metallurgical Processes: smelting, roasting, leaching, solvent extraction, electro winning, electro refining.

Secondary Metallurgical Processes: ingot casting, continuous casting, die casting, rolling, forging, extrusion, drawing, turning, milling, drilling, grinding.

There are modern trends in metallurgical technologies. Let's describe them.

Energy Efficiency: Developing energy-efficient processes to reduce costs and environmental impact.

Automation and Robotics: Implementing automation and robotics to improve productivity and safety.

Advanced Materials: Developing advanced materials with superior properties, such as high-strength steels, lightweight alloys, and functional materials.

Additive Manufacturing: Using 3D printing techniques to create complex metal parts.

Green Metallurgy: Adopting eco-friendly practices to minimize pollution and waste.

By combining these technologies and equipment, metallurgists can produce a wide range of metal products, from simple to complex, that are used in various industries, including construction, automotive, aerospace, and electronics.

Завдання:

Task 1. Read and translate the text.

Task 2. Answer the following questions.

Begin your answers with: as far as I know (наскільки мені відомо); in my opinion/ to my mind (на мою думку); I think (я думаю); if I'm not mistaken (якщо я не помиляюся); as for me (щодо мене).

1. What do metallurgical engineers do?
2. Is metallurgical engineering a good field?
3. What is the job of metallurgist engineer?
4. What equipment helps them to determine metals' properties?
5. Where can metallurgical engineer work?
6. What are the primary and secondary metallurgical processes, and how do they differ?
7. What are the key challenges and opportunities in the field of metallurgical engineering today?
8. How does the understanding of crystal structure influence the mechanical properties of metals?
9. What are some of the modern trends in metallurgical technologies, and how are they impacting the industry?
10. Explain the role of diffusion in metallurgical processes.

Task 3. Translate into English.

інженер-металург, процеси металургійного виробництва, металургійні технології та обладнання, сучасні матеріали, екстракція розчинником, електрорафінування, лиття в зливки, безперервне лиття, адитивне виробництво, машинобудування, хімічна інженерія, фізична металургія, стійкі матеріали, контроль якості, управління проектами, виробничі підприємства , науково-дослідні заклади, місця видобутку.

Task 4. Read and translate the dialogue.

A Conversation Between Two Metallurgical Engineers

Engineer 1: So, what are you working on these days? Any exciting new projects?

Engineer 2: Actually, I'm deep into research on developing a new type of high-strength, lightweight alloy for aerospace applications. It's quite challenging, but the potential benefits are enormous.

Engineer 1: That's fascinating! I've been focusing on optimizing our smelting process to improve energy efficiency and reduce environmental

impact. We're experimenting with new techniques to minimize waste and emissions.

Engineer 2: That's great to hear. It's crucial to balance innovation with sustainability. Speaking of sustainability, have you looked into additive manufacturing for creating complex metal components? It could revolutionize the industry.

Engineer 1: Definitely! We've been exploring 3D printing techniques for prototyping and small-scale production. The precision and flexibility are impressive.

Engineer 2: I agree. It's amazing how far technology has come. Remember when we used to rely solely on traditional casting and forging methods?

Engineer 1: Yeah, those were the days. But now, with advanced materials and manufacturing processes, we can create products that were once unimaginable.

Engineer 2: Absolutely. The future of metallurgy is bright. We're constantly pushing the boundaries of what's possible.

Engineer 1: Cheers to that! Let's keep innovating and shaping the future of materials science.

Task 5. Match the word with its definition.

1) Ingot Casting 2) Continuous Casting 3) Die Casting 4) Rolling 5) Forging 6) Extrusion 7) Drawing 8) Turning 9) Milling 10) Drilling 11) Grinding	a) Metal is shaped by hammering or pressing. b) Metal is pulled through a die to reduce its cross-sectional area. c) A process to remove material from a work piece using a rotating cutter. d) Molten metal is poured into molds to form ingots. e) A process to remove material from a work piece using an abrasive wheel. f) Metal is forced through a die to produce a desired shape. g) Molten metal is continuously poured into a water-cooled mold to produce a solid product. h) A process to remove material from a rotating work piece using a cutting tool. i) Molten metal is injected into a mold under high pressure to produce complex shapes. j) A process to create holes in a work piece using a rotating drill bit. k) Metal is shaped by passing it through rollers.

TEMA 2. The Present and the Future of Metallurgy.

Text: The Present and the Future of Metallurgy.

In this age of sensational discoveries, newspapers and periodicals often contain articles on light metals and plastics. These new developments have a great influence on our life. But the so-called basic instruments, in particular, the coal and iron industry are still in an early stage of development and will change considerably as a result of scientific researches. Even agriculture is now dependent on tractors and harvesters to produce the huge outputs needed to feed the world.

It is true that some things that were once made of steel may soon be made of light alloys or of plastics, but highly stressed parts such as the crankshaft in aero-engine or the propeller shaft in a big liner will be made of steel for a long time to come. Industry today has become a network of many different processes, each depending to some extent on the others.

Iron and steel have been made for many centuries, but it is only during the last hundred years that production has reached gigantic amounts.

The application of science to the iron and steel industry is a fairly new development. Most of the special steels, for example, stainless steel, the extraordinary strong magnetic steels, and the creep-resisting steels used for jet engines have all been developed during the last twenty years.

As a result of all scientific development that has taken place during this century, iron and steel making is rapidly changing from an art to a science.

Chemical analysis, magnetic testing and many other rapid methods are now being used to ensure that finished metal has the desired properties.

All changes are, however, subject to one governing factor, namely, the relative cheapness of iron and steel. The processes may be modified in many ways but any substantial increase in manufacturing costs without any corresponding increase in quality cannot be tolerated.

Завдання:

Task 1. Read and translate the text.

Task 2. Answer the following questions.

Begin your answers with: as far as I know (наскільки мені відомо); in my opinion/ to my mind (на мою думку); I think (я думаю); if I'm not mistaken (якщо я не помиляюся); as for me (щодо мене).

1. What is the main topic of the text?
2. How has the development of light metals and plastics influenced our lives?
3. Why are traditional industries like coal and iron still important, despite advancements in technology?
4. How has agriculture benefited from technological advancements?
5. What are some examples of highly stressed parts that will continue to be made of steel?

6. How has the production of iron and steel changed over the past two centuries?
7. What are some examples of special steels developed in recent decades?
8. How has science transformed the iron and steel industry?
9. What factors limit the changes in iron and steel production?
10. What methods are used to ensure the quality of finished metal products?

Task 3. Translate into English.
сенсаційні відкриття, нові розробки, основні галузі промисловості, вугільна та металургійна промисловість, наукові дослідження, величезний обсяг виробництва, легкі метали, сталеві деталі, спеціальні сталі, нержавіюча сталь, магнітні сталі, жароміцні сталі, хімічний аналіз, магнітний контроль, виробничий процес, якість продукції, собівартість виробництва.

Task 4. Put the following words in the right order to get a sentence.
1. In this age, light metals, of periodicals, sensational, newspapers, and often contain discoveries, articles on and plastics.
2. These, on our life, new, have, a great influence, developments.
3. will change, The coal, and, considerably, scientific researches, iron industry, as a result of.
4. things, of steel, of light alloys, Some, may, soon, be made, or of plastics, that were once made.
5. Iron, and, for many, have been made, centuries, steel.
6. Chemical analysis, magnetic testing and many other rapid methods are now being used to ensure that finished metal has the desired properties.
7. Most, special, of the, steels, are for jet engines, used.
8. All, scientific, cheapness, are, iron, the, relative, changes, of, and, steel.

Task 5. Make up sentences

Metallurgy	is	- the science and technology of metals.
	plays	- metallurgy at university.
Students	studied	- an important industry in this region.
	includes	- a crucial role in the automotive industry.
		- essential for creating the lightweight and heat-resistant materials used in spacecraft.
		- the development of new metal and alloy systems.

TEMA 3. Metals in Perspective.

Text: Metals in Perspective

Modern civilization is based on metals and millions of tons are extracted from the surface of the Earth every year. The place of metals in the modern world is supreme in importance. About three-quarters of all known chemical elements are metals.

Since the Stone Age, man has found many materials he could work with. However, the materials that helped him most to develop were the metals. In many regions of the Ancient World man used lumps of native metals he could pick from the surface of the ground: gold nuggets, lumps of native copper and silver.

Archaeologists have found evidence of early metal-work dating as far back as 10,000 BC. Such finds were made in the Middle East, where deposits of copper were most plentiful. This does not mean that this metal was easy to find, but that there were more deposits in the Middle East than other parts of the world.

Copper seems to be the first metal which began to oust stone. The need for copper was great indeed. The advantages that copper had over stone as a material for weapons, tools, were obvious. The metal occurred naturally in the pure (free) state and had many good things about it: it could readily be worked to any shape, flattened, pointed and holed. At first, man made it into small things such as arrowheads. Before long, however, man noticed that when hammered copper becomes harder and stronger, but if it is held over a fire - soft, malleable, easy to work.

Gold is the most malleable of all the metals. It is much softer than copper and not very strong. But gold has been valued for thousands of years for its beautiful lustre and scarcity.

In about 4300 BC in the region of the Caspian Sea man discovered the process of smelting - how to extract the metals from their ores.

Two new metals came into use at this time - about 4,000 BC. The first was silver, prized in those days as it is today, for its beauty, and used for ornaments. It was sometimes found ‘free’, lying around, as was gold, but was mostly smelted from ores. The second metal was lead, a dull heavy metal, soft and easily shaped into cups and beakers. Lead is never found ‘free’; it has always been smelted from ore.

During the next 1,000 years the knowledge of the four metals far known - copper, gold, silver and lead - spread to other lands. Troy (home of Helen), near the Dardanelles, was the chief centre of trade and from there goods were carried by boat into Europe. The River Danube provided a highway deep into the continent, and the traders’ boats also took metal goods to all countries around the Mediterranean. Eventually they reached Britain, and the art of smelting and metal working became known in this country. Quite early in the history of metal the process of casting was used to shape metal.

So, during the many centuries of history man has learnt how to mine, smelt and work many metals. But iron - the chief metal of present times - has

given the name of Iron Age to the most significant and productive period in the development of human society.

Завдання:

Task 1. Read and translate the text.

Task 2. Answer the following questions.

Begin your answers with: as far as I know (наскільки мені відомо); in my opinion/ to my mind (на мою думку); I think (я думаю); if I'm not mistaken (якщо я не помиляюся); as for me (щодо мене).

1. What is the main material that has shaped human civilization?
2. How did early humans use metals, and where did they find them?
3. What were the advantages of copper over stone as a material?
4. How did the discovery of smelting change human civilization?
5. What were the first two metals to be smelted?
6. How did the knowledge of metalworking spread to different regions?
7. Why is the Iron Age considered the most significant period in human history?
8. What are the properties of gold that make it valuable?
9. How did early humans shape metals before the discovery of smelting?
10. What factors limited the use of metals in ancient times?

Task 3. Fill in blanks with the necessary words.

malleable, shape, metals, seems, hammered, evidence, nuggets, stone, advantages, soft, chemical, metal-work, metals, silver, Stone, materials, holed, weapons, Ancient, lumps, fire, surface, harder.

1) The place of ...in the modern world is important.
2) About three-quarters of all known ...elements are....
3) Since the ...Age, man has found many ...he could work with.
4) In many regions of the ...World man used ...of native metals he could pick from the ...of the ground: gold..., lumps of native copper and....
5) Archaeologists have found ...of early ...dating as far back as 10,000 BC.
6) Copper ...to be the first metal which began to oust....
7) The ...that copper had over stone as a material for ..., tools, were obvious.
8) Copper could readily be worked to any..., flattened, pointed and...
9) ...copper becomes ...and stronger.
10) If copper is held over a ...it becomes ..., malleable and easy to work.
11) Gold is the most ...of all the metals.

Task 4. Match the word with its definition.

1) Ductile(пластичний): 2) Malleable (ковкий): 3) Soft: 4) Corrosion-resistant: 5) Lustrous (блискучий)white: 6) Bluish(синювато)-white: 7) Dense (щільний): 8) Good thermal conductor: 9) Good electrical conductor: 10) Lightest thermal and electrical conductivity:	a) Able to be hammered or pressed into thin sheets without breaking. b) Conducts electricity well. c) Having a high mass per unit volume (heavy for its size). d) Able to be stretched into thin wires without breaking. e) Transfers heat efficiently. f) Having a bluish tint to its white color. g) Easily scratched or deformed. h) Shiny and white in appearance. i) Conducts heat and electricity the least out of the listed metals. j) Resists rust and other forms of deterioration.

Task 5. Choose the correct form of the verb.

1) Metals (am, is, are) essential to modern civilization. 2) People (extract, extracts) millions of tons of metals annually. 3) About three-quarters of all elements (am, is, are) metals. 4) Man (have, has) found many materials to work with. 5) Metals (have, has) helped man develop. 6) Archaeologists (have, has) found evidence of early metalwork. 7) Copper (seem, seems) to be the first metal. 8) Copper (have, has) many good properties. 9) Gold (am, is, are) the most malleable metal. 10) Gold (have, has) been valued for thousands of years.

TEMA 4. The Importance of Iron and Advent of Steel.

Text: The Importance of Iron and Advent of Steel.

Life seems impossible now without iron, the cheapest and most important metal we use. Iron is extracted from a rocky material called iron ore. Like many elements, iron is too reactive to exist on its own in the ground. Instead, it combines with other elements, especially oxygen, in ores. The chemical process for extracting a metal from its ore is called smelting.

The first people who discovered how to extract iron from iron ore were the Hittites, a powerful group of people living in Asia Minor and Syria - south of the Black Sea. They kept the process a closely guarded secret. The Egyptians, for example, had to pay the Hittites in gold four times the weight of iron and once deceived them with lumps of bronze covered with a thin layer of gold.

The smelting of iron was the most important metallurgical development. Iron-ore is plentiful all over the world; therefore it may seem surprising that such a long time elapsed before iron was produced. The reason was that the furnaces used to smelt copper were not hot.

Sometimes the early iron-workers, or smiths, accidentally produced a steel article instead of an iron one. Steel is iron with a small percentage of carbon in it. The carbon came from the fuel in the furnace in which the iron was heated. The smiths later learned from experience how to introduce this carbon when they wanted to produce steel.

Steel is stronger than iron, and can be made stronger still by quenching, which is the sudden cooling, in water or other fluids, from red-heat. However, steel becomes very brittle when made extremely hard, and as each smith used his own method the quality of the steel varied a great deal. Often a sword made by a poor smith snapped just when it was most needed.

In those days furnaces were not hot enough to melt iron completely. To extract the iron from the iron-ore, the ore was heated as much as possible (reducing the iron to a 'spongy' consistency) and then hammered. This forced the bits of rock and other impurities out, leaving the iron behind. Great skill and dexterity were required, especially as tongs had not been invented and the hot metal was handled with green sticks.

Завдання:

Task 1. Read and translate the text.

Task 2. Answer the following questions.

Begin your answers with: as far as I know (наскільки мені відомо); in my opinion/ to my mind (на мою думку); I think (я думаю); if I'm not mistaken (якщо я не помиляюся); as for me (щодо мене).

1) From what material is iron extracted?
2) Why doesn't iron exist on its own in the ground?
3) What is the process of extracting a metal from its ore called?
4) Who were the first people to discover how to extract iron from iron ore?
5) Why did the Egyptians have to pay a hefty price for iron?
6) What was surprising about the development of iron smelting?
7) Why did it take so long to develop iron smelting?
8) How were early iron tools accidentally made of steel?
9) What makes steel stronger than iron?
10) How can steel be made even stronger?

Task 3. Translate into English.

найважливіший метал, хімічний процес, видобуток металу, процес плавки, раптове охолодження, розпечений метал, кам'янистий матеріал, реактивний елемент, залізний вік, металургійний розвиток, видобуток металів, металургійний процес, залізна руда, плавка, вуглецева сталь, загартування, коваль, кування, виплавка металів, обробка металів, термічна обробка.

Task 4. Agree or disagree with the following statements.

Begin your sentences with: I agree with you. You are right. It is true.
I disagree with you. You are mistaken. You are not right. I don't think so. It is false.

1) Life seems impossible now without iron.
2) Iron is the most expensive metal we use.
3) Iron is extracted from a rocky material called iron ore.
4) The chemical process for extracting a metal from its ore is called casting (лиття).
5) The first people who discovered how to extract iron from iron ore were British.
6) The smelting of iron was the most important metallurgical development.
7) Iron-ore is plentiful all over the world.
8) Steel is iron with a big percentage of carbon in it.
9) Steel is malleable than iron.
10) Steel becomes very brittle when made extremely hard.

Task 5. Choose the correct form of the verb.
1) Man (have, has) discovered the process of smelting. 2) Silver (am, is, are) prized for its beauty. 3) Lead (have, has) always been smelted from ore. 4) Man (have, has) learned to mine, smelt, and work metals. 5) Iron (have, has) given its name to a significant period. 6) People (extract, extracts) more and more metals. 7) Scientists (developed, develop) new metal alloys many years ago. 8) We (am, is, are) relying on metals for various applications. 9) Last year the demand for metals (increase, increased) globally. 10) Industries (uses, use) metals to create new products.

TEMA 5. Iron in the Middle Ages.

Text: Iron in the Middle Ages.

Iron came to Britain long before the reign of William the Conqueror. There is evidence that the forging of iron was the chief trade of the city of Gloucester. Yet iron continued to be scarce in England.

For some hundred years after the Norman Conquest considerable quantities of iron and steel were exported to Britain by Germany and other continental countries. The merchants who brought metals were known as “German merchants of the Steelyard”. The great quantities of iron and steel were sold at the Steel Yard in London.

According to the Act of Parliament no iron was to be carried out of the country. Some iron was manufactured in England in the reign of Henry III, but much was still imported from Germany and later from Spain.

During the reign of Edward I (1239 - 1307) there were seventy-two hearths in the Forest of Dean - a source of iron ore. By the time of Edward III (1312 - 1377) the chief centres were Kent and Sussex. That iron was still of great value is shown by an inventory of the king’s possessions, in which his iron pots, pans, and other household utensils are classed as jewels and valuables.

No sensational developments in the manufacture of iron and steel had taken place; the local smiths converted the raw ore into wrought iron by

means of charcoal obtained by burning timber from the forest round about and worked up this iron into the required shapes.

In the 14th century the direct extraction of wrought iron from the ore was gradually displaced by first carbonizing the metal, so turning it into cast iron. This displacement method has continued steadily up to the present day.

During the 14th and 15th centuries England continued to import iron and steel from the continent. The growing importance of the industry gave its owners a political influence that grew steadily from that day to this. Improvements in the manufacture of iron had taken place during this period, and the ironmasters succeeded in getting Parliament to make laws prohibiting the importation into England of any iron or steel goods already made there. In 1483, for example, an Act was passed prohibiting the importation of knives, tailors' shears, scissors and irons, grid-irons, stock-locks, keys, spurs, buckles for shoes, iron wire, iron candlesticks, grates and many other such objects.

Minor advances in the art of making iron continued up to the times of Elizabeth I and James I. Production increased, especially in Sussex. By this time the blast furnace had established itself for the smelting of iron. It continued slowly to rise higher and increase in diameter. The immediate problem confronting the iron manufacturer of the 16th century was the growing shortage of wood from which to make charcoal.

Завдання:

Task 1. Read and translate the text.

Task 2. Answer the following questions.

Begin your answers with: as far as I know (наскільки мені відомо); in my opinion/ to my mind (на мою думку); I think (я думаю); if I'm not mistaken (якщо я не помиляюся); as for me (щодо мене).

1)When did iron become available in Britain?
2)What evidence suggests ironworking was important in Gloucester?
3)Despite evidence of ironworking, why was iron scarce in England?
4)For how long did Britain import iron and steel after the Norman Conquest?
5)Who were the "German merchants of the Steelyard" and what did they trade?
6)Where was the main location for selling large quantities of iron and steel in London?
7)What did an Act of Parliament say about exporting iron?
8)During which king's reign did some iron production begin in England?
9)What was a source of iron ore during Edward I's reign?
10)By the time of Edward III, where were the main centers of iron production?
11)What does the mention of the king's iron utensils being classed as valuables tell us about the value of iron?
12)How did early English smiths convert iron ore into usable iron?

Task 3. Match the word with its definition.

1)Ore (руда) 2)Coke (кокс) 3)Limestone (вапняк): 4)Blast furnace (доменна піч): 5)Slag (шлак): 6)Molten metal (розплавлений метал):	a) A solid fuel produced by heating coking coal in the absence of air. b) A by-product of metal smelting. It consists of gangue and other impurities that are removed from the ore during smelting. c) A naturally occurring mineral aggregate from which one or more valuable metals can be economically extracted. d) Metal that is in a liquid state at a temperature above its melting point. e) A sedimentary rock composed primarily of calcium carbonate ($CaCO_3$). f) A tall furnace in which iron is smelted from ore using hot air from coke.

Task 4. Read and translate the dialogue.

Here's a dialogue between two historians discussing the history of iron production in England:

Historian 1: It's fascinating to think about how far iron production has come. Even in the time of William the Conqueror, iron was a valuable commodity, despite the fact that it was being produced domestically.

Historian 2: Absolutely. The Gloucester region was a significant center for ironworking. However, England still relied heavily on imports from the continent, particularly from Germany. The "German merchants of the Steelyard" were a powerful force in the English economy.

Historian 1: The medieval English kings recognized the strategic importance of iron. Edward I and Edward III, for instance, took steps to promote domestic iron production, especially in areas like the Forest of Dean and Kent.

Historian 2: It's interesting to note that even in the 14th century iron was still considered a precious material. Royal inventories listed iron pots and pans as valuable possessions.

Historian 1: The transition from direct iron extraction to carbonization was a significant technological advancement. It marked the beginning of a new era in iron production.

Historian 2: The increasing demand for iron, particularly during the 16th century, led to a shortage of charcoal, the primary fuel for iron smelting. This crisis spurred innovation and eventually led to the development of coke as an alternative fuel.

Historian 1: It's clear that the evolution of iron production in England was a gradual process, shaped by technological advancements, economic factors, and government policies.

Task 5. Find as many words as possible.

Наприклад: ingot

a	v	**i**	**n**	**g**	**o**	**t**	r	o	t	i	o

a	f	s	m	e	t	a	l	r	f	m	d
d	u	c	a	s	t	h	j	e	k	a	e
x	r	v	f	u	e	l	m	b	l	t	n
s	n	p	r	e	c	i	o	u	s	e	s
l	a	d	u	c	t	i	l	e	t	r	e
a	c	z	c	v	i	r	o	n	e	i	c
g	e	l	s	q	b	n	m	w	e	a	o
r	k	c	h	a	r	c	o	a	l	l	p
t	q	h	a	g	o	l	d	v	o	b	p
s	h	c	p	g	s	t	o	n	e	m	e
x	k	q	e	s	f	j	g	c	v	n	r

Task 6. Choose the correct form of the verb.

1) Iron (come, came) to Britain long before the reign of William the Conqueror. 2) The forging of iron (was, were) the chief trade of Gloucester. 3) Iron (continue, continued) to be scarce in England. 4) Considerable quantities of iron and steel (was, were) exported to Britain. 5) The merchants (was, were) known as “German merchants of the Steelyard”. 6) The great quantities of iron and steel (was, were) sold at the Steel Yard. 7) No iron (was, were) to be carried out of the country. 8) Some iron (was, were) manufactured in England. 9) Much iron (was, were) still imported from Germany and Spain. 10) Iron (was, were) still of great value. 11) The industry (give, gave) its owners a political influence many years ago.12) He said that improvements (have, had) taken place.

TEMA 6. The First Blast Furnaces.

Text: The First Blast Furnaces.

So far, no furnace in Europe had been hot enough to melt iron to a liquid state. All that could be produced was a ‘spongy’ mass from which impurities had to be hammered out. However, design of furnaces improved over the centuries, and about the year 1400 very efficient blast furnaces were introduced by the Germans. They had found that a blast of air from water-powered bellows increased the temperature, though the iron still did not liquefy. It became soft and spongy, worked its way down through the burning charcoal, and collected at the bottom of the furnace.

Furnaces were usually built about ten or fifteen feet high, but to economize on fuel a new one was built thirty feet high. Although the internal temperature in this was no higher, the iron arrived at the bottom in a completely liquid state. Not only could the metal be run off into moulds, but many of the impurities (which had previously to be hammered out) separated automatically from the melted iron.

The reason for this tremendous stride in metallurgy was simple: the height of the furnace. The soft ‘sponge’ iron took so long to seep down through the charcoal that it absorbed a great deal of carbon. It became

carburized, and as the melting point of carburized iron is 350o C less than ‘sponge’ iron, it became liquid.

By about the year 1600, iron production in Britain was beginning to suffer from lack of fuel. For 3,000 years all iron-smelting, both here and abroad, had been done with charcoal. Charcoal is partly-burned wood. In Britain, timber was running short and it was impossible for the iron-makers to equal the output of a country such as Sweden, where timber was abundant.

Fortunately for Britain, Abraham Darby, found a way to do without charcoal altogether. In his iron factory at Coalbrookdale, Shropshire, he made many experiments using coke, and finally succeeded. There were technical difficulties to overcome, and at first Darby kept the process secret for the benefit of his family. Later his methods were adopted throughout Europe. No longer had dependant on dwindling forests, Britain remained her position as a leading iron producer.

Notes:

Abraham Darby, in his later life called Abraham Darby the Elder; (1678 – 1717) was the first and best known of several men of that name. Born into an English Quaker family that played an important role in the Industrial Revolution, Darby developed a method of producing pig iron in a blast furnace fuelled by coke rather than charcoal. This was a major step forward in the production of iron as a raw material for the Industrial Revolution (XVIII).

Завдання:

Task 1. Read and translate the text.

Task 2. Answer the following questions.

Begin your answers with: I believe (suppose, guess); in my opinion/ to my mind; as for me; as far as I know (remember).

1) What was the limitation of European furnaces before 1400 regarding iron production?
2) What technology improved iron production around 1400?
3) How did the blast furnaces work?
4) What was the significance of building a taller furnace (30 feet)?
5) How did the increased carbon content in the iron affect its melting point?
6) What was a major challenge for iron production in Britain by 1600?
7) What alternative fuel source did Abraham Darby discover?
8) Why did Darby initially keep his coke-based process a secret?
9) What was the long-term impact of Darby's discovery?
10) What can we infer about the importance of fuel for iron production in the text?
11) How did the German blast furnace design differ from earlier furnaces?
12) What were the impurities mentioned in the text, and how were they removed from the iron?

Task 3. Agree or disagree with the following statements.

Begin your sentences with: I agree with you. You are right. It is true.

I disagree with you. You are mistaken. You are not right. I don't think so. It is false.

1. Early furnaces couldn't melt iron into a liquid state.
2. Germans improved the design of blast furnaces, but didn't invent them.
3. The height of the furnace was crucial for achieving liquid iron.
4. Increasing the furnace's height didn't raise the internal temperature.
5. Liquid iron allowed for easier removal of impurities.
6. Iron became liquid due to carbonization and a lower melting point.
7. Charcoal was the primary fuel for iron smelting for millennia.
8. Sweden had abundant timber, unlike Britain.
9. Abraham Darby developed a method to use coke instead of charcoal.
10. Darby initially kept his process a secret.
11. Using coke helped Britain maintain its iron production leadership.
12. Abraham Darby lived in the 17th century.

Task 4. Complete the following statements by choosing the answer which you think fits best.

1. No furnace in Europe could melt iron to a liquid state because:
   a) there were too many impurities in it.
   b) they were not hot enough.
   c) water-powered bellows didn’t work properly.
2. The reason for the tremendous stride in metallurgy was:
   a) the height of the furnace.
   b) the shape of the furnace.
   c) the internal temperature of the furnace.
3. Iron production in Britain began to suffer from:
   a) the exhaustion of the deposits of iron ore.
   b) political situation.
   c) lack of fuel.
4. Abraham Darby succeeded in his experiments to do without charcoal because:
   a) he used coke.
   b) he hammered out the impurities.
   c) he mixed iron with carbon.

Task 5. Translate into English.

рідкий стан, горить деревне вугілля, економити на паливі, внутрішня температура, розплавленого заліза, величезний розвиток металургії, чавун, температура плавлення, відсутність палива, чавуноплавильний, частково спалене дерево, скорочення лісів, технічні труднощі, провідний виробник чавуну, промислова революція, чавун, доменна піч, сировина, вибиті домішки, працював вниз, відокремлюються автоматично.

Task 6. Make up sentences.

We	will continue	- new ways to extract metals.
Scientists	will discover	- our reliance on traditional mining
People	will use	methods.
Technology	will enable	- to develop new metal alloys.
We	will reduce	- in sustainable metal production.
Engineers	will design	- metals in innovative ways.
Companies	will invest	- stronger and lighter metal structures.
The demand for	will continue	- us to recycle metals more effectively.
metals		- to grow in the future.

TEMA 7. The Vast Growth of the Iron and Steel Industry.

Text: The Vast Growth of the Iron and Steel Industry.

When James Watt invented the steam engine in the latter part of the 18th century, the whole industrial scene changed. Steam power made possible the ‘Industrial Revolution’ in Britain. Vast quantities of metal were needed for the railways pioneered by George Stephenson, and the huge iron ships and bridges of Brunel. In Sheffield, the centre of the iron and steel industry, the output of metals multiplied fifty times in thirty-five years.

During this expansion, improved tools were invented for use in the factories and many steam-powered tools were invented and developed. One of the most famous of these tools was the steam-hammer designed by James Nasmyth about 1830. It was used to forge the huge shafts and plates required in the ships of the time, and could be accurately controlled to give heavy blows or light taps. In fact, to impress visitors to the foundry an egg was placed on the anvil and cracked by the hammer without breaking the egg shell. Other machine-tools invented and developed included the rolling-mill which could roll metal, either hot or cold, into thin sheets.

A British metallurgist Henry Cort took out a patent in 1783 for a mill to roll iron sheets and bars. In 1784 he improved the puddling process by hollowing out the bottom of the reverberatory furnace so as to contain the molten metal in this puddle. Railway lines could be made in this way, the hole in the press being suitably shaped to the section of the railway-line. Puddling played a great role in the development of iron and steel industry in Britain during the Industrial Revolution.

These tremendous advances in engineering were matched by improvements in the quality of metals, and the metallurgists were as active and successful as the engineers. Between 1750 and 1850 no less than thirty-five more metals were discovered. Many of these were unimportant but three were outstanding, *nickel, cobalt, and manganese*, the latter to play a vital part in steel production.

What is the importance of the puddling process? Puddling is the process of converting pig iron to bar (wrought) iron in a coal fired reverberatory furnace. It was developed in England during the 1780s. The molten pig iron was stirred in a reverberatory furnace, in an oxidizing environment to burn the carbon, resulting in wrought iron.

Завдання:

Task 1. Read and translate the text.

Task 2. Answer the following questions.

Begin your answers with: I believe (suppose, guess); in my opinion/ to my mind; as for me; as far as I know (remember).

1. What major technological advancement revolutionized the 18th-century industry?
2. Which famous engineer designed a powerful steam-powered tool?
3. What was the primary function of the steam hammer?
4. What was the significance of Henry Cort's invention?
5. How did the puddling process contribute to the Industrial Revolution?
6. What were the three most important metals discovered between 1750 and 1850?
7. What is the role of manganese in steel production?
8. What is the process of puddling?
9. What was the fuel source used in the puddling process?
10. What was the final product of the puddling process?

Task 3. Complete the following statements by choosing the answer which you think fits best.

1. . . . iron is a relatively soft silvery metal.
   a) clean b) mixed c) pure
2. All but 20 of the over 100 elements identified to date are . . .
   a) metals b) gases c) non-metals
3. Only 7 metals are common in the earth’s . . .
   a) surface b) crust c) underground
4. Copper was the first metal . . . by man.
   a) invented b) opened c) discovered
5. The steam-hammer was . . . by James Nasmyth.
   a) elaborated b) designed c) worked out
6. Gold, silver and copper have always been . . . for their qualities.
   a) praised b) respected c) valued

Task 4. Translate into English.

паровий двигун, промислова революція, залізничний транспорт, металургійна промисловість, паровий молот, прокатно-вальцювальний стан, пудлінгування, чавун, коксівне доменне виробництво, якість металів, нікель, кобальт, марганець, виробництво сталі, паливний процес, окисне середовище, ковane залізо, інженерні досягнення, металургійні досягнення, науково-технічний прогрес, промислове виробництво, металеві конструкції, технологічний процес, якість металу, металургійне виробництво.

Task 5. Match the word with its definition.

1) Steam engine 2) Steel industry 3) Tools 4) Anvil 5) Rolling mill 6) Iron sheet 7) Bar 8) Engineer	a) are implements used to perform a particular task. They can be divided into different categories, such as hand tools, power tools, and pneumatic tools. c) is a heat engine that performs mechanical work using steam as its working fluid. d) is a long, narrow piece of metal. e) is a professional who designs, builds, and operates systems and machines. f) is the branch of industry concerned with the production of steel. g) is a heavy metal block with a flat work surface. h) is a machine used to roll metal into sheets, bars, and other shapes.

TEMA 8. More Progress in Steel Production.

Text: More Progress in Steel Production.

Iron coming from a blast furnace is called pig-iron, and still contains many impurities which have to be removed before it can be converted into steel. During the Industrial Revolution the demand for steel was so great that better and quicker methods of producing it became necessary. A big step forward was made with the invention of the ‘Bessemer Converter’.

Henry Bessemer (1813 - 1898) was a British civil engineer and inventor. He was elected to the London Royal Society in 1879. During his life-time he patented over a hundred inventions in various fields of technology.

Henry Bessemer’s idea was that the impurities would be burned away if air was blown through molten pig-iron.

An experimental vessel to contain 7 centners of molten pig-iron was set up in Bessemer’s factory. Air pipes led into the bottom of the vessel, and when the air was turned on, huge flames and showers of sparks shot out of the mouth of the converter, followed by spurts of molten metal and slag. Bessemer and his workers could only retreat and hope for the best. They could not turn off the air because the air-valve had been placed too near to the converter. However, after ten minutes the eruption subsided and it was found that the iron was free of impurities.

The new process was widely adopted, and converters were built which could purify several tons of pig-iron in half-an-hour - an enormous improvement on previous methods. The Bessemer ‘blow’, with flames shooting high into the air, is one of the most dramatic sights in steel manufacture.

Other methods followed, the Siemens ‘open hearth’ furnaces were slower than the Bessemer converter but gave better control. “Electric arc’ furnaces were introduced later.

Two metals, manganese and chromium, discovered in 1774, were to play an important role in steel manufacture. Small quantities of manganese in steel adds greatly to its strength. Chromium is used in the manufacture of stainless steel.

Завдання:

Task 1. Read and translate the text.

Task 2. Answer the following questions.

Begin your answers with: as far as I know (наскільки мені відомо); in my opinion/ to my mind (на мою думку); I think (я думаю); if I'm not mistaken (якщо я не помиляюся); as for me (щодо мене).

1. What is the name of the iron that comes from a blast furnace?
2. What is the name of the device invented by Henry Bessemer?
3. What was the main idea behind Bessemer's invention?
4. What happened during the first experiment with the Bessemer converter?
5. How long did it take to purify several tons of pig-iron using the Bessemer process?
6. What is the name of the slower but more controlled method of steel production?
7. What two metals played a significant role in steel manufacturing?
8. How does manganese affect the properties of steel?
9. What is chromium used for in steel production?
10. What was the significance of Henry Bessemer's invention for the Industrial Revolution?

Task 3. Choose the right answer:

1. The . . . of steel at Roberts bridge began in 1565.
   a) production b) output c) manufacture
2. The importance of Bessemer’s discovery was that . . . pig iron was transformed into steel within some thirty minutes.
   a) molten b) liquid c) hard
3. In the end of the 18th century . . . of metals improved greatly with the help of new methods.
   a) quantity b) quality c) number
4. One of the properties of metals is their specific . . .
   a) shining b) luster c) glitter
5. All metals except mercury are . . . substances.

a) hard b) tough c) heavy

6. Converters can . . . several tons of pig iron in a short period of time.
   a) clean b) clear c) purify
7. Impurities must be removed before pig iron can be . . . into steel.
   a) converted b) transformed c) made
8. Chromium was . . . in 1774.
   a) opened b) found c) discovered

Task 4. Translate into English.

Чавун; містити домішки; видаляти домішки; перетворювати в сталь; потреба в сталі; інженер-будівельник; випалити; запатентувати; шлак; доменна піч; модернізація існуючих методів; марганець; хром; збільшувати міцність; відігравати важливу роль; виробництво сталі; попит на сталь; різні галузі техніки; розплавлений чавун; величезне полум'я; шлак; повітряний клапан; конвертор; вдосконалення попередніх методів; джерело; головна рушійна сила; місце розташування; гострий ріжучий інструмент; перевага; доступ до; майстерність; легована сталь; відмінна характеристика; сталь з низьким вмістом вуглецю; будівельна сталь; нержавіюча сталь; жаростійка сталь; сплав; термічна обробка.

Task 5. Match the word with its definition.

1) Clay 2) Limestone 3) Slag 4) Cast Iron 5) Coke	a) A type of iron characterized by its high carbon content and brittle nature. It is often used in applications where strength and durability are important, such as engine blocks, cookware, and pipes. b) A sedimentary rock composed primarily of calcium carbonate. It is a common building material and is also used in the production of cement, glass, and fertilizer. c) A solid fuel produced from coal. It is used in blast furnaces to smelt iron ore into pig iron. d) A fine-grained, earthy material composed of hydrous aluminum silicates. It is used in the production of ceramics, bricks, and other building materials. e) A by-product of the smelting process that is composed of impurities from the ore and flux. It is often used as a road construction material or as an aggregate in concrete.

TEMA 9. The First Non - Ferrous Metals.

Text: The First Non - Ferrous Metals.

Non-ferrous metals are the metals not composed of or containing iron. As it has been said before, copper was one of the first metals to be used. In its natural form, copper occurs in the ground as copper ore, a mineral. But this ore contains only 0.5 - 1 per cent of the metal. The rest is rock. The world produces 9.6 million tons of copper a year. This means that more than a

thousand million tons of ore have to be removed from the ground and the pure copper extracted.

Most copper is extracted from a compound of iron, sulphur, and copper called sulphide ore. Hot air is blown into a furnace to separate the copper from the iron and sulphur. The iron and sulphur react with the oxygen to form iron oxide and sulphur dioxide, leaving molten copper metal. This copper, known as blister copper, is about 98 per cent pure.

A process called electrolysis is needed to separate the remaining impurities. During this process a slab of blister copper is suspended in a solution of copper sulphate and sulphuric acid, where it acts as a positive electrode (anode). When electricity is passed through the solution, the copper in the anode is dissolved. The pure copper collects at the negative electrode (cathode) and the impurities fall below.

Copper is a good conductor of heat and electricity. We use it to make cooling utensils and all sorts of pipes for carrying hot water, both in homes and in industry. We also use it to make different kinds of electrical devices, such as lightning conductors and the electric coils in motors. Copper does not rust easily, so it lasts a very long time.

Such metals as lead and tin were widely known in Roman times. Lead is a soft malleable, ductile, bluish-white, dense metallic element, extracted chiefly from galena and used in containers and pipes for corrosives, in solder and type metal, bullets, radiation shielding, paints and anti-knock compounds.

Some Roman aqueducts still stand today because they were lined with lead and lead does not rust. Many thousands of tones were used in a single aqueduct. So much lead was used in water-supply systems that eventually the Romans suffered some lead-poisoning.

Tin was the fifth metal discovered by man. It is a malleable, silvery metallic element obtained chiefly from cassiterite. It is used to coat other metals to prevent corrosion, and forms part of numerous alloys such as soft solder, pewter, type metal and bronze. For example, pewter, an alloy of lead and tin, was widely used in Roman times to make cups and dishes.

Завдання:

Task 1. Read and translate the text.

Task 2. Answer the following questions.
Begin your answers with: as far as I know (наскільки мені відомо); in my opinion/ to my mind (на мою думку); I think (я думаю); if I'm not mistaken (якщо я не помиляюся); as for me (щодо мене).

1. What is the main component of copper ore?
2. How much copper is extracted from the ground annually?
3. What is the process of separating copper from iron and sulfur called?
4. What is the purity of blister copper?
5. How is pure copper obtained from blister copper?
6. What are the main properties of copper that make it useful?
7. What are some of the common uses of copper?
8. What is the main source of lead?
9. What are some of the applications of lead?
10. What metal was used to coat other metals to prevent corrosion in Roman times?

Task 3. Translate into English.

Необроблена сталь; об'єднати; підприємство; спад виробництва; приватний сектор; зайнятість (робочої сили); випуск сталі; кінцевий продукт; машинобудування; ливарне виробництво; виробник; очищена мідь; видобуток олова; літакобудування; прогресивні технології; порошкова металургія; кольорові метали; містити залізо; витягувати; залізо і сірка вступають в реакцію з киснем; електроліз; сляб; анод і катод; електрообмотка; блискавковідвід; галенит; припій; гарт; каситерит; запобігання корозії слід передбачити; сплав на олов'яній основі; олово; система водопостачання; іржавіти; акведук.

Task 4. Read and translate the dialogue.

Teacher: So, we've been talking about metals, right? Today, let's focus on non-ferrous metals. Who can tell me what a non-ferrous metal is?
Student 1: A non-ferrous metal is any metal that doesn't contain iron, right?
Teacher: Exactly! Now, can you name a few examples of non-ferrous metals?
Student 2: Copper, aluminum, and gold are some examples.
Teacher: Very good. Let's talk about copper. What's the primary ore of copper?
Student 3: Copper sulfide ore.
Teacher: Correct. How do we extract copper from this ore?
Student 4: We use a process called smelting, where we heat the ore to high temperatures to separate the copper from the impurities.
Teacher: That's right. But what about the impurities that remain in the copper after smelting?
Student 1: We use a process called electrolysis to further purify the copper.

Teacher: Excellent! Now, let's discuss some of the properties and uses of copper. Why is copper widely used in electrical wiring?
Student 2: Because it's a good conductor of electricity.
Teacher: That's correct. What about its use in plumbing?
Student 3: Copper is resistant to corrosion, so it's durable and long-lasting for plumbing pipes.
Teacher: Great! Now, let's move on to another non-ferrous metal: lead. What were some of the historical uses of lead?
Student 4: The Romans used lead in their water pipes and aqueducts.
Teacher: Right, but why was that a bad idea?
Student 1: Lead can be toxic, and long-term exposure can lead to health problems.
Teacher: Exactly. Lead poisoning was a significant issue in ancient Rome. So, while lead has many useful properties, it's important to handle it carefully.
Teacher: Now, let's talk about tin. What's a common use of tin?
Student 2: Tin is often used to coat other metals to prevent corrosion.
Teacher: That's right. Tin plating is a common technique to protect iron and steel.
Teacher: Well done, everyone. We've covered a lot of ground today. Remember, non-ferrous metals play a crucial role in our daily lives, from the electronics we use to the infrastructure that surrounds us.

Task 5. Choose the correct form of the verb.

1) People (use, use) copper to make cooling utensils and pipes. 2) We (use, uses) copper to make electrical devices. 3) The Romans (used, use) lead to line aqueducts. 4) Many thousands of tons of lead (was, were) used in a single aqueduct. 5) People (use, uses) tin to coat other metals. 6) The Romans (use, used) pewter to make cups and dishes. 7) Hot air (are, is) blown into a furnace to separate copper. 8) Electricity (are, is) passed through a solution to dissolve copper. 9) Copper (is, are) dissolved in a solution of copper sulphate and sulphuric acid. 10) Pure copper (collect, collects) at the negative electrode.

TEMA 10. Ferrous Metals.

Text: Ferrous Metals.

There are two groups of metals: ferrous metals and non-ferrous metals. Both ferrous and non-ferrous metals are known to posses, in some degree, the following properties: elasticity, ductility, malleability, toughness, brittleness, hardness, wear resistance, and corrosion resistance.

Ferrous metals consist of iron combined with carbon, silicon, phosphorous and other elements. Carbon is the most important of all elements present in ferrous alloys. Ferrous metals are now being used in industry in two general forms: steel and cast iron, which differ in the quantity of carbon. These two ferrous alloys are derived from pig iron which is produced in a blast-furnace in the form of pigs.

Steel is iron with a very little carbon content (to 1.7 – 2 per cent) which makes it much stronger than iron and is therefore widely used in machine-building. But very much carbon makes steel brittle, which reduces its strength.

Cast iron contains a higher percentage of carbon (more than 2 per cent). It is cheapest of all the engineering metals. Cast iron is divided into two classes: white cast iron and grey cast iron. When all the carbon in cast iron is in the combined form, the metal has a white metallic appearance. It is therefore called white cast iron. It is difficult to machine it because most of the carbon present is in the chemical combination with the iron. Almost the only commercial use for white cast iron is making malleable iron.

Malleable iron castings are being increasingly used in the manufacture of machinery. Many castings that were made of grey iron are now being made of malleable iron. One of the reasons is that malleable iron is much stronger, particularly in the matter of resisting shock. Malleable iron castings are used in agriculture machinery, railroad equipment, automobile parts, and many other products.

Grey iron can be cast into almost any shape and size. The nature of the metal which used for grey iron castings is such that castings can be made so hard that ordinary tool steel will not cut them or so soft that they can be readily machined. However, in comparison with other casting metals grey iron is weak and will not stand great shock. The alloy of grey castings is composed of iron, carbon, silicon, phosphorous, manganese and sulphur. These elements are used in different proportions depending on the grade of castings.

Завдання:

Task 1. Read and translate the text.

Task 2. Answer the following questions.

Begin your answers with: I believe (suppose, guess); in my opinion/ to my mind; as for me; as far as I know (remember).

1. What are the two main groups of metals?
2. What are some of the common properties of metals?
3. What is the most important element in ferrous alloys?
4. What are the two primary forms of ferrous metals used in industry?
5. What is the main difference between steel and cast iron?
6. What is the effect of high carbon content on steel?
7. What are the two main types of cast iron?
8. Why is white cast iron difficult to machine?
9. What is the main advantage of malleable iron over grey iron?
10. What are some of the limitations of grey iron?

Task 3. Form a phrase. Наприклад: white cast iron

ferrous	combination
non-ferrous	resistance
wear	content
corrosion	metals
carbon	equipment
machine	iron
engineering	metals
white	iron
cast	resistance
chemical	building
malleable	tool
agriculture	castings
railroad	furnace
tool	cast iron
grey	machinery
blast	iron
pig	metals

Task 4. Agree or disagree with the following statements. Begin your sentences with: I agree with you. You are right. It is true. I disagree with you. You are mistaken. You are not right. I don't think so. It is false.

1. Ferrous metals are composed only of iron.
2. Carbon is the most important element in ferrous alloys.
3. Steel is stronger than iron because of its higher carbon content.
4. Cast iron is the cheapest of all engineering metals.
5. White cast iron is easily machinable.
6. Malleable iron is stronger than grey iron.
7. Grey iron can be cast into any shape and size.
8. Grey iron is very strong and can withstand great shock.
9. Both ferrous and non-ferrous metals possess all the listed properties.
10. The properties of metals are not influenced by the elements they contain.

Task 5. Translate into English.

чорні метали, пружність, пластичність, ковкість, міцність, крихкість, твердість, зносостійкість, корозійна стійкість, чавун, чавунні вироби, сірий чавун, білий чавун, залізо, вуглець, ковкий чавун, машинобудування, сільськогосподарська техніка, залізничне обладнання, автомобільні деталі, кремній, фосфор, різні пропорції, сорт лиття, хімічна сполука, інженерні метали, металевий вигляд, оброблятися на верстатах, витримувати великий удар, звичайна інструментальна сталь, слабкий і не витримує великого удару, марганець і сірка, вміст вуглецю, широко використовується.

TEMA 11. Basic Metallurgy of Cast Iron.

Text: Basic Metallurgy of Cast Iron.

Cast iron is one of the oldest ferrous alloys known to man. It is the cheapest of the ferrous metals and must be cast into shape as it does not possess the necessary plasticity to form it into desired shapes by plastic methods when in the solid state.

There are many variations in the structure and physical properties available in so-called “cast iron”. However, we may classify all cast irons into three groups: grey cast iron, white cast iron and malleable cast iron.

Grey cast iron constitutes one of the most valued cast metals. It may be made by melting pig iron and scrap in the cheapest of melting processes, the cupola, and then cast into molds forming intricate shapes that may vary from a few grams to many tons on weight. Many grey cast irons are now cast with the addition of some alloying elements, such as nickel, copper, molybdenum [mɒlˈɪbdənəm], chromium [ˈkrəʊmiəm]. The alloys are used to improve the strength and hardness of the castings.

White cast iron has practically all of its carbon in the combined state as cementite [sementait]. If white cast iron were slowly cooled in the molds it would have a structure of ferrite [ferait] and free carbon in the form of graphite [ˈgræfaɪt] . If cast iron were cooled relatively fast in the molds it would have a structure of martensite [ma:tensait] and cementite [sementait]. This improves hardness and wear resistance of the castings.

Malleable cast iron is made by a process of annealing a hard, brittle white cast iron. A white iron casting is placed in a furnace [ˈfɜːnɪs] and slowly heated to 1550-1600^0 F, which usually requires two days. Then the cast metal is cooled slowly until the heat reaches 1200^{0}F. At this temperature the door of the furnace may be opened and castings removed to cool in air. This treatment changes the hard brittle white cast iron into soft, ductile product called malleable cast iron. This form of cast iron finds many applications.

Завдання:

Task 1. Read and translate the text.

Task 2. Answer the following questions.

Begin your answers with: as far as I know (наскільки мені відомо); in my opinion/ to my mind (на мою думку); I think (я думаю); if I'm not mistaken (якщо я не помиляюся); as for me (щодо мене).

1) What is one of the oldest ferrous alloys known to man?
2) What are the three groups of cast irons?
3) What is important to know about grey cast iron?
4) How may grey cast iron be made?
5) How are many grey cast irons now cast?
6) What improves hardness and wear resistance of the castings?
7) By what process is malleable cast iron made?

Task 3. Translate into English.

чавун, найдешевший з чорних металів, пластичність, сірий чавун, плавити чавун, легуючі елементи, нікель, мідь, білий чавун, графіт, мартенсит, ковкий чавун, відпалювати, піч, м'який, пластичний продукт, різноманітні застосування, складний форми, від кількох грамів до багатьох тонн, покращують міцність і твердість, відносно швидко охолоджується, підвищує твердість і зносостійкість, змінює твердий крихкий білий чавун, звичайна інструментальна сталь, витримувати великий удар, вагранка.

Task 4. Read and translate the dialogue.

Dialogue: A Materials Science Class Discussion

Teacher: Today, we're going to delve deeper into the world of ferrous metals, specifically, cast iron. Can anyone tell me what cast iron is?
Student 1: It's a type of iron alloy, right?
Teacher: Correct. Cast iron is one of the oldest ferrous alloys known to humans. Why is it called "cast" iron?
Student 2: Because it's primarily shaped through casting, rather than being forged or machined.
Teacher: Exactly. Now, can you name the three main types of cast iron?
Student 3: Grey cast iron, white cast iron, and malleable cast iron.
Teacher: Very good. Let's start with grey cast iron. What are some of its properties and applications?
Student 1: Grey cast iron is relatively cheap and easy to cast into complex shapes. It's often used in engine blocks and machine bases.
Teacher: Correct. The graphite in grey cast iron gives it good machinability and vibration damping properties. Now, let's move on to white cast iron. What's unique about its structure?
Student 2: White cast iron has a high carbon content, which exists primarily as cementite. This gives it exceptional hardness and wear resistance.
Teacher: That's right. However, this high hardness also makes it brittle. How can we improve the ductility of white cast iron?
Student 3: By annealing it. This process converts the brittle cementite into a more ductile form of carbon, known as graphite.

Teacher: Exactly. This process results in malleable iron. What are some of the applications of malleable iron?
Student 1: It's often used in automotive components, like brackets and linkages, due to its good strength and ductility.
Teacher: Very well. So, to summarize, cast iron, in its various forms, offers a wide range of properties and applications. By understanding the different types of cast iron and their properties, engineers can select the most suitable material for specific applications.

Task 5. Find as many words as possible.
Наприклад: cast

c	**a**	**s**	**t**	a	t	t	q	w	c
a	l	h	s	t	e	e	l	s	u
s	l	a	m	e	t	a	l	o	p
t	o	p	q	s	o	f	t	l	o
i	y	e	e	i	r	o	n	i	l
n	a	s	c	r	a	p	c	d	a
g	i	d	m	o	l	d	a	t	r
i	p	h	s	n	u	y	r	u	h
c	m	a	l	l	e	a	b	l	e
y	v	r	y	u	p	f	o	g	j
x	i	d	o	o	r	l	n	y	k
z	o	f	u	r	n	a	c	e	u

Task 6. Open the brackets using the appropriate Grammar Tense.
1) Man (to know) cast iron as one of the oldest ferrous alloys. (Present Perfect)
2) We (to make) grey cast iron by melting pig iron and scrap in the cheapest melting process, the cupola. (Present Simple)
3) These alloys (to improve) the strength and hardness of the castings. (Future Simple)
4) This form of cast iron (to find) many applications. (Past Simple)
5) The industry significantly (to advance) in the production of high-performance alloys. (Present Perfect)
6) Before the Industrial Revolution, iron (to be) the primary metal used in construction. (Past Perfect)

TEMA 12. Alloy Steels.

Text: Alloy Steels.

Alloy steels play an important role in all fields of industry. They are produced by the introduction of certain non-ferrous metals into low-carbon steels, notably tungsten, manganese, nickel and chromium.

One of the earliest alloy steels was introduced by R.F.Mushet who by adding tungsten to steel discovered self-hardening steel in 1868. Tools made by this method revolutionized machining processes, and it was also upon Mushet's self-hardening steel that the experiments were based, which led to the production of the high-speed steels, developed later in America.

In 1893 Robert Hadfield made an important step forward in this field by incorporating manganese in steel. This alloy was found to possess remarkable tensile strength, elongation and hardness, and became invaluable for all machinery and plant subject to abrasive action such as railway crossings, dredger buckets and the like.

These types of steel, however, did not provide steel suitable for general constructional purposes, a start in this direction being made by J.Riley of Glasgow, who in 1889 by small additions of nickel to steel markedly increased the strength and toughness without decreasing the ductility. By addition of a further alloying element, chromium, H. Brearley in 1913 founded a class of constructional steels which, in addition to strength and resistance to wear, were also resistant to corrosion.

These alloy steels heralded in the Alloy Steel Age, and so great was their development that at the outbreak of the 1939 war there were no less than 2,000 different specifications dealing solely with alloys having various proportions of nickel, chromium and small additions of other elements. With such developments as jet propulsion, nuclear fusion as a source of power and space technology, the acceleration in alloys is likely to continue.

Завдання:

Task 1. Read and translate the text.

Task 2. Answer the following questions.

Begin your answers with: as far as I know (наскільки мені відомо); in my opinion/ to my mind (на мою думку); I think (я думаю); if I'm not mistaken (якщо я не помиляюся); as for me (щодо мене).

1. What non-ferrous metal is added to steel to create self-hardening steel?
2. Who invented self-hardening steel in 1868?
3. What kinds of tools were revolutionized by the development of self-hardening steel?
4. Which element did Robert Hadfield incorporate into steel in 1893?
5. What properties did steel gain by having manganese added to it?
6. What applications are there for steel containing manganese?
7. Who discovered the method of strengthening steel using nickel?
8. How does adding nickel affect the properties of steel?
9. In addition to chromium, what other element contributes to corrosion resistance in steel?
10. When did the "Alloy Steel Age" begin?

Task 3. Agree or disagree with the following statements.

Begin your sentences with: I agree with you. You are right. It is true.

I disagree with you. You are mistaken. You are not right. I don't think so. It is false.

1. Alloy steels are primarily made from high-carbon steel.
2. Tungsten is one of the elements commonly added to steel to create alloys.
3. R.F. Mushet's discovery of self-hardening steel revolutionized machining processes.
4. High-speed steels were developed in Europe.
5. Robert Hadfield's manganese steel was particularly useful for applications involving abrasion.
6. Early alloy steels were well-suited for general construction purposes.
7. J. Riley's addition of nickel to steel improved its strength and toughness without sacrificing ductility.
8. H. Brearley's chromium-nickel steel was resistant to both wear and corrosion.
9. The development of alloy steels accelerated rapidly in the early 20th century.
10. The demand for alloy steels is expected to decline in the future.

Task 4. Translate into English.

леговані сталі, відіграють важливу роль, галузі промисловості, кольорові метали, низьковуглецеві сталі, марганець, нікель і хром, одна з найраніших легованих сталей, додавати вольфрам до сталі, процеси механічної обробки, самозагартовуюча сталь, виробництво, високошвидкісні сталі.

Task 5. Fill in blanks with the necessary words.

1. There are carbon … and alloy steels. Low-carbon steels are tough, yet easy to…. High-carbon steels are hard and…., but can be given …cutting edges. Alloy steels contain a range of…, each giving the steel a special…. Chromium, nickel, and steel make …steel, which is …and does not ….

property, steels, stainless, sharp, shape, hard-wearing, rust, brittle, metals.

2. Steel can be … in a variety of ways. Rolling … and squeezes … of steel into…, tubes, or strips. In…, rolled steel is pulled through …to make a wire. In…, it is left to cool in a…. Forged …is made by squeezing hot steel.

steel, casting, a hole, drawing, shaped, sheets, ingots, stretches, mould.

3. Most … is converted into …in a basic oxygen furnace. A mixture of iron and …is poured into the…, and a jet of …is blown over it. Oxygen combines with the … in the iron, …it away as carbon monoxide. It takes a … oxygen furnace just 40 … to produce 350 tons of….

carbon, iron, minutes, oxygen, steel, carrying, basic, furnace, steel, steel scrap.

4. The … of molten steel are poured into … to make…, or a reservoir that serves a continuous …process. Most steel is … cast because it is … and better quality. These blocks of…, called billets, can then be … by rolling, … or casting.

casting, ladles, steel, continuously, forging, moulds, cheaper, shaped, ingots.

Task 6. Open the brackets using the appropriate Grammar Tense.

1) There (to be) carbon steels and alloy steels. (Present Simple)
2) Alloy steels still (to contain) a range of metals, each giving the steel a special property. (Present Simple)
3) Engineers (to experiment) with different alloying elements to enhance steel performance. (Past Continuous)
4) The steel industry rapidly (to expand) during the late 19th century. (Past Continuous)
5) Scientists (to develop) numerous alloy steels with specialized properties. (Present Perfect)
6) By the 19th century, steel (to become) the dominant material in many industries. (Past Perfect)
7) Engineers thought that the new alloying elements (to improve) the mechanical properties of cast iron. (Future in the Past)
8) The foundry workers knew that the next batch of castings (to require) more precise temperature control. (Future in the Past)

ПЕРЕЛІК РЕКОМЕНДОВАНИХ ДЖЕРЕЛ

1) Glendinning E. H., McEvan J. Basic English for science and technology. Oxford University press, 2003.

2) Kononenko E. P., Meleshko V. I. English for Metallurgical Students. Київ : Вища школа, 1984. 176 с.

3) White L. Engineering. Workshop. Oxford University press, 2003.

4) Wood N. Metals. Workshop. Oxford University press, 2003.

5) Raghavan V. Physical Metallurgy: Principles and Practice. 3rd ed. PHI Learning, 2015. 260 p.

6) Лисенко М. М. Посібник з англійської мови для металургів. Нікополь: НЦПО, 2020. 56 с.

7) Нікітіна І. П., Кирпита Т. В., Бояркін В. В. English for Metal Forming Engineering : навч. посіб. Дніпро : НМетАУ, 2019. 43 с.

8) Верба Г. В. Довідник з граматики англійської мови. Київ : Освіта, 2010.

9) Воробйова Г. В. Ділова англійська мова. Київ : Центр учбової літератури, 2012.

10) Зінов'єва Л. О. Усі фрази та діалоги англійської мови. Харків : Торсінг плюс, 2016. 352с.

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