UNIT 7
ENGINEERING MATERIALS

STEP 1

TEXT A. KINDS OF ENGINEERING MATERIALS

PRE-TEXT EXERCISES

I. Translate the following international words:

engineer, materias, proportion, element.

II. Translate the following pairs of words:

to stand – стояти	*to prove* – мати докази	*to go* – йти
to withstand – витримувати	*to improve* – покращити	*to undergo* – зазнавати
to understand – розуміти		

III. Read and memorize:

1. **ferrous** – що містить у собі двовалентне залізо
2. **alloy** – сплав
3. **mixture** – суміш
4. **carbon** – хім. вуглець
5. **steel** – сталь
6. **tungsten** – хім. вольфрам
7. **copper** – мідь
8. **brass** – жовта мідь, латунь

9. **shape** – надавати або приймати форму

10. **withstand** – витримувати

IV. Read and translate the text:

KINDS OF ENGINEERING MATERIALS

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

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

TEXT-BASED ASSINGMENTS

LEXICAL EXERCISES

I. Choose the right translation of Ukrainian words:

1. властивості	a) properties	b) districts	c) kinds
2. використовувати	a) to clear	b) to link	c) to use
3. чавун	a) cast iron	b) grey iron	c) ferrous materials
4. суміш	a) admission	b) mixture	c) discovery
5. доповнювати	a) to exist	b) to add	c) to apply
6. сплав	a) alloy	b) quality	c) facility
7. тиск	a) admission	b) branch	c) pressure

II. Match words in A with words in B to make word combinations:

A	B
1. economical	a) iron and carbon
2. ferrous	b) corrosion
3. mixtures of	c) proportion
4. smaller	d) changes
5. to resist	e) high temperature

6. to undergo	f) material
7. to withdraw	g) metals

III. Find antonyms:

A	B
1. to understand	a) larger
2. ferrous	b) to make worse
3. smaller	c) to decrease
4. to improve	d) different
5. to increase	e) non-ferrous
6. common	f) seldom
7. often	g) to misunderstand

IV. Write down the chemical elements from the text, translate them and fill in the table:

English	Ukrainian	Symbol
Aluminium		
Ccarbon		
Chromium		
Copper		
Ferrum (iron)		
Tungsten		

V. Find out contextual equivalents:

знати якості матеріалів; матеріали, які мають у своєму складі залізо; суміш заліза та вуглецю; збільшити твердість сплаву; класифікувати на 2 види; надати опір корозії; зазнати хімічних змін.

VI. Complete the following sentences:

1. Metals are divided into … . 2. The two most important ferrous metals are … . 3. Steel contains … . 4. Chromium may be included … . 5. Common non-ferrous metals are … . 6. Non-metals are … . 7. Ceramics are often employed … .

VII. Correct the statements if necessary using the following phrases: *No, you are wrong, Your statement is not correct, I disagree with you, I do not share your point of view:*

1. Materials are divided into metals, semi-metals and non-metals. 2. There are two kinds of metals: ferrous and non-ferrous. 3. Cast iron and steel are alloys. 4. Steel contains higher proportion of carbon than cast iron. 5. Aluminium and copper are ferrous metals.

VIII. Translate the following sentences into English:

1. Інженери повинні знати, які матеріали необхідно використовувати. 2. Існують два види матеріалів, що використовуються в техніці – метали та не метали. 3. Метали поділяються на ті, що мають у складі залізо, та на такі, що не мають. 4. Чавун та сталь є найбільш важливими матеріалами, які мають у складі залізо. 5. До матеріалів, які не мають у складі заліза, належать алюміній та мідь.

GRAMMAR EXERCISES
(Grammar Revision: Пасивний Стан)

IX. Fill in the table according to the model:

to make to know to work to understand to divide to undergo to change to employ to need	to be made	is made	was made	will be made

X. Define the voice in brackets:

1. A plastic sheet is sandwiched between two steel sheets (Active/Passive). 2. Steam, gas and oil engines were known and used prior to the invention of the diesel engine (Active/Passive). 3. Leakage of gasoline was involving hazards (Active/Passive). 4. The first steam engine to do useful work was patented in England (Active/Passive). 5. The diaphragm was alternately creating pressure and vacuum (Active/Passive).

XI. Change the following sentences into the Passive Voice:

1. Engineers cut the overall length and height of Volga by 75mm and 130mm respectively. 2. We classify plastics into two types. 3. He was checking the fuel system at 5 o'clock on Thursday. 4. Engineers often employ ceramics. 5. Etienne Lenoir built the first practical internal combustion engine.

XII. Define the tense-form of the italicized verbs:

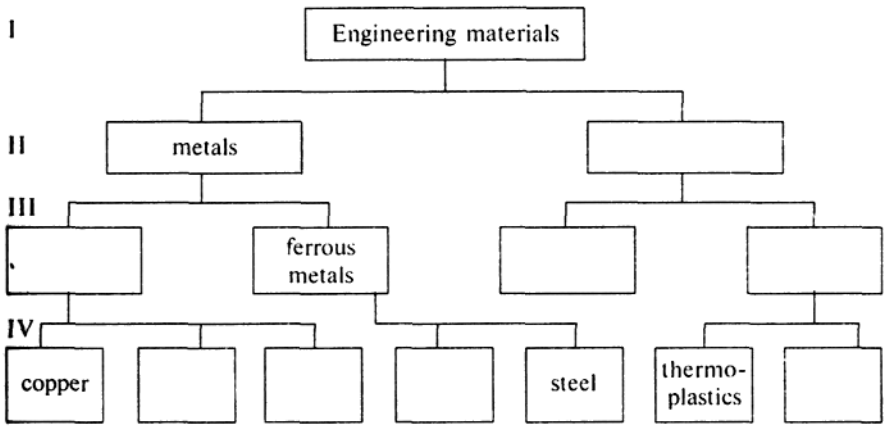
1. Metals *are distinguished* from non-metals by their high conductivity for heat and electricity. 2. Our era has sometimes *been named* the age of electricity and automobiles. 3. The most modern principles of production *had been used* in the design of this plant. 4. Engines *are* also *being built* to operate on a two-stroke cycle. 5. The dependable IC engine *will* eventually *be overtaken* by a clean alternative power system.

XIII. Replace the infinitive in brackets by the required tense and voice:

1. Plastics (to machine) like metals. 2. A car called the Silver Ghost (to build) by Rolls-Royce in 1907. 3. Henry Royce (to decide) to design the most comfortable and reliable car. 4. A diesel engine produces power by burning oil in a body of air which (to squeeze) to a high pressure. 5. The world's automakers seem to believe that the high efficiency fuel cell (to deliver) the power that drivers expect.

CONVERSATIONAL PRACTICE

XIV. Fill in the table and comment on it:



XV. Motivate the following statements:

1. Certain elements can improve the properties of other elements while being added.
2. Thermosets cannot be reshaped.
3. Ceramics are often employed by engineers.

XVI. Comment on the role of engineering materials for the automotive industry.

WRITTEN PRACTICE

XVII. Write down properties of engineering materials you know. Compare your list with that of your friend. Who's got the longest?

XVIII. You are to deliver a short introductory lecture on "Materials for the Automotive Industry". Use the following expressions:

to begin with, here I try to describe, let's proceed to, the next to be mentioned is, to sum it up.

TEXT B. MATERIALS A CAR IS MADE OF

A car is made of different materials.

The windscreen, for example, is made of glass. The headlights are also made of glass.

The tyres are made of rubber. They are filled with air. The air in the tyres is compressed (to approximately 1.5 gm/cm^3).

The body is made of metal. The metal is painted.

The steering wheel is made of plastic.

The mirrors are made of plastic and glass. This car has two mirrors. The rear-view mirrors is fixed to the roof. The wing mirror is fixed to the door.

The engine is made of different metals. The pistons are made of aluminium and valves are made of steel. The springs are also made of steel.

EXERCISES

I. Write down all engineering materials mentioned in the text and translate them consulting the dictionary.

II. Name the components and units of the automobile mentioned in the text and give their Ukrainian equivalents.

III. Find in the text the words and word combinations suitable for the description of the car given below (Fig.27):

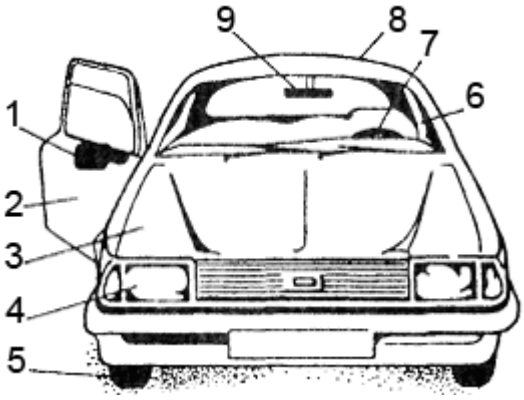


Fig.27. Front view of the car

IV. Name the car's components and engineering materials they are made of (Fig.28):

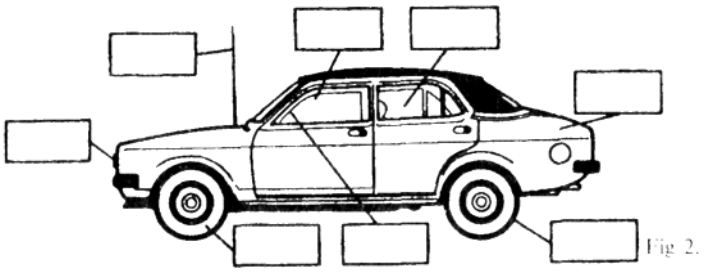


Fig.28. Side view of the car

V. Match the following words to describe the motorcycle (Fig.29):

A: glass, rubber, aluminium and glass, plastic, aluminium and steel, aluminium (painted), leather, vinyl.

B: a headlight, handlebars, tyres, a fuel tank, a saddle, a gearbox.

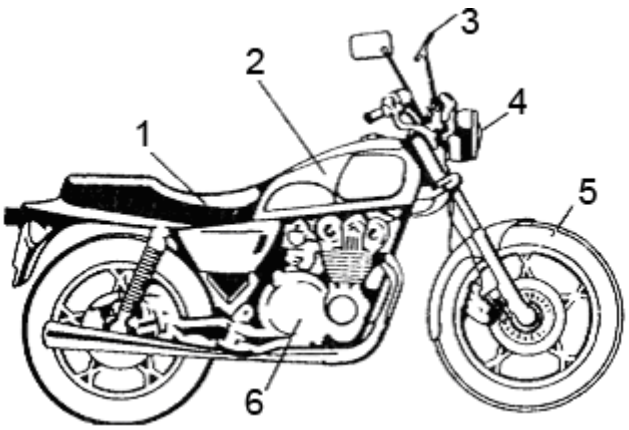


Fig. 29. A Motorcycle

STEP 2

TEXT A. METALS FOR MOTORING

PRE-TEXT EXERCISES

I. Translate international words:
metal, material, motor, symbol, complex, deformation, elasticity, specially, control, electrical, component, aluminium, structure, corrosion.

II. Read and memorize the following words:
1. **bulk –** 1. маса, 2. більша частина чогось
2. **mold –** форма
3. **sulphur –** 1. хім. сірка, 2. зеленувато-жовтий колір
4. **phosphorous –** хім. фосфор
5. **starfish –** зоол. морська зірка
6. **pearlite** – метал. перліт
7. **arsenic –** хім. миш'як
8. **antimony –** хім. сурма
9. **impurity –** домішка, забруднення
10. **hydroxide –** хім. гідрооксид

III. Read and remember the following word combinations: *different shapes and sizes* – різні за формою та розміром, *an in-depth look at* – поглиблений погляд на…, *to be unsuitable for anything* – не підходити ні для чого, *due to* – завдяки.

IV. Read and translate the text:

METALS FOR MOTORING

The parts of your car come in all kinds of different shapes and sizes and, what is equally important, in wide variety of different materials. Let us have a in-depth look at car materials.

Iron. Obviously the bulk of a motor car is made from metals based on iron. Iron is an element that has a chemical symbol Fe and is the father of the ferrous family. It is obtained by filling a blast furnace with iron.

Cast iron. Ordinary cast iron is produced by melting pig iron and pouring it into molds, made of sand, to get it to set into complex shapes. It is a cheap material that is soft, fairly brittle and unsuitable

for anything that takes a tension or bending load. In compression there is virtually no plastic deformation or elasticity, it just suddenly fractures across a plane at about 55^0. So cast iron is used for castings such as crank-cases, gearboxes and rear axles.

If the pig iron used for casting is especially selected to have smaller amounts of carbon and a low sulfur and phosphorous content and the rate of cooling the casting is controlled to a slow rate, then the structure of the iron part tends to form as pearlite. These cast irons are two or three times as strong in tension as ordinary grey cast iron and have a certain amount of elasticity and less brittleness. They are used for crankshafts as it is much easier to cast a crankshaft shape than to forge it.

Copper. The main constituent of the brass/bronze family is copper, which is obtained by roasting the copper sulphide ores to remove the arsenic and antimony impurities and then smelting the ores in a furnace to produce the molten metal. Copper is soft, ductile and easily worked and is difficult to produce in a really pure state. Plain copper is seldom used for anything but electrical components in cars, due to its low resistance. It is used for pipework because of its ductility, but has been replaced by cheaper and better materials.

Aluminium. Aluminium is produced by electrolytic means from bauxite, an aluminium hydroxide, and makes a good clean casting with a fairly coarse grain structure. It is a fair substitute for cast iron except that is a bit more ductile. On the other hand, it can be rolled or drawn into sheets, rods and tubes that can be bent due to their ductility whereas cast iron cannot. The aluminium alloys with copper, manganese, silicon and nickel are pretty numerous and are selected either for their corrosion resistance, high electrical conductivity, ductility and/or higher strength.

TEXT-BASED ASSIGNMENTS

LEXICAL EXERCISES

I. Write down chemical elements mentioned in the text, give their symbols and translate.

II. Give synonyms:
different, a motor car, to produce, to control, a constituent.

III. Make words in A with words in B to make word combinations:

A	B
1. car	a) iron
2. chemical	b) deformation
3. ferrous	c) cooling
4. pig	d) shapes
5. bending	e) metal
6. plastic	f) family
7. rate of	g) state
8. starfish	h) load
9. molten	j) materials
10. pure	i) symbol

IV. Make up your own word combinations with the following words:
iron, cast iron, copper, aluminium.

V. Translate the following word combinations with the key words:
– "material": a wide variety of different materials, car materials, a cheap material, better materials;
– "**iron**": based on iron, a blast furnace with iron, cast iron, pig iron, the structure of the iron, the iron part, ordinary grey cast iron, to be fair substitute for cast iron.

VI. Complete the following sentences:

1. The father of the ferrous family is … . 2. Cast iron is produced by … . 3. Cast iron is used for … . 4. The graphite can be made from … . 5. The main element of the brass/bronze family is … . 6. Plain copper is used for … . 7. Aluminium is produced by … .

VII. Answer the questions:

1. What is the bulk of a motor car made from?
2. How is iron obtained?
3. Where is cast iron used?
4. Is copper a main constituent of the brass/bronze family?
5. Where is plain copper produced?
6. What are the aluminium alloys?

VIII. Correct statements if necessary:

1. The bulk of a motor car is made from copper. 2. The chemical symbol of iron is Fe. 3. Cast iron is not used for castings. 4. The main constituent of the brass/bronze family is aluminium. 5. Plain copper is used for the pipework. 6. The aluminium alloys are not numerous. 7. The aluminium alloys are selected for their corrosion resistance and high electrical conductivity.

IX. Fill in the table summarizing the information of the text:

Materials	**Properties**	**Usage**
Aluminium		
Cast iron		
Copper		
Grey cast iron		
Pig iron		

GRAMMAR EXERCISES

(Grammar Revision: Дієслова в активному та пасивному стані)

X. State whether the italicized verbs are notional or auxiliary:

1. The bulk of a motor car *is* made from metals based on iron. 2. Iron *is* an element that has a chemical symbol Fe. 3. This cast iron *is* two or three times as strong in tension as ordinary grey cast iron. 4. The majority of metals *are* used in industry. 5. Ordinary cast iron *is* produced by melting pig iron and pouring it into molds. 6. Copper *is* difficult to produce in a really pure state.

XI. Correct mistakes if necessary:

1. Mankind have used metals for centuries. 2. Ordinary cast iron is produced by melting pig iron and pouring it into molds. 3. These properties was similar to each other but not the same. 4. All parts and units were made from iron and steel. 5. Copper are easily worked.

XII. Define the voice of the italicized verbs:

1. Now metals *are employed* in great quantities. 2. It *was* not until 1808 that Sir Humphrey Davy *established* the existence of aluminium. 3. Pure iron *has* never *been prepared* except for laboratory purposes. 4. According to the Aluminium Association between 1991 and 1999 the use of automotive aluminium *doubled* and *is expected* to double by 2005. 5. The parts of your car *come* in all kinds of different shapes and sizes.

XIII. Open the brackets. Use the Passive Voice:

1. Cast iron (to use) for castings. 2. Aluminium (to produce) commercially only since 1854. 3. The electrolytic process (to invent) separately but simultaneously by Paul Louis Toussaint Heroult and

Charles Martin Hall. 4. Aluminium (to produce) by electrolytic means from bauxite. 5. The use of plastic and aluminium for structural and non-structural components (to study).

XIV. Change the following sentences from Active to Passive:

1. The scientists are considering the use of graphite-fiber reinforced components, though technical problems exist. 2. We use plain copper for pipework because of its difficulty. 3. Titanium springs do not require protective coatings. 4. It took another 17 years for Hans Christian Oersted to isolate aluminium. 5. Today we know more than seventy metals.

CONVERSATIONAL PRACTICE

XV. Read and dramatize the following dialogue:

1 Student: Where have you been? I haven't seen you for ages!
2 Student: I was ill and missed some classes.
1 Student: What can I do for you?
2 Student: Can you tell me about metals for motoring?
1 Student: What exactly are you interested in?
2 Student: Car materials. What are they?
1 Student: Well, the bulk of a motor car is made from metals based on the iron. It is obtained by filling a blast furnace with iron.
2 Student: And what about cast iron?
1 Student: Ordinary cast iron is produced by melting pig iron and pouring it into molds. It is a cheap material.
2 Student: I know copper is soft, ductile and easily worked but is difficult to produce in a really pure state.
1 Student: You're right. It's used for the pipework because of its ductility, but has been replaced by cheaper and better materials.
2 Student: Aluminium is very popular now. What are the main characteristics of it?
1 Student: You see, it is a fair substitute for cast iron except that it is a bit more ductile. The aluminium alloys are selected for their corrosion resistamce, high electrical conductivity and higher strength.
2 Student: Thank you very much. You've given me so much information.
1 Student: It's a pleasure.

XVI. Comment on the following statements:

1. Cast iron is a soft material.
2. Plain copper is used for electrical components in cars.
3. The aluminium alloys with other elements are numerous and widely used.

XVII. Describe the scheme (Fig.30) below:

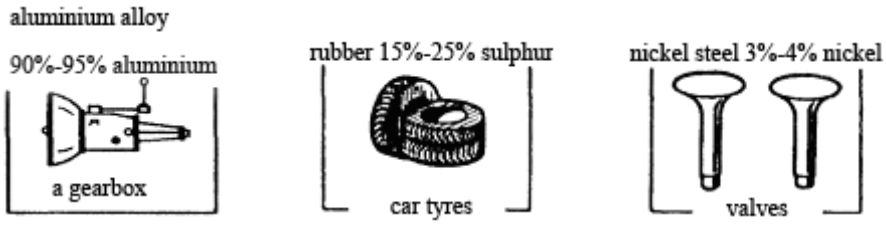


Fig.30. Engineering materials of the gearbox, car tyres and valves

XVIII. Discuss the properties which engineering materials for the automotive industry should possess.

XIX. Look through the text again and formulate the problems to discuss.

WRITTEN PRACTICE

XX. Your friend is writing a course project on engineering materials for motoring. Give your friend a piece of advice on where he/she can find information for his/her project (e.g.) library, reading-hall, scientific articles, Internet). The following formulas may help you: *It's worth (It's not worth), There is no use in…, I have no idea, I am not sure, I assume, I suppose.*

TEXT B. METALS

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

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

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.

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

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.

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

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

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.

EXERCISES

I. Give the main idea of the text and its key words.

II. Divide the text into logical parts and entitle them.

III. Ask your friends questions on the text.

IV. Prove that metals play a very important role in our life.

V. Speak about the mechanical properties of metals.

VI. Give your arguments for and against using metals.

VII. What industries are in need of metals? Motivate your answer.

STEP 3

TEXT. A THE AUTOMOBILE AND NEW STEEL PRODUCTS

PRE-TEXT EXERCISES

I. Translate international words:
automobile, product, industry, material, manufacturers, specific, panel, to combine, vibration, plastics.

II. Read and memorize the following words:

1. **comply –** 1. підкорятися, підпорядковувати(ся) 2. виконувати
2. **sheet –** 1. пласт 2. лист 3. таблиця
3. **strength –** 1. міцність, опір (металу) 2. сила
4. **pebble –** 1. каміння 2. галька
5. **bendability –** 1. гнучкість 2. вигин
6. **-yield** – 1. видобуток 2. доход(ність), відсотковий 3. корисна робота
7. **ductility –** 1. пластичність 2. ковкість
8. **bake –** 1. висушувати 2. випалювати (цеглу) 3. випікати
9. **tensile –** міцність на розрив; той, що розтягується
10. **cover –** кожух

III. Read and translate the text:

THE AUTOMOBILE AND NEW STEEL PRODUCTS

Raising fuel efficiency and complying with legal regulations related to safety and durability are pressing issues in the automotive industry. Steelmakers must supply materials that help to meet these goals while reducing users' cost as well.

Lightweight Steel Sheets. *Formable High-Strength Steel Sheets*. These sheets, used for the outer panels of automobiles, offer both high strength and good workability – properties which until now were difficult to combine in a single product. They can be thin due to their high strength, and their thinness saves weight. The new sheets resist denting by flying pebbles and are stiff enough to prevent noise and vibration when the vehicle is running. They are now available in several types: sheets for general forming, with good bendability; low-yield ratio sheets with high ductility; sheets for deep drawing, with high Lankford value; and sheets of bake-hardening type for deep drawing, their strength rising when paint-baked. These products are offered in a range of tensile strength from 35 to 100 kgf/mm^2. Coated and one-side coated high-strength steel sheets are also on the market.

Lightweight Steel Sheets. *Plastic-Sandwiching Steel Sheets*. In this product, a plastic sheet is sandwiched between two steel sheets. A type recently supplied to one automobile maker, consisting of a 0.6-mm plastic sheet between two 0.2-mm steel sheets, is only half the weight of the usual 1-mm steel sheet and yet has the same rigidity. It is used for trunk-lid panels and air-cleaner covers.

TEXT-BASED ASSIGNMENTS

LEXICAL EXERCISES

I. Derive from verbs of the following nouns:
regulation, makers, users, manufacturers.

II. Give initial words:
durability, workability, bendability, ductility, rigidity.

III. Find synonyms:

A	B
1. automotive industry	a) manufacturers
2. makers	b) to offer
3. cost	c) properties
4. to suggest	d) a car
5. features	e) automobile industry
6. a vehicle	f) to work
7. to run on	g) price

IV. Translate word combinations with the key words:

− **"steel":** new steel products, lightweight steel sheets

− **"sheet":** sheets for general forming, sheets for deep drawing, high-strength steel sheets, a plastic sheet, two steel sheets.

V. Find in the text sentences with the following word combinations and translate them:

low-yield ratio sheets, bake-hardening type, to be paint-baked, one-sided coated high-strength steel sheets, trunk-lid panels, air-cleaner covers.

VI. Complete the following sentences:

1. Steel-makers must supply … . 2. These sheets, used for the outer panels of automobiles … . 3. The new sheets resist … . 4. Steel sheets are available … . 5. A range of tensile strength of these products is … .

VII. Supply definitions for the following:

1. The automotive industry is dealt with …
2. Steelmakers are the people who…
3. Automobile manufacturers are engaged in …

VII. Answer the questions:

1. What are pressing issues in the automotive industry?
2. What are new steel products?
3. What properties do formable high-strength steel sheets possess?
4. What types of formable high-strength steel sheets do you know?
5. What is a plastic-sandwiching steel sheet?

GRAMMAR EXERCISES

(Grammar Revision: Безособові форми дієслова)

VIII. Read and translate the following sentences, paying attention to the non-finite forms of the verb:

1. Steelmakers must supply materials that help to meet these goals while reducing users' cost as well. 2. Strength and hardness can be greatly improved by alloying them with other materials. 3. Metals can undergo corrosion, changing in this case their chemical and electromechanical properties. 4. These sheets used for the outer panels of automobiles offer both high strength and good workability. 5. The first production cars to ride on titanium springs are now on the road.

IX. State if the italicized word is a Gerund, an Infinitive, Participle I or Participle II:

1. The new sheets are stiff enough *to prevent* noise and vibration. 2. In order *to protect* metals from corrosion the products *made* of metals and steel are *coated* by some films. 3. Organic coatings protect metals from corrosion by *forming* a corrosion-resistant barrier between metal and the corrosive environment. 4. A type recently *supplied* to one automobile maker, *consisting* of a 0.6-mm plastic

sheet, is only half the weight of the usual 1-mm still sheet. 5. An *added* advantage of titanium is its inherent corrosion resistance.

X. State whether the ing-form is a Gerund or a Participle:

1. The new sheets resist denting. 2. Building lighter, smaller, more fuel-efficient cars percentage of corrosion tolerance reduced. 3. Dips, sprays and different coatings are among the methods for preventing contact between hostile environmental elements and metal. 4. Various titanium alloys are suitable for making spring and exhaust system components. 5. It is a cheap material that is soft and unsuitable for anything that takes a tension or bending load.

CONVERSATIONAL PRACTICE

XI. Comment on the table below:

Changes in automotive industry's environment	New requirements for steel by automotive industry	Steels which meet automotive industry's requirements
Fuel efficiency	Weight reduction, lighter gauge of steel	High-strength sheets with good formability (dual-phase steel)
Durability	Corrosion resistance	Coated sheets (one-side galvanized sheets)
Exhaust gas restriction	Heat resistance	Heat resistant stainless sheets, aluminized sheets
Noise restriction	Noise reduction	Vibration-damping sheets
Safety requirements	Rigid structure	High-strength low alloy steel

XII. Give your arguments for or against the following statements:

1. Formable high-strength steel sheets offer both high strength and good workability.
2. Formable high-strength steel sheets are available in several types.
3. A plastic-sandwiching steel sheet is a plastic sheet sandwiched between two steel sheets.

XIII. Speak on the following topics:

− pressing issues in the automotive industry
− formable high-strength steel sheets
− plastic-sandwiching steel sheets

XIV. Can you predict the next-generation engineering materials? Motivate your answer.

XV. Read the text and comment on the information given in the text:

Stainless steel has become the buzzword in the pump industry all over the world. C. R. I.'s matchless range of stainless steel pumps and motors are constructed not just for the present but to meet the future standards too. All the vital components of the pumps are made of 304/316 grade stainless steel to ensure longevity, strength and above all, better performance. These pumps are extremely energy-efficient, capable of performing consistently even in the toughest conditions. It has ISO 9001 quality systems.

WRITTEN PRACTICE

XVI. Prepare a report on innovation trends in engineering materials for the automotive industry.

TEXT B. METALS AND NONMETALS

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

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

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.

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

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

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.

EXERCISES

I. Give the main idea of the text.

II. Write down terms and translate them consulting the dictionary.

III. Fill in the table according to the information given in the text:

Metals	Symbol	Ukrainian equivalent	Use in industry

IV. Comprehension questions:

1. How are metals distinguished from nonmetals?
2. What are the common metals?
3. What are the so-called precious metals?
4. Why elements are classified as semimetals?
5. Do nonmetals show greater variety of chemical properties than common metals?

V. Find in the text examples of metals and alloys. What do they differ in?

VI. Name fields where metals and nonmetals are applied.

VII. Give your arguments for metals and nonmetals in industry.

VIII. Speak about disadvantages of metals and nonmetals.

IX. Comment on the following scheme:

metals----------semimetals----------nonmetals

REVISION

I. Look through the following list of words and define nonmetals:

iron, steel, carbon, aluminium, oxygen, tungsten, chromium, hydrogen, copper.

II. Find a suitable word or word combination in the box for the words in brackets:

a really pure state, to be familiar with, in many respects, because of, to be cheaper, standard of living, are due to, was considered, for centuries, to be easily shaped

1. These metals are (у багатьох відношеннях) better than those ones. 2. That metal (вважався) too soft to be of any practical value. 3. We believe ferrous metals (дешевше) than non-ferrous ones. 4. Man has used metals (на протязі багатьох століть) in gradually increasing quantities. 5. Metals can (легко надати форму). 6. Steel has long been used in great quantities (завдяки) its certain properties. 7. Copper is difficult to produce in (дійсно чистому стані). 8. These properties of a metal (обумовлені) its atomic structure. 9. Man has always tried to improve his (рівень життя). 10. It is important that an engineer should (знати) the processes of metal treatment.

III. Choose synonyms for the italicized words:

1. There are two *kinds* of materials used in engineering.	a) element
2. Steel *contains* a smaller proportion of carbon than cast iron.	b) up-to-date
3. *A motor car* is made from metals based on iron.	c) types
4. The main *constituent* of the brass/bronze family is copper.	d) suggest
5. Steelmakers must supply materials which meet *modern* requirements.	e) thanks to
6. Formable high-strength steel sheets *offer* strength and good workability.	f) an automobile
7. Sheets can be thin *due to* their high strength.	g) has

IV. Find the correct answer:

1. What are pressing issues in the automotive industry?

a) car's design

b) raising fuel efficiency, safety and durability

2. What alloys are selected for their corrosion resistance?

a) the iron alloys

b) the aluminium alloys with copper, silicon and nickel

3. What is the bulk of a motor car made from?

a) iron

b) the aluminium alloys

4. What metals and alloys are non-ferrous ones?

a) aluminium, copper, bronze, brass

b) cast iron and steel

5. What materials are non-metals?

a) manganese, tin, cobalt

b) plastics and ceramics

V. Choose the suitable question:

1. We can divide metals into ferrous and non-ferrous.

a) Where can we divide metals into ferrous and non-ferrous?

b) Why can we divide metals into ferrous and non-ferrous?

c) What can we divide into ferrous and non-ferrous?

2. Cast iron and steel are the most important ferrous metals.

a) Are cast iron and steel semimetals?

b) What metals are the most important ferrous ones?

c) Why are cast iron and steel the most important ferrous metals?

3. Copper is soft, ductile and easily worked.

a) Is copper the main constituent of the brass family?

b) What properties has copper?

c) What is copper?

4. The aluminium alloys with copper, manganese, silicon and nickel are numerous.

a) What aluminium alloys are numerous?

b) Why aluminium alloys are numerous?

c) What are the aluminium alloys?

5. The new sheets resist denting by flying pebbles.

a) Do the new sheets resist winds?

b) How do the new sheets resist denting by flying pebbles?

c) What resists denting by flying pebbles?

VII. Fill in the table:

Texts	**Noun-terms**	**Verb-terms**
Kinds of Engineering Materials		
Metals for Motoring		
Automobiles and New Steel Products		

VIII. Read the text below and decide which answer (A, B, C or D) fits each space best. Circle the answer.

We use metals [1]_____ a variety of engineering purposes. [2]____ metals have ductile properties. [3]_____ a metal is ductile, it can [4]____ [5]____ a new shape. Copper is an example of this. [6]_____ is a ductile metal [7]_____ it [8]____ be stretched into [9]_____ shape. Lead can [10]_____ into a new shape. Copper is good [11]____ of electricity. We often use [12]_____ for [13]_____ conductors. [14]_____ lead [15]____ be used for electrical cables [16]_____ it [17]_____ corrosion. Cast iron is [18]_____ copper and lead. [19]____ shape cannot be altered and it [20]_____ to resist corrosion.

1.	A	for	B	of	C	in	D	on
2.	A	any	B	some	C	other	D	another
3.	A	when	B	why	C	if	D	because
4	A	to be pressed	B	press	C	be pressing	D	be pressed
5.	A	into	B	to	C	in	D	at
6.	A	it	B	its	C	his	D	that
7.	A	so	B	because	C	therefore	D	because of
8.	A	can	B	could	C	is to	D	have to
9.	A	other	B	another	C	the other	D	any
10.	A	be also pressed	B	to be also pressed	C	be also pressing	D	to be also pressing
11.	A	conducting	B	conductivity	C	conductor	D	to conduct
12.	A	it	B	her	C	him	D	his
13.	A	electricity	B	electrical	C	electrically	D	electrician
14.	A	and	B	but	C	so	D	therefore
15.	A	can	B	could	C	be able	D	is able
16.	A	if	B	because	C	so	D	therefore
17.	A	resist	B	resisted	C	resists	D	have resisted
18.	A	like	B	unlike	C	similar	D	likely
19.	A	its	B	it’s	C	her	D	his
20.	A	is not able	B	will not be able	C	was not be able	D	won’t be able

IX Fill in the gaps using comparative or superlative forms of the adjectives given in brackets:

Steel, copper and aluminium are used in making engineering products. Steel is a grey plastic material. It is [1]____ (heavy) than aluminium but it is [2]_____ (hard) and [3]____ (strong) of these three metals. Copper is a red metal. It is [4]____ (hard) and [5]____ (strong) than aluminium and [6]_____ (flexible) than steel. But copper is [7]_____(heavy) and [8]____ (expensive) metal. [9]____ (light) and [10] _____ (flexible) of these materials is aluminium. It is a white hard metal.

X. Complete the table with the missing words “copper”, “steel”, “aluminium”:

Reliability	Flexibility	Weight	Price
1. Steel	1.	1.	1. Copper
2.	2. Copper	2.	2.
3.	3.	3. Aluminium	3.

XI. Complete the following table with nouns for each property and give examples of engineering materials:

Properties of Materials		Engineering Materials
Adjectives	**Nouns**	
1. Soft	1.	1.
2. Tough	2.	2.
3. Flexible	3.	3.
4. Rigid	4.	4.
5. Plastic	5.	5.
6. Elastic	6.	6.
7. Hard	7.	7.

XII. Fill in the table:

Chemical Element	Symbol	Ukrainian Equivalent

XIII. Express your point of view as to the following statement: “Engineering materials are a fast-changing aspect”.

XIV. Show the progress in the development of engineering materials filling in the table:

Engineering Materials for the Automotive Industry

Past	Present	Future