МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
Донецький національний університет
економіки і торгівлі
ім. М.І. Туган-Барановського

Кафедра іноземних мов

О. М. Бондаревська

ENGLISH FOR ENGINEERING

Навчальний посібник

Кривий Ріг
2017

МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
Донецький національний університет
економіки і торгівлі
ім. М.І. Туган-Барановського

Кафедра іноземних мов

О. М. Бондаревська

ENGLISH FOR ENGINEERING

Навчальний посібник

Галузь знань: 13 «Механічна інженерія»
Спеціальність: 133 «Галузеве машинобудування»
Галузь знань: 14 «Електрична інженерія»
Спеціальність: 144 «Енергетичне машинобудування»
Ступінь: бакалавр

Затверджено на засіданні
кафедри іноземних мов
Протокол № 16
від “16” березня 2017 р.

Схвалено навчально-методичною
радою ДонНУЕТ
Протокол № 7
від “24” березня 2017 р.

Кривий Ріг
2017

УДК 811.111’276.6:33 (075.8)
ББК 81.2 Англ-923
Б 81

Рецензенти:
О.В Малихін, доктор педагогічних наук, професор.
С.Т Толмачов, доктор технічних наук, професор.
О.В Чепурна, кандидат філологічних наук.

Бондаревська, О. М.

Б 81 English for Engineering: навчальний посібник для студ. спец. 133 «Галузеве машинобудування» та спеціальності 142 «Енергетичне машинобудування», ступінь бакалавр / М-во освіти і науки України, Донец. нац. ун-т економіки і торгівлі ім. М. Туган-Барановського, каф. іноземних мов; О. М. Бондаревська. – Кривий Ріг : [ДонНУЕТ], 2017. – 116 с.

Запропонований навчальний посібник сприятиме розвитку лексичних навичок та комунікативній діяльності студентів. Робота містить вправи за темами, які вивчаються на першому та другому етапах вивчення іноземної мови.

Зміст посібника викликає зацікавленість, пов’язану з актуальністю розроблених тем. Завдання складені на основі сучасних вимог з урахуванням розвитку комунікативної компетенції.

Посібник відповідає сучасним методичним вимогам до навчальної літератури.

ББК 81.2 Англ-923

© Бондаревська О. М., 2017
© Донецький національний університет економіки і торгівлі ім. М. Туган-Барановського, 2017

ЗМІСТ / CONTENTS

ВСТУП / INTRODUCTION

«Іноземна мова» є навчальною дисципліною, що забезпечує підготовку студентів ступеня «бакалавр».

Мета курсу - формування необхідної комунікативної спроможності у сферах професійного та ситуативного спілкування в усній і письмовій формах; вдосконалення вмінь та навичок читання, перекладу, реферування спеціальної літератури за фахом; вироблення навичок читання та реферування наукової інформації з фаху, ведення бесіди з професійної тематики, ділового листування та роботи з комерційною документацією.

Завданнями дисципліни «Іноземна мова» є:

- набуття навичок практичного володіння іноземною мовою в різних видах мовленнєвої діяльності в обсязі тематики, зумовленої професійними потребами; одержування новітньої фахової інформації через іноземні джерела**;**
- користування усним монологічним та діалогічним мовленням у межах побутової, суспільно-політичної, загальнотехнічної та фахової тематики;
- переклад з іноземної мови на рідну текстів загальнотехнічного характеру;
- формування основних вмінь використання знань на практиці під час ведення ділової бесіди або спілкування по телефону в ділових цілях з урахуванням конкретних умов;
- ознайомлення з найбільш відомими зразками мовленнєвої поведінки під час проведення ділових зборів, презентацій та переговорів;
- навчання підготовці до участі у наукових конференціях, семінарах, дебатах, тощо;
- ознайомлення з особливостями оформлення найбільш вживаних паперів.

У результаті вивчення навчальної дисципліни студент повинен

знати:

- лексику, граматику, фонетику і орфографію іноземної мови;
- правила усного ділового спілкування;
- основні вимоги до культури мовлення.

вміти:

- конструювати параграфи для організації думок в єдину інтелектуальну структуру;
- читати та перекладами текст з побутової та професійної тематики середньої складності;
- спілкуватися іноземною мовою на побутові, суспільно-політичні та професійні теми в межах вивченої лексики та граматики;
- писати короткі повідомлення та есе іноземною мовою дотримуючись правил орфографії та граматики;

- складати ділові документи на задану тему, дотримуючись міжнародних стандартів;
- одержувати новітню фахову інформацію через новітні джерела.
- грамотно спілкуватися в межах усного мовлення;
- вести презентації згідно вимог ділового мовлення.

Даний посібник має за мету набуття студентами навичок читати та перекладати тексти з побутової та професійної тематики середньої складності, спілкуватися іноземною мовою на побутові, суспільно-політичні та професійні теми в межах вивченої лексики та граматики, писати короткі повідомлення та есе іноземною мовою дотримуючись правил орфографії та граматики.

Посібник складається з восьми тем, передбачених робочою навчальною програмою з дисципліни. Кожен розділ містить вправи на розвиток усіх видів мовленнєвої діяльності: аудіювання, читання, говоріння та писемного мовлення, виконання яких сприяє розвитку комунікативної компетенції студентів першого та другого рівнів вивчення іноземної мови.

PRACTICAL TRAINING SUBJECT MATTER

UNIT 1. ENGINEERING. GENERAL CONCEPTS

1.1 What is engineering?

Get ready!

1. Before you read the passage, talk about these questions.

1 How does technology make your life easier?

2 Why are mathematics and physics important?

Reading

2. Read this magazine article.

Engineering

Engineering is one of today's fastest growing careers. That's because engineers work in so many areas. Some engineers design roadways. Others inspect very complicated machines. But no matter where they work, they all have two things in common: math and science. Disciplines like mathematics and physics are a must for any engineer. And so becoming an engineer requires extensive study.

Engineers develop fascinating new ideas. These new ideas change the world in big ways. Engineers also create the technologies that make our lives easier. The field of engineering truly is crucial in today's modern world. It is expanding every day, and is a great field to go into.

1 What is the magazine article mainly about?

A the importance of mathematics

B the machines that engineers design

C the work and ideas in engineering

D how new technologies change the world

3. According to the article, which of the following do engineers NOT do?

A design roadways

B analyze machines

C develop new ideas

D create new materials

4. What can be inferred about students of engineering?

A They take classes in physics.

B They do not take classes in English.

C They attend an extra year of college.

D They design machines in class.

5. Check (/) the sentence that uses the underlined word correctly.

1 *A* A machine is a branch of instruction or learning.

B To design something is to plan how it will look and function.

2 *A* To inspect something is to examine it carefully.

B Mathematics is a science that studies matter.

3 *A* Engineering is the study of quantity, structure, and change.

B To develop something is to create it or cause it to grow.

4 *A* Technology is a type of machine that makes life easier.

B Physics is the art of using the knowledge gained by science.

5 *A* A machine is a device that has multiple parts and does work.

B A discipline is a person who applies scientific knowledge.

6. Use the words from the word bank to fill in the blanks.

Mathematics engineering engineer

physics disciplines

1 Daniel wants to be a(n) _____.

2 _____ investigates how mass and movement interact.

3 _____ classes are for students who want to build structures.

4 _____ includes studying addition and division.

5 This university offers degrees in many different _____

7. Listen and read the article. How do engineers change our lives?

Listening

8. Listen to a conversation between an engineer and a new employee. Mark the following statements as true (T) or false (F).

1 The woman just left the engineering lab.

2 The woman is there to inspect a design.

3 The man designed the vehicle's engine.

9. Listen again and complete the conversation.

Engineer 1: Excuse me. Do you know where the 1_____ lab is?

Engineer 2: Absolutely. Right this way. Are you new here?

Engineer 1: Yes. I'm Sarah Gladstone. I'm here to 2_____ the company's new engine 3_____

Engineer 2: Nice to meet you. I'm Bob Sanders. I'm designing the vehicle that the 4_____ is going into.

Engineer 1: I see. How's it going?

Engineer 2: Pretty well. But we're still working on some of the 5_____.

Engineer 1: Well, some projects 6_____ than others.

Engineer 2: Exactly. Here's the engineering lab. Good luck with your first day!

Speaking

10. With a partner, act out the roles below, based on task 8. Then switch roles.

USE LANGUAGE SUCH AS:

Do you know where the ... is?

I'm here to analyze the ...

But we're still working on ...

Student A: You are a new employee. Talk to Student B about:

- location of a room
- your project
- Student B's project

Make up a name for the employee.

Student B: You work with Student A. Answer his or her questions. Make up a name for the employee.

Writing

11. You are an engineer. Use the conversation from Task 8 to complete a diary entry about your first day at a new job 100-120 words). Write about:

- someone you met and what they do
- what you are doing in your new job
- a room you were shown to
- Use todays date.

Vocabulary

12. Write down the new words and learn them.

1. complicated – складний,
2. to require – вимагати,
3. fascinating – чарівний,
4. crucial - вирішальне значення,
5. expanding – розширюється,
6. to gain – здобувати,
7. to investigate – розслідувати,
8. to interact – взаємодіяти,
9. division – розподіл,
10. employee – співробітник,
11. vehicle - транспортний засіб,
12. engine – двигун,
13. quantity – кількість,
14. employee - співробітник,
15. to attend – відвідувати.

1.2 From the history of engineering

Get ready!

1. Before you read the passage, talk about these questions.

1 What do you know about the history of engineering?

2 What kinds of engineering do you know?

Reading

2. Read the text.

A science dealing with design, construction and operation of structures, engines, machines, various devices is known in English as engineering for which it is sometimes difficult to find Ukrainian equivalents.

The proper Ukrainian equivalents are “техніка, будівництво, інженерна справа”. Now the art of building houses, temples, pyramids and other structures is called “civil engineering”.

At the time of the Roman Empire there were already two branches of engineering: civil engineering and military engineering. Military engineering included the building of fortifications and military devices. One may find the remains of Roman structures in Italy, on the territory of modern England, which was under Roman rule for about four centuries.

By time civil engineering grew into a profession requiring college training and has become an important branch of national economy. With the invention of the steam engine and the growth of factories practical application of the science of mechanics and thermodynamics to the design of machines attracted the attention of civil engineers.

They called themselves “mechanical engineers”, separating themselves from civil engineering. It laid the foundation for a new branch of engineering – mechanical engineering. Mechanical engineering deals with design, construction and operation of engines, turbines, air-conditioning, refrigeration devices, elevators, conveyors, escalators. The mechanical engineer designs machine-tools for various operations and their application in various production processes.

One of the many branches of mechanical engineering is aeronautics, which deals with the mechanics of moving bodies in fluid or air. In the 19th century with the development of the science of electricity a new branch of engineering – electrical engineering appeared.

Electrical engineering is divided into main branches: communications engineering and power engineering. Communications engineering deals with minute quantities of electricity, used for all kinds of communications; power engineering – with the means for producing power. Therefore, the electrical engineer designs radio, television and telephone equipment; the power engineer – generators, switches, transformers, etc.

In the middle of the 20th century there appeared new branches of engineering – nuclear engineering and space engineering. Nuclear is based on atomic physics. Space engineering is impossible without all modern scientific achievements.

Present day engineering includes chemical engineering, dealing with processes and equipment possible to change the state, energy content, physical and chemical composition of various materials. Nowadays there are hundreds of subdivisions of engineering but all of them branched off from civil, mechanical, electrical or chemical engineering.

3. Choose the sentences containing information from the text.

1. The word “engineering” has many meanings.
2. There are some Ukrainian equivalents of the term “engineering”.
3. The art of building was known hundreds years ago.
4. There wasn’t any other branch of engineering besides civil engineering at the times of the Roman Empire.
5. The profession of civil engineer deals with many branches of national economy and science.
6. Electrical engineering is older than mechanical engineering.

Speaking

***4. Give the proper term to the following definitions**:*

*nuclear engineering, engineering, civil engineering, military engineering, mechanical engineering***.**

1. … is a science which deals with design, construction and operation of structures, machines, engines, devices used in industry and everyday life.
2. We call … … the art of building houses, palaces, temples and other structures.
3. … … includes the building of fortifications and military devices.
4. …. … deals with the design and construction of steam engines, turbines, air-conditioning, and refrigeration devices.
5. … … is based on atomic physics.

5. Find the English equivalent to the following Ukrainian sentence.

1. Саме цей науковець відіграв основну роль у вирішенні цієї проблеми.
   a) This scientist played an essential part in solving this problem.
   b) It was this scientist who played an essential part in solving this problem.
   c) It was at the time when that scientist was solving this problem.
2. Саме цивільне будівництво пов'язано із будівництвом будинків, храмів, пірамід.
   a) It is civil engineering that deals with construction of houses, temples and pyramids.
   b) Civil engineering deals with construction of houses, temples and pyramids.
   c) It is construction of houses that civil engineering deals with.

Writing

6. Fill in the blanks with the proper tenses of the verbs given in brackets.

1. What you (to do) when I came in? I (to read) an article on internal combustion engines. 2. Where you (to go) when I met you? I (to go) to the library I (to intend) to read up for my exam. 3. We (to arrive) at the station when the train (to approach) the platform. 4. At the corner of the street we (to see) a car. The driver (to examine) its engine. 5. A man was stopped by a militiaman while he (to cross) the square. The militiaman said: "Why you (to cross) the square in the wrong place?"

7. Substitute the infinitive by the proper form of the verb (active or passive).

1. At the end of the 19th century civil engineering (to enrich) with new achievements of science. 2. The profession of a civil engineer (to require) college training. 3. Now, civil engineering (to speak of) as an important branch of national economy. 4. It (to deal) with the building of industrial structures bridges, houses, tunnels, etc. 5. Dams, water systems, railways, etc. (to build) by civil engineers. 6. A very important branch of engineering (to call) mechanical engineering. 7. Mechanical engineering (to achieve) a prominent position from the very beginning. 8. Machine-tools (to use) in various production processes. 9. It (to know) that space engineering occupies a most prominent position. 10. It (to say) that electrical engineering (to subdivide) into two branches.

Vocabulary

8. Write down the new words and learn them.

1. to appear - з'являтися,
2. to branch off – відгалужується,
4. chemical engineering – хімічне машинобудування,
5. civil engineering – цивільне будівництво,
6. civil engineer - інженер-будівельник,
7. communications engineering – техніка засобів зв'язку,
8. electrical engineering – електротехніка,
9. essential - істотний
10. mechanical engineering – машинобудування,
11. machine –tools – механізми,
12. military engineering – військово-інженерне будівництво,
13. nuclear engineering - ядерна техніка,
14. power engineering - енергомашинобудування, енергетика,
15. power engineer - інженер-енергетик,
16. space engineering – космічна техніка.

UNIT 2. ELECTRICAL INSTRUMENT

2.1 What is electricity?

Get ready!

1. Before you read the passage, talk about these questions.

1 What do you know about electricity?

2 What electrical instruments are there?

Reading

2. Read the text and label the picture with the name of each part.

All substances, solids, liquids or gases, are composed of one or more of the chemical elements. Each element is composed of identical atoms.

Each atom is composed of a small central nucleus consisting of protons and neutrons around which orbit shells of electrons. These electrons are very much smaller than protons and neutrons.

The electrons in the outermost shell are called valence electrons and the electrical properties of the substance depend on the number of these electrons.

Neutrons have no electric charge, but protons have a positive charge while electrons have a negative charge. In some substances, usually metals, the valence electrons are free to move from one atom to another and this is what constitutes electric current.

3. Read the text again and complete the sentences with the missing information.

1 Elements make up _____.

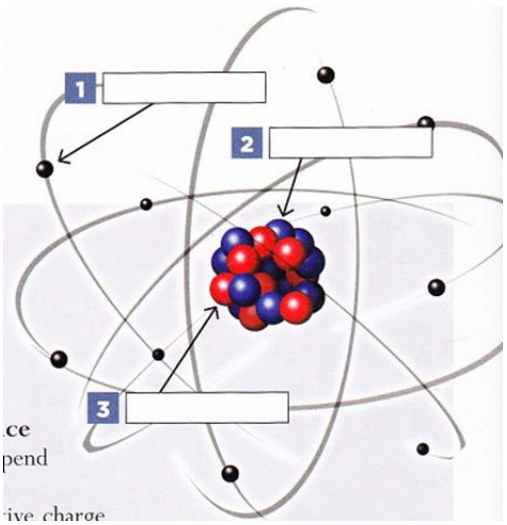
2 Identical atoms _____.

3 Atoms consist of _____, _____ and _____.

4 Inside there are _____and _____, while outside _____.

5 Shells _____.

6 Valence electrons _____.



7 Neutrons do not have _____.

8 Electricity is generated when_____.

Listening

4. Listen and complete the text with the missing information.

Electricity consists of a (1) _____ of free electrons along a conductor. To produce this current flow, a generator is placed at the end of the conductor in order to move the (2) _____

Conductors

Electricity needs a material which allows a current to pass through easily, which offers little (3) _____ to the flow; and is full of free electrons. This material is called a conductor and can be in the form of a bar, tube or sheet. The most commonly used (4) _____are wires, available in many sizes and thicknesses. They are coated with insulating materials such as plastic.

Semiconductors

Semiconductors such as silicon and germanium are used in transistors and their conductivity is halfway in between a conductor and an (5) _____

Small quantities of other substances, called impurities, are introduced in the material to (6) _____the conductivity.

Insulators

A material which contains very (7) _____electrons is called an insulator. Glass, rubber, dry wood and (8) _____resist the flow of electric charge, and as such they are good insulating materials.

5. Read the text again and decide if the following statements are true (T) or false (F), then correct the false ones.

1 A flow of electrons moving inside a conductor creates an electric current.

2 A generator is used to move the charges.

3 Electrons can easily pass through any material.

4 Any material is a good conductor.

5 Conductors are coated with insulators.

6 The presence of free electrons affects the conductivity of materials.

7 Impurities are introduced to increase conductivity.

8 Insulating materials resist the flow of electrons.

6. Read the text and complete the table with the missing information.

There are two types of current: Direct current (DC) and Alternating current (AC).

Direct current is a continuous flow of electrons in one direction and it never changes its direction until the power is stopped or switched off.

Alternating current constantly changes its direction because of the way it is generated. The term ‘frequency’ is used to indicate how many times the current changes its direction in one second.

Alternating current has a great advantage over direct current because it can be transmitted over very long distances through small wires, by making energy high voltage and low current.

There are several quantities that are important when we are talking about electnc current. Volts (V) - so named after the Italian physicist Alessandro Volta - measure the difference of electric potential between two points on a conducting wire. Amperes (A) measure the amount of current flowing through a conductor, that is to say the number of electrons passing a point in a conductor in one second. Coulomb (C) measure the quantity of charge transferred in one second by a steady current of one ampere. Power is the rate at which work is performed and it is measured in watts (W). A Kilowatt (kW), which is equal to one thousand watts, is used to measure the amount of used or available energy. The amount of electrical energy consumed in one hour at the constant rate of one kilowatt is called kilowatt-hour.

Unit of measurement. What does it measure?

1) the number of electrons passing a given point in a conductor in one second_____

2) the quantity of electricity transferred by a steady current of one ampere _____
3) the amount of electric energy used _____
4) the difference of potential between two points on a conductor_____
5) rate at which work is done _____

Vocabulary

7. Write down the new words and learn them

1. charge – заряд,
2. to pass through - проходити через,
3. coated – покритий,
4. property – майно,
5. conductor – провідник,
6. semiconductor – напівпровідник,
7. current flow – струм,
8. shell – оболонка,
9. halfway – наполовину,
10. steady – неухильний,
11. impurity – домішка,
12. to switch off – вимикати,
13. insulator – провідник,
14. thickness – товщина,
15. to name after – називати на честь,
16. valence – валентність,
17. to orbit - обертатися по орбіті.

2.2 Electric current

Get ready!

1. Before you read the passage, talk about these questions.

1 How does electric current make your life easier?

2 Why practical application of electricity is important?

Reading

2. ***Read the text.***

In a metal there is a large number of electrons, which are free and can move through the metal under the action of an electric force. When such an electric force is applied to the metal, these electrons move from one part of the metal to another. Then we say that in the conductor there is an electric current.

This flow of electrons through a conductor is similar to the flow of water through a pipe. If our aim is to maintain a flow of water in the pipe it is necessary to have a difference of pressure at the two ends. In the same way a difference of electrical pressure or potential is necessary to maintain a flow of electrons in a conductor.

The movement of electrons through conductors occurs very easily and very small electric pressures are sufficient to make the electrons move. To compare electric currents we should have certain units by means of which they are to be measured. The practical unit of current is called the ampere.

It is defined from the amount of metal deposited by a current from an electrolytic solution in a given time.

To measure the resistance of a conductor, we should have some fixed standard. The practical unit of resistance is called the ohm. This unit can be defined from the relation between the difference of potential and the current that flows in a conductor. The resistance of a conductor is proportional to its length, it is inversely proportional to its cross-sectional area and it depends on the material used.

The practical application of electricity depends upon the effects produced by the electric current. The engineer has to control the current in order to control the heating, chemical and magnetic effects of electricity. From the point of view of practical application of electricity, series and parallel circuits are the most important.

The production of heat by an electric current is widely used. Electric welding, electric melting of metals are now well known. An electric current can produce certain chemical actions, such as decomposition of water into its elements. Currents of electricity can also be produced by certain chemical actions.

3. Answer the following questions.

1. What constitutes electric current?
2. What is it an electric current?
3. What is the ampere called?
4. How is the practical unit of resistance called?
5. What is widely used?
6. What can an electric current produce?
7. What moves charges to make electric current possible?
8. What happens if we break an electric circuit?

Writing

4. *State to what parts of speech the following words belong (pay attention to the suffixes*).

Model: equipment – іменник.

Possible, structure, impossible, construction, foundation, designer, engineering, profession, escalator, mechanical, economy, electrical.

5. *Give verbs corresponding to the following nouns.*

Model: invention – invent.

Foundation, designer, production, elevator, equipment, formation.

6. *Translate the following words (as verbs and as nouns).*

Model: design – проект; проектувати.

Place, use, result, change, construct, base.

Speaking

7. *Train the pronunciation and translate the international words.*

Aeronautics, construction, electric, electricity, equivalent, fortification, machine, modern, radio.

8. Match the synonyms.

1	2
1. construction	a) building
2. house	b) project
3. design	c) cottage
4. branch	d) come into use
5. appear	e) field
6. profession	f) occupation
7. separate themselves from …	g) basis
8. foundation	h) branch off
9. to apply	i) present-day
10. modern	j) to use
	k) palace
	l) structure

Vocabulary

9. Write down the new words and learn them.

1. a number – кількість,
2. an electron – електрон,
3. to move – рухатися,
4. an action – дія,
5. a force – сила,
6. an electric current - електричний струм,
7. to apply – використовувати,
8. a conduction – провідник,
9. a pressure – тиск,
10. a pipe-труба,
11. to compare – порівнювати,
12. a resistance – опір,
12. a flow – потік,
13. to depend on - залежати (від ч.н.),

14. a length - довжина,
15. an application – використання,
16. a heating – нагрівання,
17. a melting – плавлення,
18. a decomposition - розпад,
19. an aim – мета,
20. similar - схожий,
21. to maintain – підтримувати,

UNIT 3. THE METHOD OF THE ENGINEERING DESING

3.1 Technical assistance

Get ready!

1. Before you read the passage, talk about these questions.

- Why maintenance is important for any equipment?
- What kind of maintenance do you know?

Reading

2. Read the text about maintenance and answer the questions.

Any machine and device must be controlled regularly in order to avoid the risk of damage or breakdown of single parts due to long usage. Sometimes, if a proper maintenance is not done, a fault could occur, with negative consequences on the production process and on the workers' safety. The primary goal of maintenance is to avoid or mitigate the consequences of failure of equipment. This includes performing routine actions to keep the device in working order and prevent the failure before it actually occurs (preventive maintenance), or fixing equipment after breakdown (corrective maintenance).

Preventive maintenance is designed to preserve and restore equipment reliability by replacing worn components before they actually fail. It includes maintenance activities such as partial or complete overhauls at specified periods, oil changes and lubrication. The ideal preventive maintenance is a combination of technical, administrative and managerial actions to prevent all equipment failure. If carried out properly, preventive maintenance can extend the life of the equipment.

Corrective maintenance, sometimes simply called ‘repair’, is carried out to get equipment working again. It aims at restoring the functionality of a machine so that it can continue to perform its work. This type of maintenance can be very expensive because sometimes equipment needs to be replaced, with substantial costs for the company.

Generally, maintenance is scheduled according to:

■ the original equipment manufacturer's recommendations;

■ codes and legislation within a country;

■ consultancy advice:

■ previous maintenance;

■ most important measured values and performance indications.

1 Why is maintenance important?

2 What are the main types of maintenance?

3 What is the function of preventive maintenance?

4 Which activities does it include?

6 Why can corrective maintenance be expensive?

5 What is maintenance called if it occurs after a failure?

3. Read the text again and match the words with their definitions.

1 fault	a □ damaged and in poor condition as a result of much use
2 to mitigate	b □ a set of rules about how something must be done
3 to fix	c □ expert advice within a particular field
4 overhaul	d □ applying a greasy substance to reduce friction
5 worn	e □ a break or other defect in a piece of machinery
6 lubrications	f □ to do the necessary work to repair something that doesn't work properly
7 code	g □ to make something less severe or unpleasant
8 consultancy	h □ careful examination of a machinery or system that must be repaired

Listening

4. Listen to the dialogue between Mrs. Farrell and her mechanic and complete it with the missing words.

Mechanic	Good afternoon, Mrs Farrell.
Mrs Farrell	Good afternoon, John. How are you?
Mechanic	I'm fine, thank you. How can I (1) _____ you?

Mrs Farrell Well, I need a complete (2) _____ for my car. Next week my husband and I are going on holiday by car. It's going to be a long journey all the way to Spain and I want my car to be in (3) _____.

Mechanic Sure. No problem. Have you checked your car recently?

Mrs Farrell Let me think... It must have been last year, in June, when the car wouldn't (4) _____. Anyway, it should all be written in the (5) _____. It's in the glove compartment.

Mechanic OK, I'll take it. Let's see... Oh, yes, it was the battery and I changed it. Are there any problems at the moment?

Mrs Farrell Not really, but I think the (6) _____ needs to be replaced.

Mechanic Sure. I'll check the filters too.

Mrs Farrell Yes, I think it's a good idea. Could you (7) _____ the tyres as well? And maybe wash it; it's so dirty. Well, John, when do you think the car will be ready?

Mechanic Actually, I'm quite busy at the moment, Mrs Farrell, so I could give it back to you next Friday. Would that be convenient for you?

Mrs Farrell Yes, it'd be perfect, because we're leaving on Sunday. I'll call you on Tuesday for a confirmation then.

Mechanic All right. Goodbye, Mrs Farrell.

on Friday...

Mechanic Good morning, Mrs Farrell. Here are your keys. I replaced the engine oil and the (8) _____. Then I checked the tyres and the brakes too. I had to (9) _____the spark plugs because they were fouled.

I also (10) _____ the electronics and then I washed the car. Now everything is OK, you can set off with no worries.

Mrs Farrell That's great! Thank you very much, John.

5. Read the dialogue again and answer the questions.

1 What does Mrs Farrell want?

2 Why does she need a complete tune-up?

3 What is written in the service book?

4 What does the car need to be done?

5 When will the car be ready?

6 What did John replace in the car?

Vocabulary

6. Write down the new words.

1. to aim at – намагатися,
2. alignment – вирівнювання,
3. behaviour – поведінка,
4. bolt – болт,
5. brake – гальма,
6. brake pad - гальмівні колодки,
7. chassis – шасі,
8. consultancy – консультація,
9. due to в наслідок,
10. to entail - тягне за собою,
11. exposure – вплив,
12. failure – поломка,
13. fouled – забруднення,
14. glove compartment – бардачок,
15. hinge – стрижень,
16. lock – замок,
17. lubrication – мастило,
18. overhaul – капітальний ремонт,
19. to schedule – планувати,
20. service book - книга обслуговування,
21. to set off – зараховувати,
22. spare wheel - запасне колесо,
23. spark plug - свічка запалювання,
24. steering wheel - рульове колесо,
25. to tighten – затягнути,
26. to tow – буксирувати,
27. trailer – причіп,
28. trunk – багажник,
29. tyre – шина,
30. wear – зношувати,
31. windshield - вітрове скло,
32. worn – зношений.

3.2 Health and safety at work

Get ready!

1. Before you read the passage, talk about these questions.

1 What do you know about protective and precautionary measures?

2 Why is it important to ensure a safe working environment?

Reading - 1

2. Read the text about health and safety at work and answer the questions.

Attention must be paid to safety in order to ensure a safe working practice in factories. Workers must be aware of the dangers and risks that exist all around them: two out of every three industrial accidents are caused by individual carelessness. In order to avoid or reduce accidents, both protective and precautionary measures must be followed while working.

Each country has specific regulations concerning health and safety at work. For example, The Health and Safety at Work Act 1974 is a UK Act of Parliament that establishes the fundamental rules to enforce workplace health, safety and welfare within the United Kingdom.

The objectives of the Act are:

- to secure the health, safety and welfare of people at work;
- to protect people in the work place against risks to health or safety in connection to their work activities;
- to control the keeping and use of dangerous substances;

- to control the emission of dangerous gases into the atmosphere.

The Act defines general duties of employers, employees, suppliers of goods and substances for use at work, and people who manage and maintain work premises. In particular, every employer has to ensure the health, safety and welfare at work of all the employees, visitors, the general public and clients. Employers have to ensure the absence of risk to health in connection with the use, handling or storage of items and substances, as well as provide adequate facilities tor a safe working environment. It is also very important to provide employees with proper instructions and training so that they will be able to cope with any problem that may occur at work.

Employees, on their part, should always behave responsibly at work and take care of themselves and other people who may be affected by their actions. Moreover, they should cooperate with employers to enable them to perform their duties or requirements under the Act.

Why is it important to ensure a safe working environment?

Which law regulates workers' welfare in the United Kingdom?

What does the Act define?

What are the duties of employers?

Why is it important to provide employees with adequate training?

How can employees contribute to a safe working environment?

3. Read the text again and match the words with their definitions.

1 precautionary measure	a	a responsibility or task that you have to do as part of your job
2 carelessness	b	to deal effectively with a difficult situation
3 welfare	c	the buildings and land occupied by a business
4 duty	d	poor attention to an activity, which results in harm or errors
5 premises	e	action taken in order to prevent something dangerous from happening
6 to cope with	f	the health, comfort and well-being of a person or group

Reading - 2

4. Read the text about safety signs and colours and complete the table with the correct sign category.

Safety **signs** and colours are useful tools to help protect the health and safety of employees and workplace visitors. Safety signs are used to draw attention to health and safety **hazards,** to point out hazards which may not be obvious and to remind employees where personal protective equipment must be worn.

Colour attracts attention and can be used extensively for safety purposes. For example, colour can be used as an additional safety measure to identify the contents of pipes and the nature of the hazard.

Different combinations of colours are used to indicate the various types of hazards. For example, the colour red is used to indicate a definite hazard, while a potential hazard is communicated by the colour yellow. When employees are aware of the hazards around them and take the necessary precautions, the possibility of an injury, illness or other loss is minimised.

As shown in the table below, there are three basic sign categories used in the workplace:

- warning, to indicate definite or potential hazards;
- regulatory, to indicate which actions are prohibited or mandatory;
- information, to provide general information and directions.

Each category is distinguished by its shape and can be divided into subcategories having different colours.

Category	Subcategory	Colour
 1_____ A circle indicates that an order is in force.	- Prohibition: it forbids an action. - Mandatory: it requires an action.	Red and black on white White on black

 2_____ A triangle indicates caution or danger.	- Caution: it indicates a potential hazard. - Danger: it indicates a definite hazard.	Black on yellow White on red
 3_____ A square indicates information.	- Emergency: it indicates first aid, health, fire protection and emergency equipment. - General information: it indicates permission or public information.	White on green White on blue

5. Match each sign with its meaning and write the correct subcategory for each of them.

a □ slippery when wet; b □ high voltage; c □ first aid station;

d □ head protection must be worn; e □ cafeteria; f □ no smoking area

Reading - 3

6. Read the texts about safety equipment and match the words in the box with the correct description.

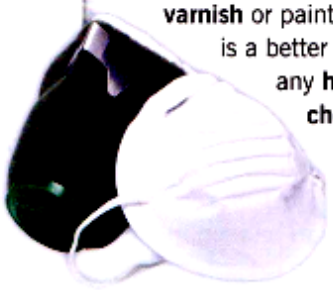
hearing protection hard hats respirator safety glasses face shield **overall**

(1) _____ are the most important piece of safety equipment. There are many styles of these, but all share the same features, that is to say impact resistant **lenses** and side screens to protect against dust.

(2) _____ should be worn when working with **loud** power tools and machinery, in order to protect you from long-term hearing loss.

(3) _____ are predominantly used in workplace environments such as **building sites**. They protect the head from injury by falling objects, impact with other objects, **debris**, bad weather and electric shock.

When working with chemicals or machinery which makes dust, it is advisable to wear a face mask, to keep these fine particles away from the face. When spraying **varnish** or paint, a (4) _____ is a better choice, to protect you from any **harmful** effects of using these **chemicals**.



(5) A _____ must be worn when using machinery which gives off **sparks** or little parts. It is comfortable, can be **flipped up** when not needed, and will keep most of the flying chips away from your face.

When working, you should always wear proper clothing, like an (6) _____. Comfortable, **long-sleeved** shirts and long trousers combined with good safety boots will each provide a layer of protection.

Reading - 4

7. Read the text about fire safety procedures and put the actions in the correct order.

A fire safety plan is required in all public buildings, from schools, hospitals, supermarkets to workplaces. Generally, the owner of the building is responsible for the preparation of a fire safety plan. Once the plan has been approved by the Chief Fire Official, the owner is responsible for training all staff in their duties.

Evacuation drills are a very important part of the staff training associated with emergency evacuation procedures. Drills should be carried out in all buildings at least once a year. The drill should be checked, recording the time required to complete the evacuation, and noting any problems and deficiencies.

After each drill a meeting should be held to evaluate the success of the drill and to solve any problems that may have arisen.

What to do in case of fire...

■ If you see fire or smoke, do not panic. Remain calm and move quickly, but do not run.

■ Alert the responsible staff and telephone the correct national emergency number. Have someone meet the **firefighters** to tell them where the fire is. They can lose valuable minutes if they have to find it themselves.

■ Rescue any people in immediate danger only if it is safe to do so.

■ If practicable, close all doors and windows to contain the fire.

■ Try to extinguish the fire using appropriate firefighting equipment only if you are trained and it is safe to do so.

■ Follow the instructions of your supervisor and prepare to evacuate if necessary.

■ Save **records** if possible.

■ Evacuate your area and check all rooms, especially changing rooms, toilets, storage

■ Do a head count of all staff and report any people unaccounted for to the supervisor.

a □ Close all doors and windows.

b □ Do a head count of all staff and visitors.

c □ Evacuate your area and check all rooms.

d □ Meet the firefighters and give them details about the fire.

e □ Save records.

f □ Prepare to evacuate.

g □ Remain calm and move quickly.

h □ Report any people unaccounted for to the supervisor.

i □ Rescue any people in immediate danger.

j □ Telephone the correct national emergency number.

k □ Try to extinguish the fire using appropriate firefighting equipment.

Vocabulary

8. Write down the new words and learn them.

1. ash – попіл,
2. to assemble – зібрати,
3. building site - будівельний об'єкт,
4. carelessness – неуважність,
5. chemicals - хімічні речовини,
6. to cope with - щоб впоратися з,
7. debris – сміття,
8. employee - найманий працівник,
9. employer – роботодавець,
10. to enable – увімкнути,
11. evacuation drill -евакуаційна дриль,
12. fire extinguisher – вогнегасник,
13. fire fighter – пожежний,
14. to flip up - перевернути вгору,
15. harmful – шкідлива,
16. hazard – небезпека,
17. injury – травми,
18. lens - лінзи,
19. long-sleeved – з довгими рукавами,
20. loud – гучний,
21. overall - в загальному,
22. precautionary - прийняття запобіжних заходів,
23. record – запис,
24. safety – безпека,
25. sign – знак,
26. spark – іскра,
27. supplier – постачальник,
28. varnish – лак.

UNIT 4. REFRAGIRATION EQUIPMENT AND ALL INSTALLATIONS

4. 1 Understanding refrigeration

Get ready!

1. Before you read the passage, talk about these questions.

- What do you know about refrigeration process?
- Do you know anything about how a refrigerator works?

Reading

2. Read the text

To understand what is happening inside your refrigerator, it is helpful to understand refrigerants a little better. Here are two experiments that help you see what is happening. These experiments can help you understand the properties of gases and their role in refrigeration. *Experiment 1.*

You will need:

- a pot of water;
- a thermometer that can measure up to at least 250 degrees F;
- a stove.

Put the pot of water on the stove, stick the thermometer in it and turn on the burner. You will see (if you are at sea level) that the temperature of the water rises until it hits 212 F. At that point, it will start boiling, but will remain at 212 F - this is the boiling point of water at sea level. If you live in the mountains, where the air pressure is lower than it is at sea level, the boiling point will be lower - perhaps between 190 and 200 F. This is why many foods have "high-altitude cooking directions" printed on the box. You have to cook foods longer at high altitudes. *Experiment 2.*

You will need:

- an oven-safe glass bowl;
- a thermometer that can measure up to at least 450 F;
- an oven.

Put the thermometer in your container of water, put the container in the oven and turn it to 400 F.

As the oven heats up, the temperature of the water will again rise until it hits 212 F, and then start boiling. The water's temperature will stay at 212 F even though it is completely surrounded by an environment that is at 400 F. If you let all of the water boil away (and if the thermometer has the range to handle it), as soon as the water is gone the temperature of the thermometer will shoot up to 400 F.

The second experiment is extremely interesting if you think about it in the following way: Imagine some creature that is able to live happily in an oven at 400 degrees Fahrenheit. This creature thinks 400 F is just great - the perfect temperature (just like humans think that 70 F is just great). If the creature is hanging out in an oven at 400 F, and there is a cup of water in the oven boiling away at 212 F, how is the creature going to feel about that water? It is going to think that the boiling water is really cold. After all, the boiling water is 188 degrees colder than the 400 F that this creature thinks is comfortable. That's a big temperature difference! (This is exactly what is happening when we humans deal with liquid nitrogen. We feel comfortable at 70 F. Liquid nitrogen boils at - 320 F. So if you had a pot of liquid nitrogen sitting on the kitchen table, its temperature would be - 320 F, and it would be boiling away - to you, of course, it would feel incredibly cold.)

Modern refrigerators use a regenerating cycle to reuse the same refrigerant over and over again. You can get an idea of how this works by again imagining our oven creature and his cup of water.

He could create a regenerating cycle by taking the following four steps:

The air temperature in the oven is 400 degrees F. The water in the cup boils away, remaining at 212 F but producing a lot of 400 F steam. Let's say the creature collects this steam in a big bag.

Once all the water boils away, he pressurizes the steam into a steel container. In the process of pressurizing it, its temperature rises to 800 F and it remains steam. So now the steel container is "hot" to the creature because it contains 800 F steam.

The steel container dissipates its excess heat to the air in the oven, and it eventually falls back to 400 F. In the process, the high-pressure steam in the container condenses into pressurized water (just like the butane in a lighter - see sidebar).

At this point, the creature releases the water from the steel pressurized container into a pot, and it immediately begins to boil, its temperature dropping to 212 F.

By repeating these four steps, the creature now has a way of reusing the same water over and over again to provide refrigeration.

Now let's take a look at how these four steps apply to your refrigerator.

1. Have you ever made any experiments in your chemistry classes? What were they?
2. Do you know anything about how a refrigerator works?

3. Make the right choice:

1) To understand the … you need to conduct some experiments:
   a) role of refrigeration;
   b) boiling process;
   c) properties of gases.
2) We can measure up the temperature of water with the help of a … :
   a) thermometer;
   b) burner;
   c) pot of water.
3) Altitude influences much the process of … :
   a) temperature measuring;
   b) water boiling;
   c) refrigeration.
4) A regenerating cycle helps… the same refrigerant again and again:
   a) reuse;
   b) understand;
   c) heat up.

5) A regenerating cycle consists of steam collection, … and steam condensing into pressurized water:

a) refrigerant reusing;
b) stem pressurizing;
c) temperature rising.

Writing

4. Put the sentences into the right order according to the text continuity:

1) For the successful organization of the experiments you will need some water, a thermometer and an oven.
2) The second experiment demonstrates the difference in temperatures of boiling water and an environment inside the oven.
3) To understand the properties of gases and their role in refrigeration you can conduct two experiments.
4) The first experiment shows the boiling point of water.
5) This temperature difference explains what happens when people deal with liquid nitrogen.
6) Then the steam is pressurized and its temperature rises.
7) Due to temperature difference stem is produced
8) After pressurization the steam condenses into water which begins to boil.

5. Mark true (T) and false (F) statements. Correct false ones:

1) The difference in temperatures at sea level and in mountains influences boiling point of water.
2) The two experiments show how to measure air pressure.
3) The temperature of water in the oven rises as the oven heats up.
4) In the mountains the air pressure is higher than it is at sea level.
5) Modern refrigerators use boiling water.
6) If liquid nitrogen boiled you would feel incredibly hot.

6. Match the words with their description:

1) thermometer	a) to use something for the second time
2) to heat up	b) more heat than necessary
3) to reuse	c) watery
4) excess heat	d) features
5) properties	e) a device for measuring temperature
6) liquid	f) to make something hot at high temperature

7. Fill in the missing prepositions where necessary:

1) To conduct the first experiment put the pot … water … the stove and stick the thermometer … it.

2) When the temperature … water reaches … the boiling point, the water may boil … .

3) If you are … high altitudes it will take you a long time to cook food.

4) The temperature … boiling water will stay … the same figure even if it is surrounded … environment … much higher temperature.

5) A regenerating cycle, used … modern refrigerators, reuses the same refrigerant … and … again

6) … the process … pressurizing the temperature of steam rises … 80 F.

8. Put the words into the right order to make up correct sentences:

1) Nitrogen, an, important, in, plays, role, refrigeration.
2) To, measure up, you, need, temperature, thermometer, a.
3) If, don't, boiling, it, boil, away, you, water, will, stop.
4) Water, when, it, produces, boils, steam, away.
5) Refrigerators, use, cycle, modern, same, over, a, over, to refrigeration, again, reuse, the, refrigerant, the, and.

Speaking

9. Answer the questions:

1) What helps us understand the work of a refrigerator?
2) Why are the two experiments given? What do they illustrate?
3) What is the essence of these experiments?
4) Does the temperature of water mean much in this process?
5) What is a refrigerating cycle?
6) Why do modern refrigerators use this cycle?
7) How many stages does the cycle consist of? Describe it.
8) Does the temperature remain unchanged?
9) How is the temperature changed?
10) What does this change show?

10. Look at the scheme of two-temperature refrigerated semitrailer, pay attention to new word.

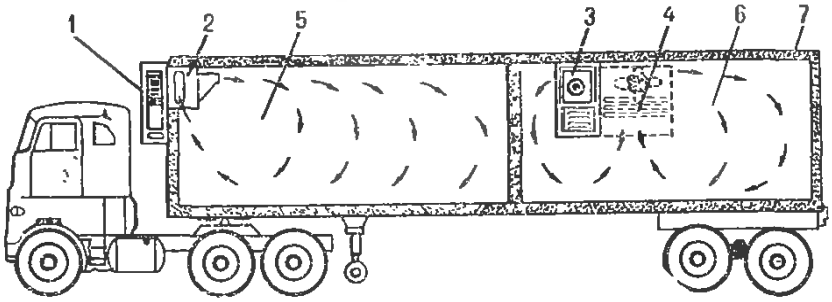


Рис. 1. Two-temperature refrigerated semitrailer / напівпричіп-рефрижератор з двома охолоджуваними відділеннями.

1. condensing unit компресор-конденсаторний агрегат;
2. air cooler - повітроохолоджувач ;
3. condensing unit - компресор-конденсаторний агрегат;
4. air cooler - повітроохолоджувач;
5. frozen food compartment - відділення для заморожених продуктів;
6. chilled food compartment- відділення для охолоджених продуктів;
7. insulation - ізоляція.

11. Write down the new words and learn them.

1. property - здібність,

2. to measure up - вимірювати,

3. thermometer - термометр,

4. burner - горелка,

5. to boil - кип’ятити,

6. sea level - рівень моря,

7. to heat up - нагрівати,

5. creature - істота,

6. liquid - рідина,

7. air pressure - атмосферний тиск,

8. stove - плита,

9. surrounded - оточений,

10. to hang out - мешкати,

11. steam - пар,

12. repeating - повторювання,

13. altitude - висота,

14. to influence - впливати,

15. difference - різниця.

4.2 Electric current in the refrigeration equipment

Get ready!

1. Before you read the passage, talk about these questions.

1 What do you know about electric current application in the refrigerators?

2 What types of electric current are there?

Reading

2. Read the text.

There are two common types of electric current: "direct" and "alternating". In a "direct" current (DC) the electrons flow steadily from the negative to the positive. In an "alternating" current (AC) they do not flow along at all. They merely vibrate a short distance backwards and forwards.

A direct current is the flow of electrons that starts from a battery or generator, passes through resistances, meters, motors and so on and finally returns to its starting point.

A direct current is used in the electrical system of an automobile and an airplane, in the tram, telegraph, telephone, in industry, etc. However, at present another type of electric current is used for lighting, heating and industrial purposes. This current flowing first in one direction and then in another is called an alternating current.

A direct current has one great disadvantage – there is no economic way by means of which one can increase or decrease its voltage. The alternating current does not know this disadvantage, for its voltage can be increased or decreased with little loss of energy by a transformer.

Using a transformer, it is possible to transform power at low voltage into power at high voltage and back again. Current is to be generated at a voltage which is best suited for any given machine. In large power-plants this is often 6.300 or 10, 500 V. Power is transmitted over long distances with less loss at high voltage than at low voltage.

The alternating current supplies the greatest part of the electric power for industry today. Radiomen know well that the alternating current makes radio transmission possible. Radiograms as well as music can be sent through the air to distant places because electric current can change its direction many times a second. Our Russian scientist Yablochkov first applied the alternating current. His electric candle was fed by the AC. So we have considered the types of currents and their practical use.

An electric current may be produced in a variety of ways and from a number of different types of apparatus, e.g. an accumulator, a d. c or an a. c generator, or a thermionic valve. Whatever the source of origin, the electric current is fundamentally the same in all cases, but the manner in which it varies with time may be very different.

A direct current (d. c.) flows continuously through a conducting circuit in one direction only, although it may not be steady so far as magnitude is concerned. It is unidirectional in character. An alternating current (a.c.) on, the other hand, continually reverses in direction.

As its name implies starting from zero, it grows in one direction, reaches a maximum, dies down to zero again, alter which it rises in the opposite direction, reaches a maximum, again dying down to zero.

It is thus continually changing in magnitude as well as in direction and this continual change causes certain effects of far-reacting importance. It can be shown that high voltages are desirable for the economic transmission of a given amount of electric power. Take, for example, the transmission of 1000 kW. If the transmission voltage is 100 volts, the current must be 10000 amperes, but if the transmission voltage is 10000 volts, the current is only 100 amperes.

The cross-section of the cables transmitting, the power is determined by the current to be carried, and so in the former case the cables would need to be very much larger than in the latter case.

It is true that the high voltage cable would need to have more insulation, but ever so, it would be very much cheaper than the large low voltage cable. Being cheaper, high voltage is therefore essential for the economic transmission or electric cower.

Speaking

3. Answer the following questions.

1. What types of electric current are there?
2. What current is the alternating current called?
3. What current is the direct current called?
4. Who was Yablochkow? What did he apply?
5. Whose electric candle was fed by the AC?
6. Can you tell the difference between DC and AC?
7. What direction of DC is conventionally assumed?

8. Is there any way to convent AC into DC?

Writing

4. Translate the following sentences paying attention to different meanings of the words in bold type:

1. An electric **current** can be alternative or direct. 2. The **current** in mountain rivers is very strong. 3. If you read newspapers regularly, you will know all **current** events. 4. We must **provide** all necessary conditions for the experiment. 5. Old people must be **provided** for by the state. 6. Students get grants **provided** they are full-time students. 7. The reaction **takes** place when the temperature rises. 8. He **takes** an active part in the life of our University. 9. The sick person was **taken** to hospital. 10 It usually **takes** me 40 minutes to get to the Institute.

5. Give the degrees of comparison of the following words.

Difficult, high, large, long, useful, small, much, many, easy, little, far, fast, early, important, silent, slow, necessary, poor.

6. a) Insert "more" or "(the) most":

1. … of all I liked this museum. 2. Mathematics is … interesting for me than chemistry. 3. This subject is … difficult than strength of materials. 4. She is … beautiful girl here.

add "-er" or "-est":

1. This student is the (clever) in our group. 2. The course in this Institute is (long) than in ours. 3. Your work is (short) than hers. 4. This hall is the (large) in our Institute.

7. Fill in the blanks with as…as, not so…as.

1. His scientific career was not … successful as his practice.
2. These machines are … reliable … all lab equipment.
3. Knowledge of theoretical material is … important …doing grammar exercises.

4. The second-year students don't take … many exams … the third year students.

5. You have made … great progress in your studies … your friends.

8. Use the construction the …, the …, combining the necessary parts of the two columns.

1. The longer we waited
2. Tell more I got to know him
3. The earlier we leave
4. The more you practice your English
5. The longer the telephone call

Vocabulary

9. Write down the new words and learn them.

1. a type - вид, різновид,
2. a direct current (DC) - постійний струм,
3. an alternating current (AC) - змінний струм,
4. an electric battery – електроакумулятор,
5. an electrical conductivity – електропровідність,
6. an electric circuit - електричне коло,
7. an electric charge - електричний заряд,
8. a disadvantage - недолік, мінус,
9. a voltage – напруга,
10. a power- сила,
11. a low voltage - низька напруга,
12. a high voltage - висока напруга,
13. a transmission – передача,
14. to change - змінювати,
15. a direction – напрямок,
16. a scientist – науковець,
15. to apply - використовувати, застосовувати,
16. an electric candle – електросвічка,
17. to feed – живитися,
18. to use – використовувати,
19. a source - джерело, початок,
20. desirable – бажаний,
21. a cause – причина,
22. to reach – досягати,
23. to rise - підійматися, збільшуватися.

UNIT 5. MAINTENANCE OF THE MACHINARY INSTALLATIONS

5.1 Materials

Get ready!

1. Before you read the passage, talk about these questions.

1 What kind of materials does mechanical engineer use to build machinery or tools?

2 What kind of knowledge of materials is required?

Reading

2. What are these objects made of? Match the words in the box with the pictures, then read the text.

steel gold wood plastic glass ceramic

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

When a machine or a tool is made, the most suitable material must be chosen by considering its properties, which can be classified as mechanical, thermal, electrical and chemical. The main types of materials used in mechanical engineering are metals, polymer materials, ceramics and composite materials. The most commonly used materials are metals, which can be divided into ferrous and non-ferrous. They can be used in their pure form or mixed with other elements. In this second case we have an alloy and it is used to improve some properties of the metals. The most commonly used ferrous metals are iron and alloys which use iron. Because iron is soft and pasty it is not suitable to be used as a structural material, so a small amount of carbon is added to it to make steel alloy.

Non-ferrous metals contain little or no iron. The most common non-ferrous metals used in mechanics are copper, zinc, tin and aluminium. Some common non-ferrous alloys are brass (formed by mixing copper and zinc), bronze (formed by mixing copper and tin) and other aluminium alloys which are used in the aircraft industry. Other examples of materials used in mechanical engineering are plastic and rubber.

PVC or polyvinyl chloride is a type of plastic and is used to insulate wires and cables. Rubber is a polymer and its best property is elasticity, as it returns to its original size and shape after deformation. Ceramic materials are good insulators: hard, resistant and strong, but brittle. Composite materials are made up of two or more materials combined to improve their mechanical properties. Concrete is reinforced with steel and is used in building engineering.

3. Read the text again and match the words with their definitions.

1 alloy	A	a type of plastic used for insulation
2 steel	B	a combination of different metals
3 PVC	C	an alloy formed by mixing iron and carbon
4 concrete	D	an alloy formed by mixing copper and zinc
5 brass	E	metals containing iron
6 ferrous materials	F	a composite material used to build houses
7 ceramic	G	a metal not suitable as structural material
8 iron	H	a good insulator but brittle

Speaking

4. Read the text again and answer the questions.

1 What is the basic classification of metals?

2 What are the characteristics of iron?

3 Why are alloys created?

4 Which materials are good insulators?

5 Is steel an alloy? Which metal does it contain?

Listening

5. Listen and complete the definitions with the following words.

cooking, wires, coins, alloy, air, copper, steel, carbon, gold, expensive, ductile, ferrum.

Iron: Its Latin name is (1) *ferrum.* It is magnetic and has a silvery colour. In prehistoric times it was used to make ornaments and weapons. If exposed to the (2) _____, it oxidises.

(3) _____: It is one of the most widely used metals by humans. In prehistoric times it was used to make cooking utensils, (4) _____and ornamental objects. It is used in (5) _____and cables.

(6) _____: It is the most (7) _____metal and is used to create precious jewellery. It is the most (8) _____metal.

(9) _____: It is an (10) _____ formed from iron and (11) _____It can contain between 2.1% and 4% carbon. It is also used for (12) _____utensils and pans.

6. Listen and complete the texts about the different processes metals can go through.

Metal processes

Casting is a 6,000 year old process. It is the oldest and most well-known technique based on three fundamental steps: moulding, melting and (1) _____. First the pattern is made to form the mould. Then an empty mould is created, and finally the empty cavity is filled with molten metal which is then left to solidify into the shape. Casting materials are

Usually (2) _____ but can also be plastic, resin or various cold materials for example (3) _____ . Casting is usually used for making complex shapes.

Drawing is a manufacturing process for producing wires, bars and (4) _____ by pulling on material through a series of dies until it increases in length. It is divided into two types: sheet metal drawing, and wire, (5) _____, and tube drawing.

Drawing is usually done at room temperature but it can be performed at elevated temperatures to hot work large wires, rods or hollow sections in order to reduce forces.

Forging is the process by which metal is heated and shaped by a compressive force using a hammer or a press. It is used to produce large quantities of identical parts, such as (6) _____ parts in the automobile industry. Cold forging is done at a low temperature using (7) _____ metals and plastic. Hot forging is done at a high temperature and makes metal easier to shape without breaking. In the past, forging was done by a blacksmith using a hammer. Nowadays industrial forging is done with (8) _____ powered by a machine.

Writing

7. Put the words in the correct order to make complete sentences.

1. taking their forms / fluid substances / into moulds/ solidify
2. drawing / room temperature / is done at
3 not essential / heat / is / in the drawing process
4 in the past / using / forging / a hammer / was done
5 can be / brittle materials / extrusion / done / with
6 many / is used / everyday objects / sheet forming / to make

8. Read the texts again and answer the following questions.

1. Which steps are included in casting?
2. What is the mould used for?
3.What does drawing use in order to process metals?
4. What types of drawing are there?
5. What kind of process is forging?
6. How was forging done in the past?
7. What does rolling consist of?
8. What materials can be used in rolling?
9. What are the advantages of extrusion?

10. What materials can be used in extrusion?

11. What kind of process is sheet metal forming?

12. What can vary in sheet metal forming?

Speaking

9. Work in pairs. Read the texts again and write the correct processes that produce the objects listed below.

Product	**Process**
wires	
pasta	
sheet	
bricks	
tubes	
rods and bars	
golden leaves	
machine parts	
concrete	

Vocabulary

10. Write down the new words and learn them.

1. alloy – сплав,
2. bar – засув,
3. brass – латунь,
4. brittle – ломкий
5. casting - лиття,
6. concrete – бетон,
7. extrusion – екструзія,
8. to mould – формувати,
9. rolling – прокатка,
10. to oxidise – окислюється,

11. pipe – труба,
12. rod – стрижень,
13. rubber – гума,
14. shape – форма,
15. sheet – лист,
16. steel – сталь,
17. tin – олово,
18. tool – інструмент,
19. wire – дріт.

5.2 What happens inside the engine

Get ready!

1. Before you read the passage, talk about these questions.

1 What do you know about the engine work?
2 What types of engine are there?

Reading

2. Read the text.

To begin learning how a diesel engine works, let's see what happens inside the engine, step by step. Basic Actions. First, air must be gotten into the cylinder because no fuel will burn without air. Burning or combustion is the process of uniting a fuel or combustible with the oxygen in the air. The process is a chemical one, which means that the fuel and oxygen, in uniting, change into new substances. Second, the air must be squeezed or compressed to a high pressure.

There are two reasons for compressing the air. One reason is that it the combustible mixture has been compressed to a high pressure before it starts to burn, it will produce more power than if it had not been compressed. The other reason is that when air (or any gas, for that matter) is compressed, its temperature goes up the higher the pressure, the higher the temperature. In a diesel engine, the air is compressed so much that it becomes as hot as red-hot iron, in fact, so hot that it will

ignite oil that is sprayed into it.

This is a fundamental difference between a diesel engine and a gasoline engine such as the one in an automobile. In a gasoline engine, a spark is used to ignite the combustible mixture, while in a diesel engine the fuel ignites by itself just from contact with air - air that is very hot because it has been highly compressed.

Third, the fuel must be squirted into the cylinder in the form of a line spray. The oil squirted in after the air has been compressed and thus heated to a high temperature. It must be in the form of a fine spray so that a cloud of oil droplets will spread throughout all of the air. This produces a thorough or "homogeneous" mixture of oil and air, which is needed for quick and complete combustion. (It all must happen so fast in an engine that there's no time to waste.)

Fourth, combustion takes place immediately after the oil is sprayed into the cylinder; this generates a large amount of heat. The gaseous mixture gets hotter and tries to grow larger or expand. It pushes oil the piston, which in turn transmits the force through the connecting rod to the crank on the crankshaft. This makes the crankshaft revolve and thus deliver power to whatever machine the engine is driving.

Fifth and last, when the piston has finished its preceding power stroke, and the gases in the cylinder have lost their pressure, the spent gases must be gotten rid of or exhausted.

Meaning of a "Cycle". When the cylinder is rid of the spent gases, it is ready to receive a fresh charge of air and start the cycle all over again. A cycle, in other words, is a full series of the separate steps or events which follow each other.

This is a good place to learn what is meant by the common terms of two-cycle engines and four-cycle engines. These terms are really abbreviations for two-stroke cycle and four-stroke cycle, which make more sense, but almost everyone now uses the shorter terms. In a two-cycle engine, it takes' two strokes of the piston (that is, one up-stroke and one down-stroke) to go through one complete cycle of events. In a four-cycle engine, a complete cycle requires four strokes of the piston (one up. one down, one up and one down). These terms apply to all kinds of internal-combustion engines, not merely to diesels.

Speaking

3. Read and guess the meanings of the new words.

1) confined space. An internal combustion engine is an engine in which combustion of the fuel takes place in a confined space.

2) profound impact. The invention and development of the internal combustion engine had a profound impact on human life.

3) ignition. The first internal combustion engines did not include compression of gas before ignition.

4) fossil fuel. Generally using fossil fuel (mainly petroleum), these engines appeared in transport in almost all vehicles.

5) significant distinction. The most important significant distinction between modern internal combustion engines and the early designs is the use of compression.

6) spark ignition. According to the type of ignition, engines can be divided into spark-ignition and compression-ignition engines.

7) four-stroke cycle, piston. A four-stroke cycle engine has four piston movements over two engine revolutions for each cycle.

8) valve, I-head engine, L-head engine. In accordance with valve location, engines are called I-head and L-head engines.

4. Read and translate following word combinations.

a great number of elements, the common properties of materials, the standard conditions of pressure, the great quantities of heat, the different atoms of substances, the electronic theory of matter, negative particles of electricity.

5. Read and guess the meanings of the new words.

1) confined space. An internal combustion engine is an engine in which combustion of the fuel takes place in a confined space.

2) profound impact. The invention and development of the internal combustion engine had a profound impact on human life.

3) ignition. The first internal combustion engines did not include compression

of gas before ignition.

4) fossil fuel. Generally using fossil fuel (mainly petroleum), these engines appeared in transport in almost all vehicles.

5) significant distinction. The most important significant distinction between modern internal combustion engines and the early designs is the use of compression.

6) spark ignition. According to the type of ignition, engines can be divided into spark-ignition and compression-ignition engines.

7) four-stroke cycle, piston. A four-stroke cycle engine has four piston movements over two engine revolutions for each cycle.

8) valve, I-head engine, L-head engine. In accordance with valve location, engines are called I-head and L-head engines.

9) reciprocating engine. A reciprocating engine has one or more cylinders in which pistons reciprocate back and forth.

10) combustion chamber. The combustion chamber is located in the closed end of each cylinder.

Vocabulary

6. Try to enrich your vocabulary:

a) analyze the following words with different suffixes and divide them into two groups — nouns and adjectives:

internal, combustion, development, successful, efficient, commercial, mixture, different, ignition, distinction, mechanical, injector, classification, motion, invention, operation, compression, production, application, significant, different;

b) make up as many words as you can by combining different parts of the words:

re- inject -ment

dis- intern -al

multi- compress -age

link -or

point -ion

place

Writing

7. Divide the following terms into two groups, those which belong to a) spark-ignition engines; b) compression-ignition engines.

Gasoline direct injection engines, homogeneous charge compression-ignition engines, multipoint port fuel injection engines, throttle body fuel injection engines, indirect injection engines, carbureted engines, direct injection engines.

Speaking

8. Think over the definitions of the terms which appear in the texts and dialogues and then:

a) agree or disagree with the following definitions

1. An internal combustion engine is an engine in which combustion of the fuel takes place in a confined space, producing expanding gases that are used directly to provide mechanical power.

2. A four-stroke cycle engine is an engine which has two piston movements over two engine revolutions for each cycle.

3. A two-stroke cycle engine is an engine which has four piston movements over one revolution for each cycle.

4. A single-cylinder engine is an engine which has some cylinders and pistons connected to the crankshaft.

5. A reciprocating engine is an engine which has one or more cylinders in which pistons reciprocate back and forth.

b) match each word with its correct definition

rotary engine, radial engine, in-line engine, W-type engine, carbureted engine

1. This engine is made of a block (stator) built around a large non-concentric rotor and crankshaft.

2. Cylinders are positioned in a straight line, one behind the other along the length of the crankshaft in this engine.

3. Pistons are positioned in a circular plane around a circular crankshaft in this

engine.

4. Air and fuel are mixed to facilitate the combustion process in this engine.

5. This is an engine of two different cylinder arrangements.

Vocabulary

9. Write down the new words and learn them.

1.combustion - горіння,

2. combustible - горючий,

3. mixture - суміш,

4. spark - іскра,

5. ignite - запалюватися,

6. squirt - забризкувати,

7. force - сила,

10. homogeneous - однорідний,

11. gaseous mixture - газова суміш,

12. expand - розширюватися,

13. connecting rod - шатун,

14. the crank - колінвал,

15. revolve - обертатися,

16. rid - позбавитися,

17. exhaust - вихлопні гази,

18. abbreviations - скорочення,

19. two-stroke - двотактний,

20. four-stroke - чотиритактний,

21. piston - поршень.

UNIT 6. SPECIFICATIONS

6.1. Dimensions

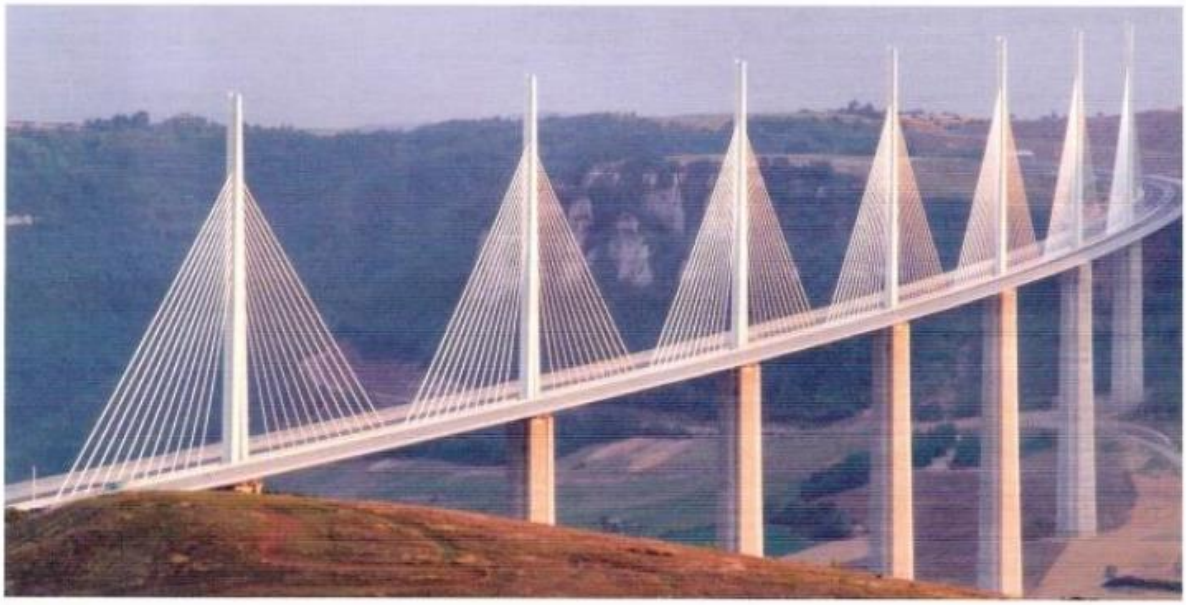
Get ready!

1. What do you know about this bridge?

1 What's it called?

2 Where is it?

3 How high is it?



Listening

2. Listen to part of a TV programme about the bridge. Check your answers to 1.

3. Work in pairs. Which of the following can you see in the photo?

cable deck pier pylon span

4. Listen to the next part of the TV programme and complete the specifications of the bridge.

Millau Bridge: specifications					
Structure	(1) *cable-stayed*		Length of outer spans	(7)	m
Completion date	(2) *December 2004*		Number of piers	(8)	
Material: cables and deck	(3)		Height of pylons above deck	(9)	m
Material: piers	(4)		Height of deck above water	(10)	m
Total number of spans	(5)		Length of deck	(11)	km
Length of inner spans	(6)	m	Width of deck	(12)	m

Vocabulary **5** Complete the table.

Adjective	high	long	_____	wide
Noun	_____	_____	depth	_____

Writing

6. Complete the sentences with the correct word in brackets.

1 The ____ of the road is 6 m. (wide/width)

2 The river is 230 kin (long/length)

3 The sea has a __of 330 m. (deep/depth)

4 These pylons are over 80 m (high/height)

5 These oil wells are more than 700 m (deep/depth)

6 Tile total __ of the road Is about 120 km. (long/length)

7 The tunnel is 15 m (wide/width)

8 The ____ of the bridge is 130 m. (high/height)

How	high wide long deep	is it? are they?	It's They're	2 10 100 1000	millimetres centimetres metres kilometres	high. wide. long. deep.

Speaking

7. Make questions about the Millau Bridge. Use the specification chart in 4.

8. Work in pairs. Ask and answer your questions in 7.

Example:

TV presenter How long are the inner spans?

Engineer: They're M2 meters long.

Reading

9. Read this article.

The **IP Code**

Part 1

Not to be confused with IP address or Intellectual property.

The **IP Code**, **International Protection Marking**, IEC standard 60529, sometimes interpreted as **Ingress Protection Marking**, classifies and rates the degree of protection provided against intrusion (body parts such as hands and fingers), dust, accidental contact, and water by mechanical casings and electrical enclosures. It is published by the International Electrotechnical Commission (IEC). The equivalent European standard is EN 60529.

The standard aims to provide users more detailed information than vague marketing terms such as *waterproof*. The digits (characteristic numerals) indicate conformity with the conditions summarized in the tables below. Where there is no data available to specify a protection rating with regard to one of the criteria, the digit is replaced with the letter *X*. The digit *0* is used where no protection is provided.
A rating of *X* for one or more of the protection criteria can be erroneously misinterpreted as "no protection". To illustrate, a piece of electronic equipment rated *IPX7* will almost certainly demonstrate a robust resistance to the ingress of particles, even though a rating for ingress of solids hasn't been formally assigned. Hence, an *X* designation shouldn't be automatically misconstrued as a lack of protection.

For example, a cellular phone rated at IP58 is "dust resistant" and can be "immersed in 1.5 meters of freshwater for up to 30 minutes". Similarly, an electrical socket rated IP22 is protected against insertion of fingers and will not be damaged or become unsafe during a specified test in which it is exposed to vertically or nearly vertically dripping water. IP22 or 2X are typical minimum requirements for the design of electrical accessories for indoor use.

10. Look at this table and learn what each digit or part of the IP code represents.

IP indication	Solid particle protection	Liquid ingress protection	Mechanical impact resistance	Other protections
IP	Single numeral: 0–6	Single numeral: 0–9	Single numeral: 0–9	Single letter
Mandatory	Mandatory	Mandatory	No longer used	Optional

Vocabulary

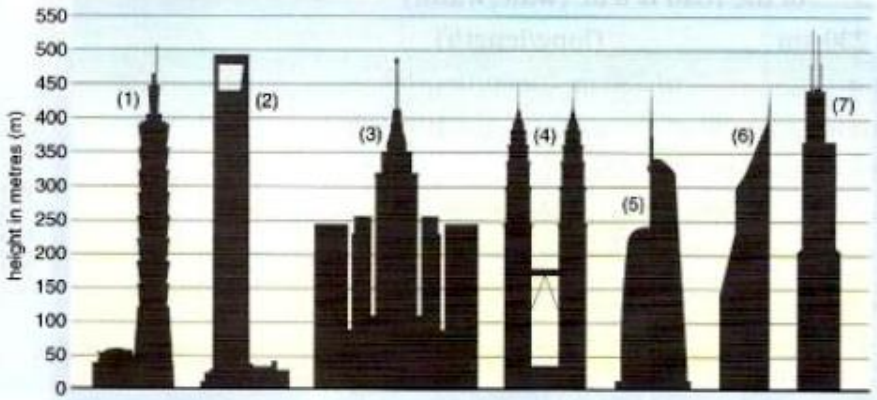
11. Write down the new words and learn them.

1. cable – кабель,
2. deck – палуба,
3. pier – пірс,
4. pylon – пілон,
5. span - проліт
6. dust - пил,
7. accidental – випадковий,
8. enclosure – застосування,
9. erroneously – помилково,
10. ingress protection – пиловологозахист,
11. designation – позначення,
12. similarly – аналогічним чином,
13. accessory – аксесуар.

6.2. Quantity

Get ready!

1. Try the quiz. Match the names of the buildings to the pictures. Write the number and the approximate height of each building.



A **Dubai Towers Doha, Qatar**
(Picture # ____; height _____ m)

B **Federation Tower, Russia**
(Picture # ____; height _____ m)

C **Abraj Al Bait Towers, Saudi Arabia**
(Picture # ____; height _____ m)

D **Sears Tower, USA**
(Picture # ____; height _____ m)

E **Petronas Towers, Malaysia**
(Picture # ____; height _____ m)

F **Taipei 101, Taiwan**
(Picture # ____; height _____ m)

G **Shanghai World Financial Centre, China**
(Picture # ____; height _____ m)

Listening

2. Listen and check your answers to 1.

Reading

3. Read the FAQs from the website and match them to the answers.

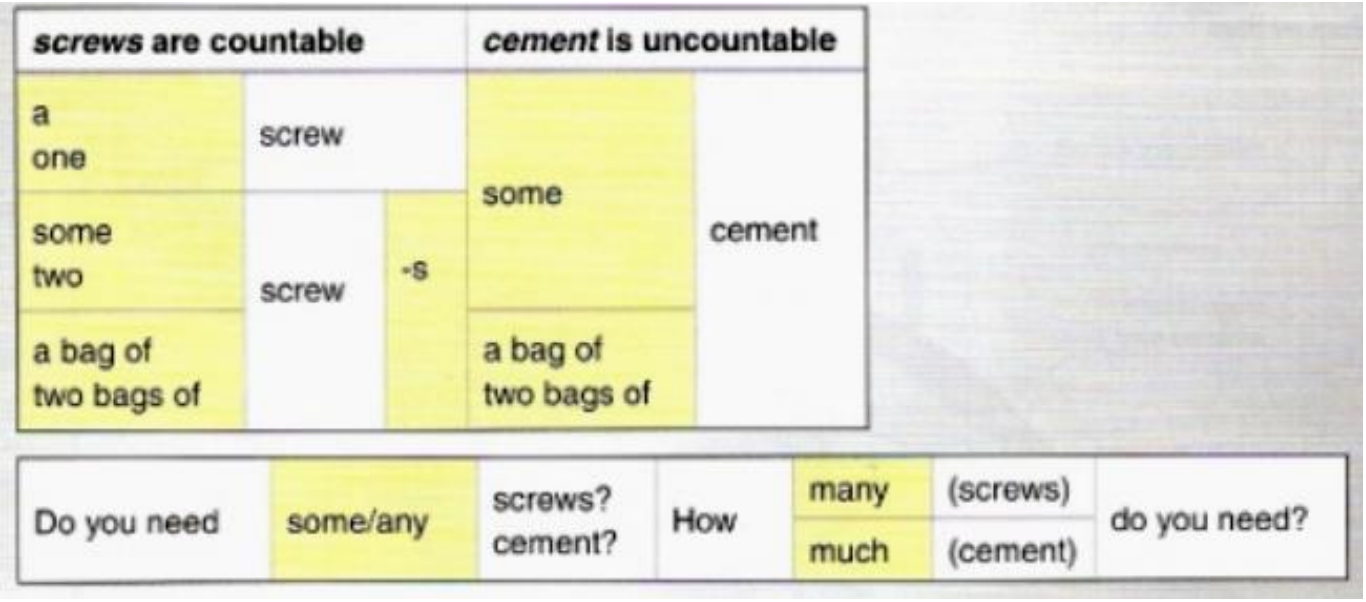
write: *8000 m³*; say: *eight thousand square metres.*
write: *250,000 m³*; say: *two hundred and fifty thousand cubic metres.*
write: *5 kg*; say: *five kilograms or five kilos.*

This is Taipei 101. It is currently the highest in the world. Here are some frequently asked questions (FAQs) about the building.

1 *How high is Taipei 101?*
2 *What's the footprint of the building?*
3 *How many storeys does it have?*
4 *How do you get to the top?*
5 *What's the building made of?*
6 *How much steel and concrete is in the building exactly?*

A About 700,000 tonnes.
B By super-fast elevator. The building has two high-speed elevators. Each elevator travels at 17 m/s.
C 101.
D It towers above Taipei at the amazing height of over 508 metres.
E Reinforced concrete, steel, aluminium and glass.
F The base of the building has an area of about 450 m².

Countable nouns can be both singular and plural. Examples: screw, nail, bottle. Uncountable nouns are always singular. Examples: concrete, cement, sand, oil.



***screws* are countable**			***cement* is uncountable**	
a one	screw		some	cement
some two	screw	-s		
a bag of two bags of			a bag of two bags of	

Do you need	some/any	screws? cement?	How	many much	(screws) (cement)	do you need?

Writing

4. Complete the dialogue with the words in the box.

any	how	many	much	some	What colour	What size

- Good morning. Can I help you?
- Hello. Do you have (1) screws?
- Certainly. (2)_____ do you need?
- Ten mil.
- OK And (3)_____ do you need?
- Fifty, please.
- Right. So that 's fifty 10 mil screws. Anything else?
- Yes. I need to buy (4)_____ paint, please.
- (5) _____?
- Black.
- OK. So (6) _____ black paint do you need?
- Six large tins, please.
- Anything else?
- No, that's all. Thanks.

Speaking

5. Make similar dialogues with your partner. Use the questions below and the information from the table.

How many? How much? What colour? What kind? What size? What type?

To buy …		
Item	**Quantity**	**Kind, size or colour**
screws	50	10 mm
paint	6 large tins	black
glue	2 tubes	superglue
nuts	30	15 mm
oil	15 L	motor oil
bolts	60	25 mm
cement	20 bags	white
nails	2 packets of 50	20 mm

Reading

6. Read this article.

The **IP Code**

Part 2

The ratings for water ingress are not cumulative beyond IPX6. A device which is compliant with IPX7, covering immersion in water, need not be compliant with IPX5 or IPX6, covering exposure to water jets. A device which meets both tests is indicated by listing both tests separated by a slash, e.g. IPX5/IPX7.

There are no hyphens in a genuine IP code. IPX-8 (for example) is thus a false IP code.

IP codes with the letter "K" are from ISO 20653:2013 Road Vehicles-Degrees of protection (IP code), which states that it is in accordance with IEC 60529 except for the "K" tests, which describe special requirements for road vehicles. ISO 20653 has replaced DIN 40050-9. By 2013, IEC/EN 60529 was updated to include the IPX9 water ingress test. This test appears to be identical to the IP69K test from ISO 20653.

This article contains a combination of IEC 60529 (also EN 60529) and other standards, such as ISO 20653. The original documents are available for purchase, and have important and specific requirements that cannot be fully reprinted due to copyright restrictions. This often includes drawings specifying the required test equipment, such as the shape of water nozzles used for water jet testing. Additional standards are often referenced that may contain important information. It's important to refer to the latest revision of the required standard when conducting tests for agency certification.

Vocabulary

7. Write down the new words and learn them.

1. nozzle – сопло,
2. additional – додатковий,
3. conducting – проведення,
4. screw – гвинт,
5. nail – цвях,
6. bottle – пляшка,
7. compliant – поступливий,
8. hyphen - дефіс,
9. update – оновлення,
10. purchase – покупка,
11. copyright – авторське право,
12. restrictions – обмеження
13. footprint – слід.

UNIT 7. AUTOMATIZATION OF THE MANUFACTORING PROCESS

7.1 Monitoring and control

Get ready!

1. In pairs, discuss the difference between an automated and a manual system.

What do you think a Building Management System (BMS) does in intelligent buildings? Suggest some operations that can be monitored and controlled automatically by the BMS in large buildings such as offices.

Listening

2. Roland, a mechanical and electrical services (M&E) engineer, is talking to Saskia, an architect, about the design of a new building. Listen to the conversation and answer the following questions.

1 What is a key characteristic of the client company?

2 How will this characteristic affect the building design?

3 What do you think is meant by presence detectors?

4 What does Roland say about design options and how does he describe option one?

3. Roland gives some examples of sensors and controls. Listen to the next part of the conversation and tick the points he mentions.

1 controlling the electric lighting inside the building

2 controlling the amount of solar radiation entering the building

3 controlling the air flowing in and out through the windows of the building

4 controlling the flow of warm and cool air around the interior of the building

Writing

4. Match the words in the box to the synonyms (l -5).

detect	detector	pick up	reading	regulate	set off	trigger

sensor sense

measurement activate

control

5. Complete the following extracts from the conversation by underlining the correct words.

1 Not just the usual systems that activate/detect the lights ...

2 We could use presence detectors to pick up/control other systems ...

3 ... a presence detector sets off/senses thot everyone's left a meeting room -..

4 ... a temperature sensor picks up a positive detector/reading ...

5 ... the sensor detects/regulates sunlight, and senses/triggers the blinds ...

6 ... those sensors set off/sense a circulation systems ...

7.... we'd use presence detectors and heat sensors to detected/regulate as many systems as possible?

6. In pairs, describe the following automated systems using the words in Exercise 5.

	sensor	**parameter**	**system**
1.	presence detector	movement	lights
2.	smoke detector	smoke	fire alarm
3.	thermostat room	temperature	electric convector heater
4.	pressure plate	weight of a person	intruder alarm

Listening

7. Rolland and Saskia go on to discuss an alternative control system in the building. Listen to the conversation and answer the following questions.

1. What assumption is the idea based on?
2. What design approach might be taken with regard to controls?
3. What is the advantage of this approach?

Reading

8. You are in the M&E design team for the new building project and have received the following email from the project engineer asking for your input. Read the email and, in pairs, discuss what the engineer wants you to do.

Could you look into the practicalities of using presence detectors for controlling the |lights in different parts of the building? We'll probably have a mixture of detector controlled systems and manual switches. The question is, which type of control do we want to have in each location? (Please see my list below.) A critical issue will be setting the switch-off delay in different locations, i.e. how long the lights remain on after the last movement is detected. On my last project, we had a lot of complaints from the client about the |lights going off while people were still in rooms. So can you think about different timer delays for different locations in the building?

Main locations: open-plan offices, individual offices, meeting rooms, corridors, store rooms.

Speaking

9. Prepare notes for a short talk to brief the project engineer using your ideas from Exercise 8. Student A, you are an M&E engineer. Brief the project engineer on your ideas. Student B, you are the project engineer. Listen to the briefing and ask questions about specific details. Swap roles and practice again.

Vocabulary

10. Write down the new words and learn them.

1. intelligent – розумний,
2. suggest – пропонувати,
3. presence detectors - датчики присутності,
4. amount – сума, кількість.
5. interior - інтер'єр,
6. sunlight - сонячне світло,
7. heater – обігрівач,
8. weight – вага,
9. assumption – припущення,
10. regard - що стосується,

11. advantage – перевага,
12. practicality – практично,
13. manual – керівництво,
14. complaint – скарга,
15. open-plan - з відкритим плануванням,
16. store – склад, магазин.

7.2 Referring to measurable parameters

Get ready!

1. In pairs, think of monitoring and control systems that are widely used around the home. Discuss how the following parameters are measured and/or controlled in these common domestic appliances.

Parameters: temperature, pressure, time, actions/movement.

Appliances: boilers, heating systems, refrigerators, washing machines.

Writing

2. Match the sensor or measuring system (1-5) to the industrial applications (a-e).

1	pressure measurement	a	monitoring the speed of water travelling along a supply pipe
2	temperature measurement	b	measuring the level of heat generated by an exothermic reaction
3	flow measurement	c	monitoring the number of cans moving along a conveyor belt
4	level measurement	d	monitoring the amount of ethanol contained in a storage tank
5	process recorders	e	checking the force exerted by steam inside a vessel

Speaking

3. In pairs, think of other uses for the kinds of sensor and measuring equipment in Exercise 2.

Listening

4. Jochem and Katerina, two process engineers at a chemicals plant, are discussing the monitoring and control systems that will be needed for a new production line. Listen to three extracts from their discussion and answer the following questions.

Extract 1 a What problem is discussed?

b What mechanical safety precaution is proposed?

Extract 2 c What issue is discussed?

d What three parameters related to consumption are important?

e To calculate the parameters, what does consumption need to be continuously measured against?

Extract 3 f What issue is discussed?

g Which two measurements need to be taken?

h What optimum value needs to be determined?

Writing

5. Match the words (1-10) from the discussion to the definitions (a-j).

1	input	a	the best / the most effective/efficient
2	output	b	how often something happens
3	optimum	c	the amount of supplies/ fuel used
4	differential	d	the total quantity so far
5	consumption	e	a specified period
6	cumulative	f	a value often expressed with per, for example units per hour
7	rate	g	the exit value, for example at the end of a process
8	cycle	h	the entry value, for example at the start of a process
9	frequency	i	the gap between two values
10	timescale	j	all the steps in a process, from tart to finish

Reading

6. The following specification was written following the conversation. Complete the text using the words in Exercise 5.

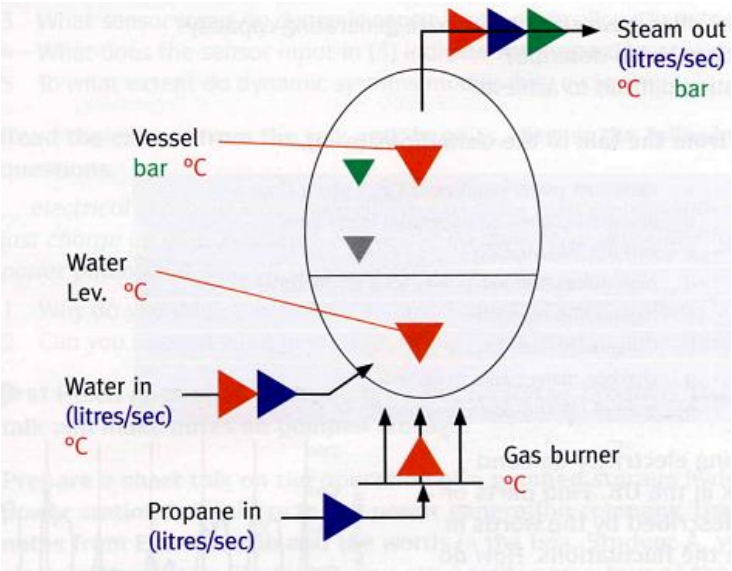
Vessel B1: Sensor and Measuring System Requirements. Two pressure sensors: one located inside the vessel, and a second situated on the pipe running downstream, to enable any pressure (l) _____ to be detected.

A flow meter to monitor gas (2)._____. Data will be recorded as a (3) _____ figure (total usage), and as flow (4) _____ , in liters per second. Note: Software will be configured to log flow against the (5) _____of a system clock, in order to pinpoint peak flow periods occurring between the start and finish of a given reaction (6) _____, and to assess the (7) _____ with which they occur.

Two temperature sensors: one at the entry point of the vessel, to measure (8) _____ temperature, and a second at the outlet point to monitor (9) _____ temperature. Note: Precise regulation of the entry temperature will be key to obtaining (10) _____ reaction performance.

Speaking

7. You and your partner are process engineers working with Jochem and Katerina at the chemical plant. You need to assess the sensors and measuring equipment required for the steam production facility. In pairs, discuss the requirements using the information in the diagram. Make notes of your ideas.



Speaking

8. In pairs, discuss what parameters can be determined for the installation of a heating cycle using your ideas from Exercise 7. You should assume that all the measurements will be recorded against a timescale.

9. In pairs, discuss the factors that cause mains electricity consumption to vary

Listening

10. Helen, an electrical engineer at a power station, is giving a talk to a group of visiting investors. Listen to the talk and note the five factors that influence electricity consumption.

1.
2.
3.
4.
5.

11. Complete the following extracts from the talk using the correct form of the words in the box.

decrease rise	***fall***	***increase***	

Vocabulary

12. Write down the new words and learn them.

1. appliances – побутові прилади,
2. can – банка,
3. precaution – обережність,
4. consumption – споживання,
5. pinpoint – малогабаритний,
6. peak – пік,
7. decrease – зниження,
8. rise – зростання,
9. assume – враховувати,
10. power station – електростанція,
11. requirements – вимоги,
12. steam – пар,
13. facility – засіб.

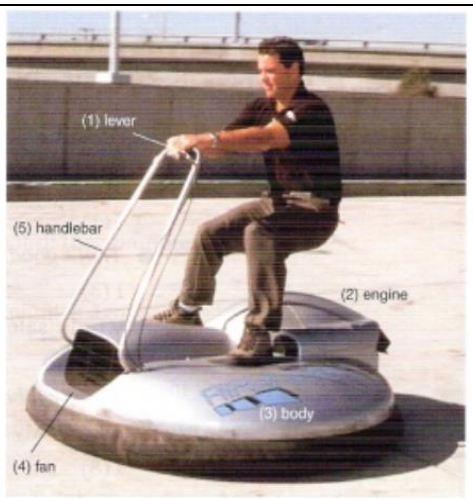
UNIT 8. TROUBLESHOOTING

8.1 Operations

Get ready!

1. Work in pairs. How does this vehicle move? Discuss with your partner.

2. What do the main parts do? Complete the chart.

Part	Function	
	drive the fan, pull the air in force the air down, control the speed and acceleration, steer the airboard, support the rider.	

Listening

3. Listen and check your answers.

4. Listen again and complete the dialogue.

- Look at the airboard. You can see the five main parts: the body, the engine, the fan, the handlebar and the two levers. The body (1) _____supports the rider and the engine (2) _____the fan. The handlebar (3) _____the airboard left and right.

- Ah yes, I see. So what (4) _____the fan (5) _____?

- It (6) _____the air in and (7) _____it downwards.

Right. And what (8)_____the two levers (9)_____?

They (10)_____the speed and acceleration of the airboard.

what	does	the engine		do?	It	drive	-s	the fan
	do	the lever	-s		They	control		the speed

Speaking

5. Make short dialogues about the parts of the airboard.

1 fan / cool the engine? no - push air downwards

2 engine i drive the wheels? no - drive the fan

3 levers / stop the airboard? no - Increase the speed

4 handlebars / control the brakes? no - steer the airboard

A: Does the fan coni the engine?

B: No, it doesn't.

A: So, what does it do?

B: It pushes air downwards.

Reading

6. Read this article from a technical magazine and answer the questions below.

The airboard how it works

You stand on the airboard and ride it like a skateboard. The board moves on a cushion of air, like a small hovercraft. It has fiberglass body, an engine, a large fan, a flexible rubber skirt, a friction wheel, a handlebar and two levers.

The engine and the fan are mounted on the body. The skirt and the friction wheel are suspended from the body. The handlebar s mounted on the body, at the front. The levers are attached to the handlebar.

The engine drives the fan. The function of the fan is to suck air in and to force it downwards. This pushes the vehicle upwards and propels it forwards. On the body there is a fiberglass platform. This supports the rider. The skirt contains the air and the cushion of air supports the airboard. The rider uses the handlebar to steer the board. One lever controls the speed of the engine and the fan. The other lever controls the friction wheel. The friction wheel touches the ground for one or two seconds and accelerates the airboard into the air. If you want to stop, simply release the levers.

1 What is the friction wheel for?

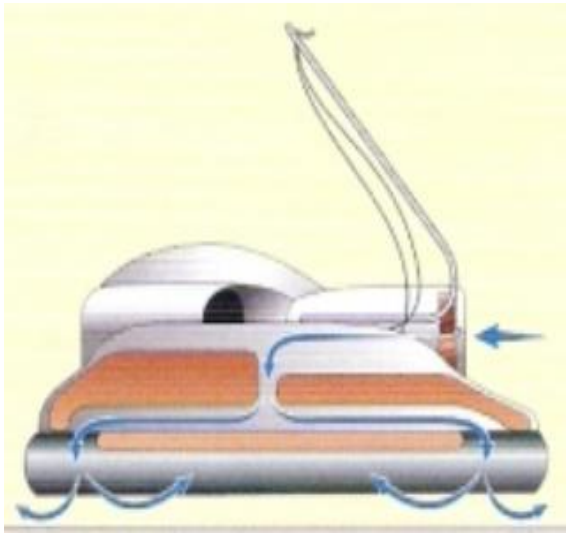
2 Is the skirt above or below' the body? What is it made of? Can you bend it?

3 Which part of the airboard does the rider stand on?

4 What happens if you take your hands off the levers?

5 Does *propel* (line 15) mean pull, push, hold or control?

6 Find words which mean the opposite of *backwards* and *upwards*.



Writing

7. Rewrite the sentences to give the same meaning.

1 The purpose of the handlebar is to steer the airboard.

2 The job of those levers is to control the speed of the airboard.

3 The function of the friction wheel is to accelerate the airboard.

4 The purpose of the fan and the engine is to propel the airboard forwards.

5 The function of the skirt is to hold the air and to support the airboard.

6 The job of the body and the platform is to support the rider.

Example: I The handlebar steers the airboard.

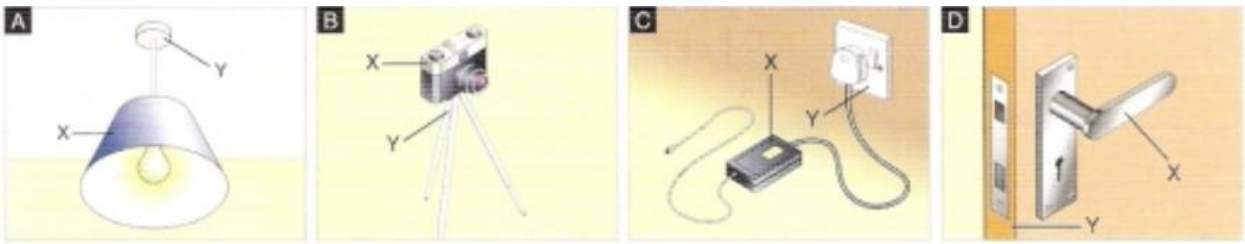
8. Match the pictures with the sentences.

1 X is attached to Y.

2 X is suspended from Y.

3 X is mounted on Y.

4 X is connected to Y.



9. Complete these sentences. Use each phrase once only, attached to connected to mounted on suspended from.

1 The huge cables of the Millau Bridge are _____ steel pylons.

2 The pylons and the road deck are _____ concrete piers.

3 Close the circuit switch. Now the lamp is _____ the current.

4 The shelf is _____ the wall with screws.

Reading

10. Read and translate the text very carefully.

Some Kbytes from Peter Norton's Life

Nobody knew an ordinary programmer called Norton in 1981. After being involved in programming since 1969, he bought one of PCs just appeared on the market. Just for fun. In 1982 at the age of thirty nine he left his job in the aerospace industry and founded his own firm "PETER NORTON COMPUTING", which began to supply utilities for IBM-compatible PC.

The stock of the company was $ 30 000. And the personnel consisted of one and the only man - P.N. himself. The main product at that time was THE NORTON UTILITIES BATCH which allowed the users to recreate lost data. Very soon Norton's name became known to millions and his products became a "brand-name". Peter Norton is a bachelor of mathematics from the famous Berkeley University. At that time he became and still is the presiding genius in the PC industry. For more than 20 years Norton has been saving people from catastrophes with computers. He enables them to manipulate data easily, protects from viruses and provides data security. His BMW number - "Mr. IBM PC" - proves that.

11. Answer these questions. If possible, ask someone else the same questions.

1. When was Peter Norton born?
2. When did Peter Norton start programming?
3. What was his aim?
4. Where did he work before founding his own company?

5. How did he call the company?

6. What was the first product of the company?

7. What university did he graduate from?

8. How does Peter Norton save people?

9. What is his BMW number?

Vocabulary

10. Write down the new words and learn them.

1. to be involved into - займатися,
2. to entertain – розважати,
3. batch – пакет,
4. the stock of the company - основний капітал компании,
5. “brand-name” - престижна категория товарных знаків, що присвоюють дуже якісним оригінальним товарам,
6. data security - захист інформації,
7. to prove – доводити,
8. versatile – універсальний,
9. anticipate – очікувати,
10. robust – надійний;
11. sophisticated – вдосконалений,
12. handlebar – кермо,
13. to steer – керувати,
14. fiberglass – скловолокно,
15. to support – підтримувати.

8.2 Hotline

Get ready

1. Everybody knows that computers can facilitate our every day duties work and study. But are you computer-literate? Do you know the essential concepts in informatics? Can you work with a computer?

Speaking

2. Discuss and dramatize the following dialogue:

Shop assistant How can I help you today?

Customer I'm thinking of buying a laptop, and I have a few questions.

Shop assistant What would you like to know?

Customer A friend of mine recommended buying Lap-Pal 2000. I'm wondering about power compatibility - I'll be taking this computer back to Argentina with me.

Shop assistant That's not a problem. This laptop has a universal power adapter.

You won't need to buy anything extra.

Customer OK. Does the package include a modem and DVD?

Shop assistant Yes, it does.

Customer That's good. Is this all the software that's included?

Shop assistant I think you'll find that the software package is very versatile. But if you anticipate needing something specific, I'm sure we can help you out.

Customer I'll need something with more robust capabilities for spreadsheets and databases.

Shop assistant Then I'd suggest moving up to the Versa2 package. It's a little more sophisticated, and it has enhanced printing and expanded memory.

Customer How much is this package?

Shop assistant Right now we're running a promotion. You can get the Versa2 software option for $79 over the base price.

Customer I see. Would you suggest purchasing an extended warranty?

Shop assistant Oh, yes. The package comes with a standard one-year warranty on parts and labor, but I'd recommend getting that extended option. It's only an additional $259, and you can avoid paying for repairs during the first three years.

Customer Would you consider throwing in the extended warranty?

Shop assistant Well, at these low prices, I'm afraid I can't do that.

Customer Mm... OK, I'll take it anyway, with the standard warranty.

Reading

3. Complete this text about using a computer for word processing.

I wrote a report on the (1) _____ this morning. When I finished, I (2) _____ out two copies-one for me and one for my boss. Then without any warning, the computer went (3) _____ and I'm afraid I lost the whole document. This is very unusual because normally I (4) _____ the data while I'm writing and then make a (5)_____ copy when I have finished, this morning I forgot.

Anyway, I gave the report to my boss, hoping that she would not ask me to change it in any way. She did. She thought it was a bit long and said it would be better if I used more (6) _____ to illustrate some of the written information. She also thought it would make the report look more attractive.

I went back and rewrote most of the report when the computer was OK. Only I (7) _____ part of the middle section which was rather repetitive, and I added extra (8) _____ as my boss advised. It did look better by the time I'd finished, and this time I remembered to (9) _____ it and make a (10) _____copy.

4. Read the telephone conversation and put the correct auxiliary verb (to be, to do, to have) into each gap. Use the contracted form where possible.

D) Good afternoon, Apple Helpline here. I'm Damian. How can I help you?

V) Oh, at last! Hello, Damian. I (**a**) _____ got a terrible problem with my computer. It (**b**) _____ (not) working at all!

D) OK, OK. Tell me your name and your company name and describe what (**c**) _____ happened.

V) My name's Valerie, Val actually, Valerie Marks. I (**d**) _____ (not) work for a company, I'm self-employed. I work at home, and I (**e**) _____ trying to meet an important deadline at the moment. This morning I (**f**) _____ working away happily, when suddenly everything stopped and a message came on the screen. Then the screen went blank.

D) OK Val, (**g**) _____ (not) worry! What (**h**) _____ the message say?

V) I can't remember exactly, because I (**i**) _____ (not) understand it, but I think it said something about not enough memory.

D) It's OK, Val. I understand. Tell me, Val, (**j**) _____ you switched the computer off?

V) No, I (**k**) _____ (not). It's still on.

D) Fine, Val. Now do exactly what I say. Go to your computer, OK? Can you see a "W" in the top right-hand corner? Click on that "W" with the mouse. What (**d**) _____ it say? Can you read it to me?

V) It says three things. There's a list of three things. First it says...

5. Here are some questions about the conversation. The words are mixed up. Put them in the right order. Then answer the question.

a) Val the is why Apple Helpline ringing?

_____?

Because _____

b) work for Val does company which?

_____

She _____

c) doing when computer she her was what stopped?

_____

She _____

d) Val why remember message the can't?

_____

Because _____

e) switched computer she has her off?

_____

No, _____

Writing

6. ***Rewrite the sentences with contracted forms where they are possible.***

Example I do not know where the post office is. *I* ***don't*** *know where the post office is.*

a) She has got two brothers and she does not get on with either of them.

_____

b) He has no brothers or sisters, he is an only child.

_____

c) We were not interested in the film so we did not stay until the end.

_____

d) He did not go to the party because he had a cold.

_____

e) They are getting married when they have saved enough money.

_____

f) John is not sure where Jill is.

_____

g) She is feeding the dog. It is always fed at six o'clock.

_____

h) I do not want them to know who I am.

_____

i) Do you not understand what I am saying?

_____

j) Where is the man who has been to New Zealand?

_____

Vocabulary

7. Write down the new words and learn them.

1. anticipate **–** очікувати**,**
2. robust **–** надійний**;**
3. sophisticated – вдосконалений.
4. terrible – жахливий,

5. self-employed – працюючий на себе,

6. deadline - граничний термін,

7. to switch off – вимикати,

8. suddenly – раптово,

9. exactly – точно,

10. considered – обґрунтований,

11. to express – виражати,

12. accepted – прийнятий,

13. advantage – перевага,

14. relatively – відносно.

STUDENTS' SELF-DIRECTED ACTIVITY ORGANIZATION GUIDE

UNIT 1. ENGINEERING. GENERAL CONCEPTS

1.1 Scientific aspect of Engineering

1. Read and guess the meanings of the new words. Translate the sentences.

1) science, scientist, scientific. Science deals with facts and relationships among these facts. Scientists may try to solve difficult mathematical problems. They use different scientific methods.

2) to search, researcher. Some scientists search for clues to the origin of the universe. Researchers have examined this problem.

3) to investigate. Some researchers investigate why we act the way we do.

4) to unify. Scientists develop theories that help them order and unify the facts.

5) to attempt. Scientists attempt to solve mathematical problems.

6) to explain. Scientists try to explain different phenomena.

7) to prove. A theory becomes a part of scientific knowledge if it has been tested experimentally and proved to be true.

8) complicated. The theory is complicated and hard to comprehend.

9) to appear. Many new fields of science have appeared.

10) boundary. The boundaries between scientific fields have become less clear.

11) to interconnect. All sciences are closely interconnected.

12) tool. Different kinds of tools and machines make our life easier.

13) discovery, invention. Discoveries and inventions made by scientists help shape our views about ourselves and our place in the universe.

14) to satisfy. Technology means the use of people's inventions and discoveries to satisfy their needs.

15) shelter. Since people have appeared on the earth, they have had to get food, clothes, and shelter.

16) steam engine. Industrial technology began to develop with the invention of the steam engine, the growth of factories, and the mass production of goods.

17) to contribute. Science has contributed much to modern technology.

18) nuclear power. Some modern technologies, such as nuclear power production and space travel, depend heavily on science.

2. Try to enrich your vocabulary:

a) analyze the following words with different suffixes and divide them into two groups — nouns and adjectives:

relationship, scientist, structure, researcher, mathematical, systematic, observation, general, scientific, natural, social, technical, numerous, influence, invention, industrial, development, production, different, television, communication;

b) make up as many words as you can by combining different parts of the words:

re- search -er -ly

inter- experiment -al

close -ion

invent -ment

general -ent

develop, connect, product, differ, nation.

3. Divide the following words into two groups, those which describe

a) science; b) technology.

Tools, steam engine, knowledge, systematic methods, theory, natural sciences, technical sciences, discoveries, to explain, television, radio, numbers, researchers, scientists, social sciences.

4. Think over the definitions of the words which appear in the texts and dialogues and then

a) agree or disagree with the following definitions:

1. Science is the study of knowledge which can be turned into a system, and which usually depends on seeing and testing facts and stating general natural laws.

2. Technology is a branch of knowledge dealing with scientific and industrial methods and their practical use in industry.

3. Researchis a serious and detailed study of a subject that is aimed at learning new facts, scientific laws, testing ideas, etc.

4. Tool is a piece of equipment that is designed to do a particular type of work.

5. Shelter is a building or something of the kind that gives protection.

b) match each word with its correct definition:

to prove, to search, to unify, to explain, to appear

1. To combine parts of something to form a single whole.

2. To make clear or easy to understand, usually by speaking or writing.

3. To become able to be seen, to come into sight.

4. To show to be true by means of facts, documents, information, etc.

5. To try to find something or someone by looking carefully.

1.2 Engineering. Connection between science and technology

1. Read the text, try to focus on its essential facts and choose the most suitable heading given below for each paragraph.

1) The Fields of Scientific Research

2) Different Groups of Sciences

3) The Connection between Science and Technology

4) The Importance of Science

5) What Is Science?

6) Technology

7) Methods of Scientific Research

SCIENCE AND TECHNOLOGY

The word “science” comes from the Latin word “scientia” which means “knowledge”. Science covers the broad field of knowledge that deals with facts and relationships among these facts.

Scientists study a wide variety of subjects. Some scientists search for clues to the origin of the universe and examine the structure of the cells of plants and animals.

Other researchers investigate why we act the way we do or try to solve complicated mathematical problems.

Scientists use systematic methods of study to make observations and collect facts. They develop theories that help them order and unify facts. Scientific theories consist of general principles or laws that attempt to explain how and why something happens or has happened. A theory becomes a part of scientific knowledge if it has been tested experimentally and proved to be true.

Scientific study can be divided into three major groups: natural, social, and technical sciences. As scientific knowledge has grown and become more complicated, many new fields of science have appeared. At the same time, the boundaries between scientific fields have become less clear. Numerous areas of science overlap and it is often hard to tell where one science ends and other begins. All sciences are closely interconnected.

Science has great influence on our lives. It provides the basis of modern technology – the tools and machines that make our life and work easier. The discoveries and inventions made by scientists also help shape our view about ourselves and our place in the universe.

Technology means the use of people's inventions and discoveries to satisfy their needs. Since people appeared on the earth, they had to get food, clothes, and shelter. Through the ages, people invented tools, machines, and materials to make work easier. Nowadays, when people speak of technology, they generally mean industrial technology. Industrial technology began to develop about 200 years ago with the invention of the steam engine, the growth of factories, and the mass production of goods. It influenced different aspects of people's lives. The development of the car influenced the way people lived and worked. Radio and television changed their leisure time. The telephone revolutionized communication.

Science has contributed much to modern technology. Science attempts to explain how and why things happen. Technology makes things happen. But not all technology is based on science. For example, people had made different objects from iron for centuries before they learnt the structure of the metal. But some modern

technologies, such as nuclear power production and space travel, depend heavily on science.

2. Agree or disagree with the following statements.

1. Scientists make observations and collect facts.
2. The boundaries between scientific fields have become less clear.
3. It is easy to tell where one science ends and other begins.
4. Science provides the basis of modern technology.
5. All modern technologies depend on science.

3. Match the adjectives in column A with the nouns in column B to form meaningful phrases.

A	B
1) broad	a) word
2) systematic	b) problem
3) natural	c) theory
4) Latin	d) principle
5) different	e) groups
6) general	f) methods
7) major	g) field
8) industrial	h) objects
9) scientific	i) technology
10) mathematical	j) sciences

UNIT 2. ELECTRICAL INSTRUMENT

2.1 Main electric instruments

1. Decide which of the verbs on the left collocate with the nouns on the right.

1) to cover a) clues
2) to deal with b) cells
3) to come from c) problems
4) to search for d) tools
5) to examine e) fields
6) to investigate f) facts
7) to develop g) word
8) to divide into h) theory
9) to provide i) groups
10) to shape j) basis
11) to invent … k) views

2. Try to enrich your vocabulary:

a) find words in the text which have the same meanings as the following words: wide, to research, to attempt, to examine, main, complex, difficult, to start, big, a motor, various, to study;

b) find words in the text whose meanings are opposite to the meanings of the following words:

narrow, easy, practice, artificial, old, more, to begin, small, little;

c) replace the words in italics with the words with similar and opposite meanings:

1. He happened to meet her in that broad street. 2. They are investigating complex problems. 3. It was a very difficult experiment. 4. They started researching this problem. 5. It was a big contribution.

3. Complete the sentences: change the word in capitals at the end of each sentence to form a word that fits suitably in the blank space.

1. … examine the structure of the cells SEARCH.

2. The … of radio and television changed our leisure time INVENT.

3. This theory was … proved EXPERIMENT.

4. He has won a prize at the … conference NATION.

5. There are … scientific fields DIFFER.

4. Insert the words at the sentence level: fill in the blanks with the missing words (the first letter of each word is given).

1. Science d… with a variety of subjects. 2. Scientists s… for the answers to the different questions. 3. The structure of the cells is e… by scientists. 4. ferent theories u… the facts. 5. The b… of some scientific fields are not clear. 6. Natural, social and technical sciences are closely i… 7. T… the ages, people have invented tools, machines, and materials to make work easier. 8. Science c… much to modern technology. 9. Some modern technologies d… on science. 10. During our l… time we watch TV.

2.2 Electric current in engineering

1. Read and guess the meanings of the new words. Translate the sentences.

1) to design. Engineers design structures, machines, apparatus, or manufacturing processes.

2) cognizance. They construct machines with full cognizance of their design.

3) to utilize, utilization. Utilization of advanced systems and devices simplify our life.

4) to encompass. Engineering encompasses chemical, electrical, civil engineering, and mechanical engineering.

5) predecessor. This society was a predecessor of that one.

6) processing. Chemical engineering covers areas from biotechnology and nanotechnology to mineral processing.

7) to overlap. In each new field, considerable overlap takes place.

8) core concepts. Engineering applies the core concepts of mechanics, kinematics, material science, structural analysis to mechanical systems.

9) to maintain. Mechanical engineering tries to apply the core concepts of different sciences to design, manufacture and maintain mechanical systems.

10) computer-aided engineering, product lifecycle management. These tools include both computer-aided engineering and product lifecycle management to design manufacturing plants.

11) heating and cooling systems, robotics. They design heating and cooling systems, robotics and medical devices.

12) to emerge. Mechanical engineering emerged as a field during the industrial revolution in Europe.

13) to incorporate advancement. Mechanical engineering incorporates advancements in technology.

14) to pursue. Mechanical engineers pursue developments in technology.

15) to proceed. They proceed to work on both power-producing and power-using machines.

16) internal combustion engines. Mechanical engineers work with power producing machines such as electric generators, internal combustion engines, steam and gas turbines.

17) material handling systems. Material handling systems and robotics are used in manufacturing.

18) artificial joints, heart valves. Engineers should design products that are both challenging and exciting, for example, artificial joints and heart valves just to name a few.

19) tough, flexible, responsive, smart. Engineers can make materials that are not just lighter, tougher and more flexible but also responsive and smart.

20) tiny. They manufacture complex nanocomponents from these materials in order to create tiny machines.

21) to cope with. The student has managed to cope with his task.

2. Try to enrich your vocabulary:

a) analyse the following words with different suffixes and divide them into two groups — nouns and adjectives:

combination, safety, energy, scientific, difference, mechanical, chemical, automation, engineering, pollution, consumption, considerable, structural, production, operation, different, industrial, advancement, development, generator;

b) make up as many words as you can by combining different parts of the words:

nanotechnology

design

vision

structure

-er

-ance

-al

-ly

3. Divide the following terms into two groups, those which describe a) engineering; b) mechanical engineering.

Chemical engineering, to maintain mechanical systems, electrical engineering, machinery, mechanical power, civil engineering, mechanical engineers, to test tools, engines, mechanical devices, internal combustion engines.

4. Think over the definitions of the words and then:

a) agree or disagree with the following definitions

1.Engineering is application of scientific principles aiming at designing and developing structures, machines, and manufacturing processes.

2. Mechanical engineering is the science or profession dealing with studying, designing, or building machines.

3. Biotechnology is the use of bacteria and plant/animal cells for industrial or scientific purposes.

4. Valve is the part of a machine or piece of equipment that opens and closes in order to control the flow of air or liquid.

5. Automation is the process easing working environment.

b) match each word with its correct definition competence, CAD (computer-aided design), cognizance, tool, concept

1. The process by which you recognize and understand something.

2. A piece of equipment that is designed to do a particular type of work.

3. The process of using drawings made by a computer to design machines, building, etc.

4. Skills, knowledge and suitable experience.

5. The idea of something that exists.

UNIT 3 THE METHOD OF THE ENGINEERING DESING

3.1 Flexible manufacturing system

1. Read and guess the meanings of the new words. Translate the sentences.

1) flexible manufacturing system (FMS). FMS is a manufacturing technology.

2) to incorporate. FMS incorporates a system view of manufacturing.

3) to evolve. The concept of FMSs went on evolving at that time.

4) to succeed in. Computerized numerical controls succeeded in bringing a controlled environment to the factory floor.

5) numerically controlled, direct-numerically-controlled machines. They managed to control the manufacture using numerically-controlled and direct-numerically-controlled machines.

6) sophisticated material-handling systems. Early FMSs contained sophisticated material-handling systems.

7) incredibly. Early FMSs were controlled by incredibly complex software.

8) flexible cell. The trend in FMS is towards small versions of the traditional FMS called flexible manufacturing cells (FMC).

9) to introduce a wide scale automation. The progress of computing machines allowed introducing a wide scale automation of all branches of industry.

10) independent development. The progress of computing machines led to independent development of automation process.

11) computer-aided designing (CAD). Automated data processing includes automated control systems and computer-aided designing.

12) computer-aided manufacturing (CAM). Automation of production technology includes numerically-controlled equipment, computer aided manufacturing, and industrial robots.

13) to be interconnected. The various cells for machining are interconnected by an automated transport system.

14) loading, unloading stations. The various machining cells are interconnected via loading or unloading stations by an automated transport system.

15) possibility. This prospect of automation and flexibility presents the possibility of producing non-standard parts.

16) competitive advantage. They employ different competitive advantages to maintain a lead in this industry.

17) to approach. The general objectives of FMS are to approach the efficiencies and economies of mass production.

18) small- and medium-lot-size production. FMS maintains the flexibility required for small- and medium-lot-size production of variety of parts.

19) to fall within. Two kinds of systems for manufacturing fall within the FMS spectrum.

20) generic. A generic FMS consists of some components.

21) set-up time, change-over. A set of stations do not require significant set-up time or change-over between successive jobs.

22) milling, boring, drilling. These machines perform operations of milling, boring, drilling, etc.

23) routing. Computers direct the routing of jobs through the system.

24) to be capable of. Computers are capable of performing complex tasks.

25) to track. Computers track the status of all jobs in progress.

26) to ensure. A network of supervisory computers and microprocessors is to ensure that the right tools are available for the job.

27) to provide the monitoring. Computers provide the monitoring of correct performance of operations.

28) to require attention. Computers signal problems requiring attention.

29) to make customizations. Machines can be used to assemble different parts and to make customizations.

30) to implement. Several companies decided to implement flexible manufacturing systems.

31) agility. The common word for today’s manufacturer is agility.

3.2 Safe working environment

1. Match the adjectives in column A with the nouns in column B to form meaningful phrases.

A B

1) stiff a) amount

2) electrical b) steel

3) various c) element

4) ferrous d) conductivity

5) ductile e) insulators

6) brittle f) materials

7) indispensable g) ceramics

8) stainless h) cast iron

9) frequent i) properties

10) large j) metals

2. Decide which of the verbs on the left collocate with the nouns on the right.

1) to encompass a) classes

2) to influence b) thermoplastics

3) to contain c) material

4) to change d) properties

5) to choose e) nickel

6) to mould f) technology

7) to substitute g) popularity

8) to increase h) steel

9) to save i) groups

10) to memorize j) weight

3. Try to enrich your vocabulary:

a) find words in the text which have the same meanings as the following words:

for example, people, to embrace, big, an element, different, to manufacture, aim;

b) find words in the text whose meanings are opposite to the meanings of the following words:

the latest, unlimited, synthetic, small, decrease, soft, heavy, low, rare, the worst, stiff, expensive, organic, conductors;

c) replace the words in italics with the words with similar meanings:

1. Materials science includes different classes of materials. 2. Materials science embraces the traditional classes of engineering materials: metallic and non-metallic materials. 3. Clay was used to manufacture ceramics. 4. There are a lot of alloys containing copper, for example, brass, bronze, etc. 5. Ancient people had an access to a very limited number of natural materials.

4. Complete the sentences: change the word in capitals at the end of each sentence to form a word that fits suitably in the blank space.

1. … steels which contain nickel do not rust STAIN.
2. Materials were very important in the … of societies DEVELOP.
3. Carbon increases … in cast iron BRITTLE.
4. There are … kinds of engineering materials DIFFER.
5. Corrosion … is one of the aluminum properties RESIST.

5. Insert the words at the sentence level: fill in the blanks with the missing words (the first letter of each word is given).

1. A lot of materials with specialized p… have been developed. 2. Metallic materials which contain iron are called f… metals. 3. Steels which contain t… are extremely hard. 4. Copper is a m… metal. 5. Copper is a f… element of various alloys. 6. R… is a natural polymer. 7. T… can be moulded numerous times. 8. The plastics properties are i… . 8. Ceramics are strong and s… . 9. Materials science e… different groups of materials. 10. Metallic materials include metals and a… .

UNIT 4. REFRAGIRATION EQUIPMENT AND ALL INSTALLATIONS

4.1 Refrigeration process

1. Look at the scheme of two-temperature refrigerated semitrailer. Write down the new words and learn them.

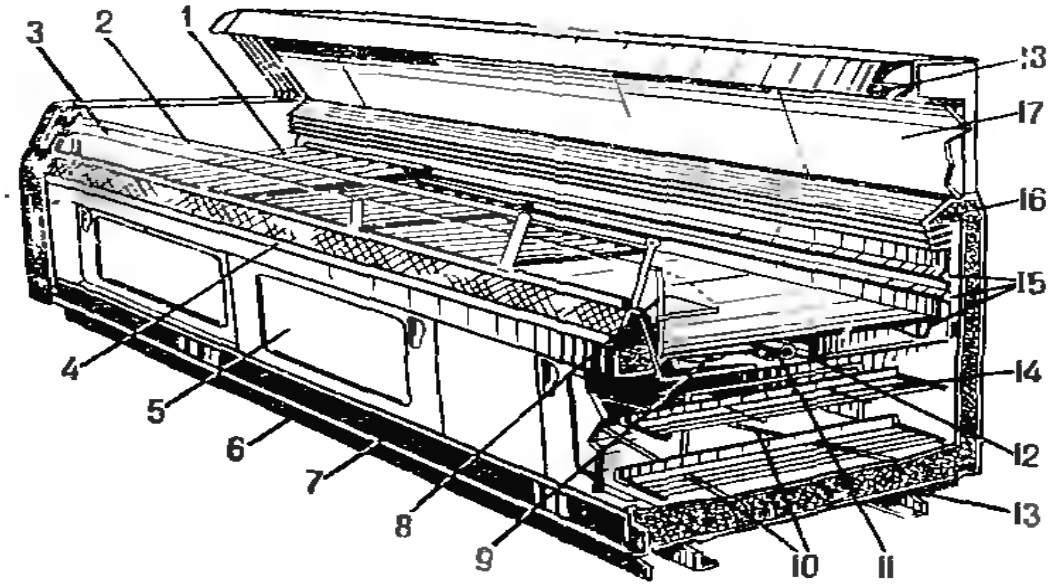


Рис. 2. Refrigerated display case / охолоджуваний прилавок-вітрина

1. shelf - полиця;

2. heated top rail - нагрівна верхня планка ;

3. double glass front wall - передня стіна з подвійним склом ;

4. stainless steel rail - планка з нержавіючої сталі ;

5. storage compartment door двері - відділення для зберігання продуктів;

6. plate to conceal drain lines - планка для ліній спуску талої води;

7. protective rail for electrical raceway - планка огорожі лінії подачі електроенергії;

8. heavy plate glass - товсте , листове скло;

9. oilless fan motor - незмащений електродвигун вентилятора ;

10. drain channels - дренаж ;

12. refrigerant lines - трубопроводи холодоагенту.

11. electric defrost - випаровувач ;

12. steel base for air circulation - стальна опора для циркуляції повітря ;

13. pullout shelf - виїзна шафа ;

14. shelf adjustments - направляючі поличок ;

15. fiberglass insulation - ізоляція зі скловолокна ;

16. mirror - дзеркало,

17. fluorescent light - флуоресцентний світло.

2. Match the words in column A with the words in column B to form meaningful phrases

A	B
1) mechanical	a) designs
2) fossil	b) power
3) profound	c) result
4) significant	d) impact
5) in-cylinder	e) space
6) combustion	f) chamber
7) expanding	g) gases
8) efficient	h) compression
9) early	i) fuel
10) confined	j) distinction

4. 2 Electric current in the refrigeration equipment

1. Decide which of the verbs on the left collocate with the nouns on the right.

1) to run on	a) coal gas
2) to deliver	b) cylinders
3) to push	c) air (fuel) mixture
4) to inject	d) power
5) to slide against	e) process
6) to identify	f) surface
7) to facilitate	g) engines
8) to mix	h) air and fuel
9) to position	i) piston

10) to produce j) motion

2. Try to enrich your vocabulary:

a) find words in the text which have the same meanings as the following words:

limited, to construct, plane, important, to join, car, energy, to throw out, different, forward, application, to place;

b) find words in the text whose meanings are opposite to the meanings of the following words:

unusual, inefficient, small, to disjoin, to end, ancient, mobile, solid, forward, external, after, the last, outer, in front of, longer;

c) replace the words in italics with the words with similar meanings:

1. The most important distinction between modern internal combustion engines and the early designs is the application of compression and, in particular, in-cylinder compression. 2. Power is delivered to a rotating output crankshaft by mechanical linkage with the pistons. 3. The connecting rods of the pistons are joined to a master rod. 4. Opposed-cylinder engines are common on some automobiles with an even number of cylinders from two to eight or more. 5. He constructed the internal combustion engine.

3. Complete the sentences: change the word in capitals at the end of each sentence to form a word that fits suitably in the blank space.

1. The first internal combustion engines did not have in-cylinder… COMPRESS.
2. In accordance with valve …, the internal combustion engines are called I-head engines and L-head engines LOCATE.
3. Basic design divides engines into … and rotary ones RECIPROCATE.
4. The … chambers are built into the non-rotating block in rotary engines COMBUST.
5. The … of the internal combustion engine had a profound impact on human life INVENT.

4. Insert the words at the sentence level: fill in the blanks with the missing words (the first letter of each word is given).

1. The invention and development of the internal combustion engine in the nineteenth century has had a p… impact on human life. 2. The first internal combustion engines did not have c… before i… . 3. Opposed-cylinder engines are often called f… engines. 4. A two-stroke cycle engine has two p… movements over one revolution for each cycle. 5. Radial engines are engines with pistons positioned in a circular plane around a circular c… 6. According to the basic design, engines are divided into r… and rotary engines. 7. In h… charge compression ignition engines, well-mixed fuel and oxidizer are compressed to the point of auto-ignition. 8. According to the type of c…, engines can be classified as air-cooled engines and liquid-cooled engines (water-cooled engines). 9. Engines of two different c… arrangements have been classified as W-type engines in the technical literature. 10. In-line engine cylinders are positioned in a s… line.

UNIT 5. MAINTENANCE OF THE MACHINARY INSTALLATIONS

5.1 Engineering materials

1. Try to enrich your vocabulary:

a) analyse the following words with different suffixes and divide them into two groups — nouns and adjectives:

development, civilization, natural, possible, various, traditional, ferrous, different, brittleness, stainless, structure, corrosion, resistance, thermal, electrical, frequent, indispensable, action, industrial, insulator, superconductor:

b) make up as many words as you can by combining different parts of the words:

super- develop -ment
in- tradition -al
re- resist -ance
differ -ent
stain -less
brittle -ness
conduct -or
mould

2. Divide the following words into two groups, those which describe or belong to a) metallic materials; b) non-metallic materials.

Ferrous, iron, polymers, alloys, thermoplastics, steel, chromium, polycarbonate, copper, rust, tungsten, cobalt, ductile, brass, electrical insulators, thermosets, non-ferrous, cobalt, nickel, zinc, aluminium, ductile, bronze, rubber, thermoset, plastics, polyvinylchloride, ceramics, clay, porcelain, malleable, cast iron.

3. Think over the definitions of the words and then:

a) agree or disagree with the following definitions

1. Common means happening frequently or existing in large amounts or numbers.

2. Rubber is a strong substance that can bend easily and is used for making things such as tyres or boots.

3. Non-ferrous metals are metals that do not contain iron.

4. Ferrous metals are metals that contain iron.

5. Amount is a quantity of something.

b) match each word with its correct definition cast iron, property, conductor, insulator, copper

1. Quality or a feature of something.

2. Ferrous metal.

3. Non-ferrous metal.

4. Substance that allows heat or electricity to pass through it.

5. Substance that reduces the amount of heat or electricity that can pass through something.

5.2 Engines

1. Try to enrich your vocabulary:

a) analyze the following words with different suffixes and divide them into two groups — nouns and adjectives:

internal, combustion, development, successful, efficient, commercial,

mixture, different, ignition, distinction, mechanical, injector, classification,

motion, invention, operation, compression, production, application, significant, different;

b) make up as many words as you can by combining different parts of the words:

re- inject -ment

dis- intern -al

multi- compress -age

link -or

point -ion

place

2. Divide the following terms into two groups, those which belong to a) spark-ignition engines; b) compression-ignition engines.

Gasoline direct injection engines, homogeneous charge compression-ignition engines, multipoint port fuel injection engines, throttle body fuel injection engines, indirect injection engines, carbureted engines, direct injection engines.

3. Think over the definitions of the terms which appear in the texts and dialogues and then:

a) agree or disagree with the following definitions

1. An internal combustion engine is an engine in which combustion of the fuel takes place in a confined space, producing expanding gases that are used directly to provide mechanical power.

2. A four-stroke cycle engine is an engine which has two piston movements over two engine revolutions for each cycle.

3. A two-stroke cycle engine is an engine which has four piston movements over one revolution for each cycle.

4. A single-cylinder engine is an engine which has some cylinders and pistons connected to the crankshaft.

5. A reciprocating engine is an engine which has one or more cylinders in which pistons reciprocate back and forth.

b) match each word with its correct definition rotary engine, radial engine, in-line engine, W-type engine, carbureted engine

1. This engine is made of a block (stator) built around a large non-concentric rotor and crankshaft.

2. Cylinders are positioned in a straight line, one behind the other along the length of the crankshaft in this engine.

3. Pistons are positioned in a circular plane around a circular crankshaft in this engine.

4. Air and fuel are mixed to facilitate the combustion process in this engine.

5. This is an engine of two different cylinder arrangements.

UNIT 6. SPECIFICATIONS

6.1 Dimensions

1. Read the text about technical drawing.

Technical drawing, also known as drafting**,** is the act and discipline of composing plans. The main purpose of technical drawing is to describe or explain all the characteristics of a product, giving all the necessary information that will help a manufacturer to produce that component. The visual image should be accurate in terms of dimensions and proportions, and should provide an overall impression of what an object is or does. It is a precise task requiring a high level of skill and suitable engineering tools. A drafter is the person who makes a drawing and who requires a wide knowledge of geometry, trigonometry and spatial comprehension, and in all cases must be precise and accurate and give great attention to detail.

People who communicate with technical drawings use a visual language and technical standards that define practical symbols, perspectives and units of measurement. What are the tools and instruments used by a drafter in manual drafting? A T-square, a protractor, a compass, rulers**,** and triangles**.** Paper is also important and can be divided into layout paper, which is thin and fragile, and cartridge paper, which is heavier and more suitable for final drawings. Pencils used in drawing are graded from H to F depending on the hardness**.** The final drawing is made using a technical pen, graded according to the point**,** which must maintain the same line width. They are used with a range of stencils to add symbols, letters and patterns to the drawing. Rubbers remove pencils or pen writing when mistakes are found. Correction fluid is used to mask text errors.

2. Read the text again and choose the correct answer.

1 Technical drawing is needed to ...

A make a scale of the product.

B practice pens, rulers and stencils.

C let the manufacturer understand the requirements.

2 The drafter needs .. .

A some paper and a pencil.

B a wide range of technical instruments.

C the final product.

3 Paper is chosen considering .. .

A what sort of drawing the drafter is going to make.

B the pencils he/she is going to use.

C the drafter's preference.

4 Pencils are graded according to ...

A hardness.

B hardness and colour.

C hardness and point.

5 A technical pen .. .

A makes regular lines.

B maintains the same line width.

C draws lines of the same length.

6 When mi stakes are found .. .

A we can't correct them .

B they're removed with correction fluid.

C stencil can cover them.

6.2 Quantity

1. Read the text about automation technologies and answer the questions.

Numerical control over automated devices has resulted in a rapidly expanding range of applications and human activities. Computer-aided technologies (CAx) is a **broad** term that means the use of computer systems to **aid** in the design, analysis, and manufacture of products, by serving the basis for mathematical and organizational tools used to create complex systems. It includes computer-aided design (CAD software) and computer-aided manufacturing (CAM software).The current limit of computer-aided technologies is that some abilities are well **beyond** the capabilities of

modern mechanical and computer systems. Moreover, these technologies require high-skilled engineers and the synthesis of complex sensory data to work properly. As for costs involved, in some cases, automation is more expensive than mechanical approach.

Thanks to the incredible improvements in automation technology, a number of other technologies have developed from it, such as domotics and robotics. Domotics is a field in building automation aimed at the application of automation technologies in households for the comfort and security of its residents. This means that lights, heating and conditioning systems, windows **shutters,** kitchen equipment and **surveillance** systems can be controlled by a remote control or even by a cell phone at a distance. Robotics is a special branch of automation in which the automated machines have certain human features and are used to replace human workers in factory operations. Robots are computer controlled mechanical devices that are programmed to move, manipulate objects and interact with the environment. **Nowadays** more and more sophisticated robots are being built to serve various practical purposes, for example in houses, businesses, in the **army** and for medical appliances for **disabled** people.

1 What does computer-aided technologies mean?
2 Which software does CAx include?
3 What are the current limits of CAx?
4 Can you name two applications of automation technologies?
5 How does a domotic house differ from a traditional house?
6 What are robots used for?

2. Think of what robots can do nowadays and tick the boxes below.

Nowadays robots can …
get sick
go underwater
see obstacles

speak fluently

handle dangerous material

smell things

clean nuclear waste

o taste food

explore volcanoes

move objects

go to space

have feelings

easily walk on two legs

UNIT 7. AUTOMATIZATION OF THE MANUFACTORING PROCESS

7.1 Monitoring and control

1. Complete the text with the words in the box.

creation advantages boards drawings software defects faster instructions traditional reduce modification electronically

Drawing (1) _____ and manual drawing are not always precise and rapid (2)_____ design is usually slow, especially in its revision and (3) _____. For this reason manufacturing firms have replaced manual drawing with computer-aided design (CAD) to carry out functions related to design and production.

This computer technology assists the designer in the (4) _____, modification and analyze is of a physical object. Nowadays computer (5) can easily provide a three-dimensional drawing, which allows engineering designers to see how mechanical components may fit together without making mode ls thus saving a lot of time. CAD is much (6) and more accurate than manual drawing, designs can be quickly modified, reproduced and transmitted (7) _____. Computer simulated analysis of the model helps experts find problems and (8) without building prototypes, in this way saving a lot of money and time. When the design is ready, the CAD system can generate the detailed (9) _____ needed to start manufacturing equipment controlled by computers, they form an integrated CAD/CAM system. Computer-aided manufacturing(CAM) offers significant (10) over traditional approaches by control ling manufacturing equipment with computers instead of human labour. CAM converts the design of a component into computer language and it gives (1 1) _____ to the computer regarding machine operations.

Thanks to CAD/CAM systems it is possible to eliminate operator errors and (12) _____ manufacturing costs .

2. Read the text again and match each sentence with its ending.

1 CAD helps designers	a seen from any angle and are easily
2 By using a CAD technology	manipulated.
3 Unlike manual drawing, CAD	b to draw, modify and correct designs.

4 CAD allows us to save	c the design into computer language.
5 CAD designs can be	d defects can be easily found .
6 CAM is the use of computer software	e provides three-dimensional drawings g
D time and money.	minimize errors and manufacturing costs.
7 The CAM system turns	h to control machine tools in the
8 CAD/CAM systems	manufacturing process.

3. Read the text about CNC and put the sentences in the correct order.

Computer Numerical control (CNC) refers to the automation of machine tools in manufacturing processes. The machines are controlled by computer software which carries out a series of operations automatically. The first NC machines were built in the 1940s and 1950s. They are used to cut and shape products, such as automobile parts that need precise specifications. Parts must be carefully planned and prepared by CNC programmers. First they view the three-dimensional computer aided designed part. Then they calculate where to cut, the speed and shape and select the tools and materials. The CNC programmers translate the planned machine operations into a set of instructions. These instructions are translated into a computer aided manufacturing (CAM) program containing a set of commands for the machine. The commands are a series of numbers which explains where to cut and the position of material. The computer checks all the operations made by the machine tools.

a The planned machine operations are translated into a set of instructions.
b These instructions are translated into a CAM program.
c The program contains a set of commands for the machine.
d It is calculated where to cut and tools and materials are selected.
e The computer checks all the operations made by the machine tools.
f Programmers view the part in its three-dimensional computer aided design.

7.2 Referring to measurable parameters

1. Read the text about automation and match the words with their definition.

Mechanization refers to the process of providing human beings with machinery capable of assisting them with the muscular requirements of work. A further development of mechanization is represented by automation, which implies the use of control systems and information technologies to reduce the need for both physical and mental work to produce goods. Automation has had a great impact on industries over the last century, changing the world economy from industrial jobs to service jobs. In manufacturing**,** where the process began, automation has meant that the desired results can be obtained through a series of instructions made automatically by the system, which define the actions to be done. Automated manufacturing grants higher consistency and quality, while reducing lead times and handling**.** It also improves work flow and increases the morale of workers when a good implementation of the automation is made. However, the purpose of automation cannot be seen only in terms of a reduction of cost and time; there are several more aspects to be taken into consideration. For example, while it is true that automation offers a higher precision in the manufacturing process, it is also true that it requires skilled workers who can make repairs and manage the machinery

The following table sums up the main advantages and disadvantages of automation:

Advantages	**Disadvantages**
Speeding up the developmental process of society	Disastrous effects on the environment (pollution, traffic,
Replacing human operators in tasks that involve hard physical or monotonous work replacing human beings	energy consumption)
Saving time and money as human operators can be employed in higher-level work automate all the desired tasks	Sharp increase in unemployment rate due to machines
Replacing human operators in tasks	Technical limitations as current technology is unable to
	Security threats as an automated system may have

done in a dangerous environments (fire, space, volcanoes, limited level of intelligence and can make errors nuclear facilities, underwater) Higher reliability and precision in performing tasks which may exceed the cost saved by the automation itself Economy improvement and higher productivity	Unpredictable costs due to research and development, High initial costs as the automation

1 manufacturing	a the time between the design of a product and its production
2 information technologies	b the amount of confidence that a group of people have
3 goods	c a set of tasks performed to complete a procedure
4 service jobs	d the process of packing and distributing goods
5 skilled	e the industry in which machinery is used to produce goods
6 morale	f the development and application of computer systems
7 unemployment	g having the knowledge and the ability to do something well
8 lead times	h things that are made to be sold
9 handling	i jobs in transports, communications, hospitals, energy industry, etc.
10 work flow	j the state of not having a job

UNIT 8. TROUBLESHOOTING

8.1 Operations

1. Read the text about mobile phones and complete it with the words in the box.

cell	lines	microprocessor	photo	radio	signals
flash	emails	antenna	movement		

A cellular phone (or mobile phone) is designed to give the user freedom of (1) while using a telephone. It uses (2) signals to communicate between the phone and the (3) _____. The server area is divided into smaller areas called cells and an antenna is placed within each cell and connected by telephone (4) _____. These lines connect cellular phones to one another: a computer selects the antenna closest to the telephone when a call is made. If the phone moves to one serving (5) _____ to another, the radio signal is transferred to the actual cell without interrupting the conversation. The circuit board is the heart of the system. A chip translates the outgoing and incoming (6) _____from analogue to digital and back from digital to analogue. The (7) _____handles all the functions for the keyboard, the display and the loudspeakers, and it controls the signal to the base station. Other (8) _____ memory chips provide storage for the operating system.

A cellular phone is not only a phone but it provides an incredible amount of functions:

- store information;
- use a calculator;
- send and receive (9) _____
- surf the Internet;
- play simple games;
- play music, take (10) _____ and videos.

Can you imagine your life without your mobile phone?

2. In pairs, decide if the following statements are true (T) or false (F).

1 Mobile phones use radio signals to communicate.

2 The server area is divided into smaller areas called stations.

3 An antenna is placed every two or three cells.

4 Communication with a mobile within a cell is independent from the base station.

5 There are interruptions when you move to one cell to another.

6 The antenna is the heart of the system.

7 The signal must be translated.

8 The flash memory hand les all the functions.

9 Loudspeakers are controlled by the microprocessor.

10 You can text and send emails with your mobile phone.

8.2 Hotline

1. Read the text about sensors and match each paragraph with a heading.

Sensor applications

Types of sensors

What is a sensor?

Almost every industrial automated process requires the use of sensors and transducers, which are very advanced devices capable of measuring and sensing the environment and translating physical information (e.g. variations of light, pressure, temperature and position) into electrical signals. The sensor picks up the information to be measured and the transducer converts it into electrical signals that can be directly processed by the control unit of a system.

Because of the industrial and scientific importance of measuring, sensors are widely used in a variety of fields, such as medicine, engineering, robotics , biology and manufacturing. Traditional machines have difficulty measuring small differences in product size, so sensors can be particularly useful as they can discriminate down to 0,00013 millimetres. They can also detect temperature, humidity and pressure, acquire data and alter the manufacturing process. Sensors are also vital components of advanced machines, such as robots.

There are two types of sensors: analogue and digital. Analogue sensors operate with data represented by measured voltages or quantities, while digital ones have numeric or digital outputs, which can be directly transmitted to computers. The

sensors usually employed in manufacturing are classified as mechanical, electrical, magnetic and thermal, but they can also be acoustic, chemical, optical and radiation sensors. Moreover, according to their method of sensing, they can be tactile or visual. Tactile sensors are sensitive to touch, force or pressure and they a re used to measure and register the interaction between a contact surface and the environment. These sensors are used in innumerable everyday objects, such as lift buttons and lamps which turn on and off by touching the base. Visual sensors, instead, sense the presence, shape and movement of an object optically. They are becoming more and more important in surveillance systems, environment and disaster monitoring and military applications.

2. Read the text again and choose the correct answer.

1. Sensors pick up _____ to be measured.
   A electrical signals
   B physical information
   C the control unit
2. Physical data is translated into electrical signals by _____.
   A the transducer
   B the sensor
   C a computer
3. Sensors_____ used to alter the manufacturing process.
   A can't be
   B are never
   C can be
4. _____ sensors can transmit data directly to computers.
   A Chemical
   B Digital
   C Analogue
5. Tactile sensors are commonly used in _____.
   A everyday objects

B military applications

C sophisticated machinery

6. _____sensors are used to localize objects in space.

A Analogue

B Visual

C Tactile

СПИСОК ВИКОРИСТАНИХ ДЖЕРЕЛ / REFERENCES

1. Карпова Т. А. Английский язык для технических вузов: учебник / Т. А. Карпова, Т.В. Асламова, Е.С. Закирова, П.А. Красавин ; под общ. ред. А.В. Николаенко. — М. : КНОРУС, 2014. — 352 с.

2. Шевелева С. А. Деловая переписка на английском языке: 1000 фраз / С. А. Шевелева. – М., 2000. – 128 с.

3. L. Alexander. (2002) Longman English Grammar Practice. Longman, 372 p.

4. D. Bonami, C. Jacques. (2005) Technical English Flexi-Course Book. Longman, 51 p.

5. P. Emmerson. (2006) Essential Business Grammar Builder. MacMillan, 176 p.

6. V. Evans, J. Dooley. (2012) Career Paths. Electrician. Express Publishing, 40 p.

7. C. Charles, J. A. Frazier (2011) Career Paths. Engineering. Express Publishing, 40 p.

8. S. Cedraro (2010) Flash on English for Mechanics, Electronics and Technical Assistance. Eli Publishing, 50 p.

9. J. Dearholt. (2012) Career Paths. Mechanics. Express Publishing, 40 p.

10. M. Ibbotson (2012) Cambridge English for Engineering. Cambridge University Press, 108 p.

11. C. Maxfield, J. Bird, (2008) Electrical Engineering. Newnespress, 1105 p.

Навчальне видання

Бондаревська *Олена Михайлівна*

Кафедра іноземних мов

ENGLISH FOR ENGINEERING

Навчальний посібник

Формат 60×84/8. Ум. др. арк. 19.

Донецький національний університет економіки і торгівлі
імені Михайла Туган-Барановського
50005, Дніпропетровська обл.,
м. Кривий Ріг, вул. Трамвайна, 16.
Свідоцтво суб'єкта видавничої справи ДК № 4929 від 07.07.2015 р.