

Міністерство освіти і науки України
ОДЕСЬКИЙ НАЦІОНАЛЬНИЙ ПОЛІТЕХНІЧНИЙ
УНІВЕРСИТЕТ

ПРОФЕСІЙНА ІНОЗЕМНА МОВА

МЕТОДИЧНІ ВКАЗІВКИ ДО ПРАКТИЧНИХ ЗАНЯТЬ З
АНГЛІЙСЬКОЇ МОВИ ДЛЯ СТУДЕНТІВ І КУРСУ ТЕХНІЧНИХ
СПЕЦІАЛЬНОСТЕЙ

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Затверджено на засіданні кафедри
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Передмова

Методичні вказівки для роботи зі студентами 1 курсу укладено відповідно до Програми вивчення іноземних мов у нефілологічному ВУЗі і спрямовано на розвиток у студентів немовних спеціальностей навичок читання та перекладу загально-технічних та науково-технічних текстів, збагачення словникового запасу і оволодіння навичками письма та говоріння .

Метою данного видання є розширення та закріплення студентами термінологічної лексики, а також надбання базових навичок загально-технічного читання, аудіювання та спілкування. З метою розвитку у студентів навичок перекладу та розуміння спеціальної термінології без перекладу та щоб розвинути мовленнєві навички для бесід, до текстів додано багато вправ на систематизацію та закріплення знань з лексики та розвиток навиків мовлення.

Виконання студентами методичних вказівок сприяє інтенсифікації процесу вивчення англійської мови і створює умови для правильного й найбільш доцільного навчання, яке забезпечує тривалі навички розуміння структури загально-технічних та науково-технічних текстів.

У підручнику використано адаптовані текстові матеріали зарубіжних видань.

Lesson 1

ENGINEERING AND SCIENCE

Read the text about engineering:

Engineering is the application of science to the optimum conversion of the resources of nature to the uses of humankind. The field can be defined as the creative application of “scientific principles to design or develop structures, machines, apparatus, or manufacturing processes, or works utilizing them singly or in combination; or to construct or operate the same with full cognizance of their design; or to forecast their behaviour under specific operating conditions; all as respects an intended function, economics of operation and safety to life and property.” The term engineering is sometimes more loosely defined, especially in Great Britain, as the manufacture or assembly of engines, machine tools, and machine parts.

The words engine and ingenious are derived from the same Latin root, *ingenerare*, which means “to create.” The early English verb engine meant “to contrive.” Thus the engines of war were devices such as catapults, floating bridges, and assault towers; their designer was the “engineer,” or military engineer. The counterpart of the military engineer was the civil engineer, who applied essentially the same knowledge and skills to designing buildings, streets, water supplies, sewage systems, and other projects.

The function of the scientist is to know, while that of the engineer is to do. The scientist adds to the store of verified, systematized knowledge of the physical world; the engineer brings this knowledge to bear on practical problems. Engineering is based principally on physics, chemistry, and mathematics and their extensions into materials science, solid and fluid mechanics, thermodynamics, transfer and rate processes, and systems analysis.

Engineers employ two types of natural resources—materials and energy. Materials are useful because of their properties: their strength, ease of fabrication, lightness, or durability; their ability to insulate or conduct; their chemical, electrical, or acoustical properties. Important sources of energy include fossil fuels (coal, petroleum, gas), wind, sunlight, falling water, and nuclear fission. Since most resources are limited, the engineer must concern himself with the continual development of new resources as well as the efficient utilization of existing ones.

Engineering Branches

Engineers apply scientific principles to design or develop structures, equipment, or processes. Engineering encompasses several disciplines. Traditionally, the main branches of engineering are chemical engineering, civil engineering, electrical engineering and mechanical engineering, and they produce chemical, civil, electrical and mechanical technologies, respectively. More specialized branches, such as software engineering and biomedical engineering, also yield corresponding technologies. Note that engineering branches are sometimes defined in terms of technological features (e.g. mechanical engineering), and sometimes in terms of application areas (e.g. environmental engineering). There are many more engineering branches, with more being developed all the time as new technologies develop.



Engineering and the development of new technologies are closely tied to science. We use many technologies in scientific studies, and scientific knowledge helps engineers do their jobs and build new technologies.

Exercise 1. Read and memorize using a dictionary:

application _____	determine _____
branch _____	emergence _____
be concerned with _____	equipment _____
define _____	invention _____
depend _____	property _____

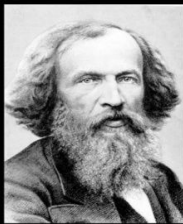
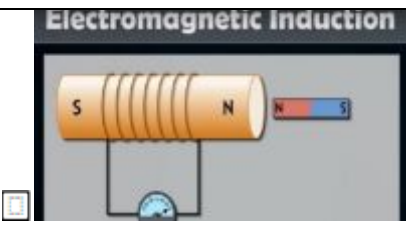
Exercise 2. Answer the questions.


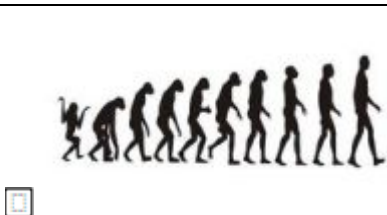



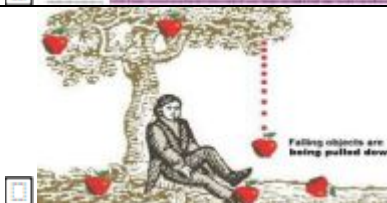
1. What is engineering?
2. What sciences is engineering based principally on?
3. Why must the engineer concern himself with the efficient utilization of resources?
4. What do engineers apply scientific principles for?
5. What are the main branches of engineering?
6. What is engineering closely tied to?

Exercise 3. Read the text about engineering again and match each sentence with its ending.

1	The term engineering is sometimes defined as	a	fossil fuels (coal, petroleum, gas), wind, sunlight, falling water, and nuclear fission.
2	The words engine and ingenious are derived from	b	in terms of technological features (e.g. mechanical engineering).
3	Engineers employ two types of natural resources	c	the manufacture or assembly of engines, machine tools, and machine parts.
4	Important sources of energy include	d	materials and energy.
5	Engineering branches are sometimes defined	e	the same Latin root, <i>ingenere</i> , which means "to create."

Exercise 4. Match the names of the scientists with their discoveries.

1	 <p>Dmitri Ivanovich Mendeleev Russia 1871</p>	a	 <p>Electromagnetic Induction</p>
---	--	---	---

2		b	
3		c	
4		d	

Exercise 5. Read the text about science and find synonyms for the words below.

Science is any system of knowledge that is concerned with the physical world and its phenomena and that entails unbiased observations and systematic experimentation. In general, a science involves a pursuit of knowledge covering general truths or the operations of fundamental laws. Physical science is the systematic study of the inorganic world, as distinct from the study of the organic world, which is the province of biological science. Physical science consists of four broad areas: astronomy, physics, chemistry, and the Earth sciences. Each of these is in turn divided into fields and subfields.

On the simplest level, science is knowledge of the world of nature. There are many regularities in nature that humankind has had to recognize for survival since the emergence of *Homo sapiens* as a species. The Sun and the Moon periodically repeat their movements. Some motions, like the daily “motion” of the Sun, are simple to observe, while others, like the annual “motion” of the Sun, are far more difficult. Both motions correlate with important terrestrial events. Day and night provide the basic rhythm of human existence. The seasons determine the migration of animals upon which humans have depended for millennia for survival. With the invention of agriculture, the seasons became even more crucial, for failure to recognize the proper time for planting could lead to starvation. Science defined simply as knowledge of natural processes is universal among humankind, and it has existed since the dawn of human existence.

The history of philosophy is intertwined with the history of the natural sciences. Long before the 19th century, when the term *science* began to be used with its modern meaning, the major figures in the history of Western philosophy were often equally famous for their contributions to “natural philosophy,” the inquiries now designated as sciences. Aristotle (384–322 BCE) was the first great biologist; René Descartes (1596–1650) formulated analytic geometry and discovered the laws of the reflection and refraction of light; Gottfried Wilhelm Leibniz (1646–1716) laid claim to priority in the invention of the calculus; and Immanuel Kant (1724–1804) offered the basis of a hypothesis regarding the formation of the solar system.

The great philosophers also offered accounts of the aims and methods of the sciences. They ranged from Aristotle’s studies in logic through the proposals of Francis Bacon (1561–1626) and Descartes, which shaped 17th-century science. They were joined in these ideas by the most eminent natural scientists. Galileo (1564–1642) supplemented his arguments about the motions of earthly and heavenly bodies with claims about the roles of mathematics and experiment in

discovering facts about nature. Similarly, the account given by Isaac Newton (1642–1727) of his system of the natural world is punctuated by a defense of his methods and an outline of a positive program for scientific inquiry. Antoine-Laurent Lavoisier(1743–94), James Clerk Maxwell (1831–79), Charles Darwin (1809–82), and Albert Einstein (1879–1955) all continued this tradition, offering their own insights into the character of the scientific enterprise.

- | | |
|-----------------|-------------------|
| 1 involve _____ | 6 emergence _____ |
| 2 pursuit _____ | 7 inquiry _____ |
| 3 general _____ | 8 outline _____ |
| 4 eminent _____ | 9 insight _____ |
| 5 account _____ | 10 offer _____ |

Exercise 6. Match the left part with the right:

1. Physical science is	a) hypothesis regarding the formation of the solar system.
2. René Descartes (1596–1650) formulated	b) the motions of earthly and heavenly bodies.
3. Galileo (1564–1642) presented arguments about	c) the systematic study of the inorganic world.
4. Gottfried Wilhelm Leibniz (1646–1716) laid claim to	d) analytic geometry and discovered the laws of the reflection and refraction of light
5. Immanuel Kant (1724–1804) offered the basis of a	e) priority in the invention of the calculus.

Exercise 7. Ask questions to the given answers:

- 1) Question: _____ ?
Answer: Physical science consists of four broad areas: astronomy, physics, chemistry, and the Earth sciences.
- 2) Question: _____ ?
Answer: Science is any system of knowledge concerned with the physical world and its phenomena.
- 3) Question: _____ ?
Answer: The history of philosophy is intertwined with the history of the natural sciences.
- 4) Question: _____ ?
Answer: The term *science* began to be used with its modern meaning in the 19th century.
- 5) Question: _____ ?
Answer: The major figures in the history of Western philosophy were equally famous for their contributions to “natural philosophy”.

Exercise 8. Decide if the following statements are true (T) or false (F), then correct the false ones.

1. Engineering is the application of science to the optimum conversion of the resources of nature to the uses of humankind. _____
2. Engineering cannot be defined as the creative application of “scientific principles to design or develop structures, machines, apparatus. _____
3. Engineers employ one type of natural resources: energy. _____
4. Engineering branches are never defined in terms of technological features. _____

5. Science involves a pursuit of knowledge covering general truths or the operations of fundamental laws. _____
6. Day and night provide the basic rhythm of human existence. _____
7. Science has existed since the beginning of the 18th century. _____
8. Aristotle (384–322 BCE) was the first great composer. _____

Lesson 2

METAL PROCESSES AND MATERIALS

Read the text:

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 casting. 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 metals but can also be plastic, resin or various cold materials for example concrete. Casting is usually used for making complex shapes.

Drawing is a manufacturing process for producing wires, bars and tubes 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, bar 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 machine parts in the automobile industry. Cold forging is done at a low temperature using soft 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 presses powered by a machine.

Rolling is a metal forming process in which a material (metal, plastic, paper or glass) is passed through a pair of rollers. According to the type of material rolled, there is hot rolling or cold rolling.

Extrusion is a process used to produce objects with a fixed cross-sectional profile. A material is pushed or drawn through a die of the desired cross-section. The two main advantages of this process are its ability to create very complex cross-sections and work materials that are brittle. The extrusion process can be done with hot or cold materials. Commonly extruded materials include metals, polymers, ceramics, concrete and foodstuffs. Ceramic can also be formed into shapes via extrusion. Terracotta extrusion is used to produce pipes. Many modern bricks are also manufactured using a brick extrusion process. Extrusion is also used in food processing. Products such as certain pastas, many breakfast cereals, French fries, dry pet food and ready-to-eat snacks are mostly manufactured by **extrusion**.

Sheet metal forming is simply metal formed into thin and flat pieces. The basic forms can be cut and bent into a variety of different shapes. Everyday objects are constructed with this process. There are many different metals that can be made into sheet metal, such as aluminium, brass, copper, steel, tin, nickel and titanium. For decorative uses, important sheet metals include silver, gold, and platinum. Sheet metal forming is used in car bodies, airplane wings and roofs for buildings.

Exercise 1. Read and memorize using a dictionary:

alloy _____	die _____	rod _____
bar _____	extrusion _____	rolling _____
bent _____	flat _____	rubber _____
blacksmith _____	hammer _____	shape _____

brick _____	hollow _____	sheet _____
brittle _____	insulate _____	tin _____
casting _____	mould _____	tool _____
concrete _____	oxidize _____	tube _____
copper _____	pipe _____	wire _____

Exercise 2. 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 _____

Exercise 3. 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?

Exercise 4. Using the following words complete the texts about materials: *properties, pure, tools, reinforced, insulate, ceramics, aircraft, pasty, alloy, non-ferrous.*

Materials

A mechanical engineer uses different materials to build machinery or 1)_____. A specific knowledge of materials is required, concerning qualities, 2)_____, costs and general characteristics.

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, 3)_____ 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 4)_____ form or mixed with other elements. In this second case we have an 5)_____ 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 6)_____ 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.

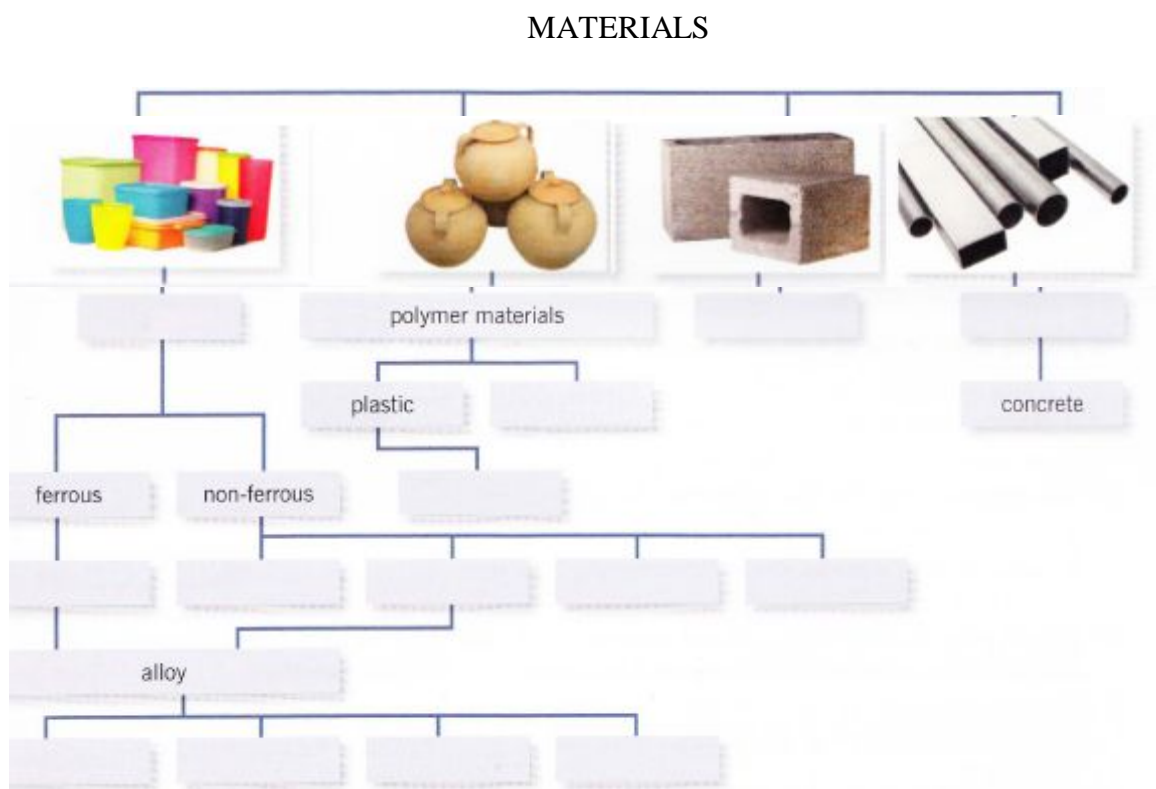
Non-ferrous metals contain little or no iron. The most common 7)_____ metals used in mechanics are copper, zinc, tin and aluminium. Some common non-ferrous alloys are brass (formed by mixing copper and zinc), bronze (formed by mixing copper and tin) and other aluminium alloys which are used in the 8)_____ 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 9)_____ 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 10)_____ with steel and is used in building engineering.

Exercise 5. 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

Exercise 6. Complete the following diagram.



Exercise 7. Complete the definitions with the words in the box.

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

Iron: Its Latin name is (1)____. 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.

(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.

Lesson 3

TECHNICAL DRAWING and CAD/CAM SYSTEMS

Read the text:

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 details. 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? They are: 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.

Drawing boards and manual drawing are not always precise and rapid: traditional design is usually slow, especially in its revision and modification. 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 creation, modification and analysis of a physical object. Nowadays computer software can easily provide a three-dimensional drawing, which allows engineering designers to see how mechanical components may fit together without making models thus saving a lot of time. CAD is much faster and more accurate than manual drawing; designs can be quickly modified, reproduced and transmitted electronically. Computer simulated analysis of the model helps experts find problems and defects 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 drawings needed to start product manufacturing. When CAD systems are linked to manufacturing equipment controlled by computers, they form an integrated CAD/CAM system. Computer-aided manufacturing (CAM) offers significant advantages, over traditional approaches by controlling manufacturing equipment with computers instead of human labour. CAM converts the design of a component into computer language and it gives instructions to the computer regarding operations.

Thanks to CAD/CAM systems it is possible to eliminate operator errors and reduce manufacturing costs.

Exercise 1. Read and memorize using a dictionary.

carry out _____	ruler _____
drafter _____	skill _____
drafting _____	technical drawing _____
fit _____	save _____
hardness _____	triangle _____
point _____	T-square _____
protractor _____	width _____
to replace _____	

Exercise 2. Match the words with their definitions

1 protractor	a) a thin sheet of card, plastic, or metal with a pattern or letters cut out of it, used to produce the cut design on the surface below
2 ruler	b) an instrument for drawing circles and arcs and measuring distances between points, consisting of two arms linked by a movable joint, one arm ending in a point and the other usually carrying a pencil or pen
3 compass	c) a tough elastic polymeric substance made from the latex of a tropical plant or synthetically and used for erasing pencil or ink marks
4 rubber	d) a straight strip or cylinder of plastic, wood, metal, or other rigid material, typically marked at regular intervals and used to draw straight lines or measure distances
5 triangle	e) a flat, semi-circular piece of plastic or metal which is used for measuring angles
6 T-square	f) a measure of how resistant solid matter is to various kinds of permanent shape change when a compressive force is applied
7 stencil	g) T-shaped instrument for drawing or testing right angles
8 hardness	h) an object, arrangement, or flat shape with three straight sides and three angles

Exercise 3. Find antonyms in the text for the words below:

1 accurate _____	5 suitable _____
2 high _____	6 manual _____
3 wide _____	7 thin _____
4 heavy _____	8 fragile _____

Exercise 4. Choose the correct answer.

- 1 Technical drawing is needed to...
 - A make a scale of the product.
 - B practise 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 mistakes are found...
 A we can't correct them.
 B they're removed with correction fluid.
 C stencil can cover them.

Exercise 5. Answer the following questions:

1. Why have manufacturing firms replaced manual drawing with computer-aided design to carry out functions related to design and production?
2. What does a three-dimensional drawing allow engineering designers to see?
3. What can the CAD system generate when the design is ready?
4. How does computer simulated analysis of the model help experts find problems?
5. What does computer-aided manufacturing offer?
6. What does CAM convert the design of a component into?

Exercise 6. Match each sentence with its ending.

- | | |
|---------------------------------------|--|
| 1 CAD helps designers | a) seen from any angle and are easily manipulated |
| 2 By using a CAD technology | b) to draw, modify and correct designs. |
| 3 Unlike manual drawing, CAD | c) the design into computer language. |
| 4 CAD allows us to save | d) defects can be easily found. |
| 5 CAD designs can be | e) provides three-dimensional drawings. |
| 6 CAM is the use of computer software | f) time and money |
| 7 The CAM system turns | g) minimise errors and manufacturing costs. |
| 8 CAD/CAM systems | h) to control machine tools in the manufacturing process |

Exercise 7. Ask questions to the given answers:

1. Question: _____ ?
 Answer: CAD assists the designer in the creation, modification and analysis of a physical object.
2. Question: _____ ?
 Answer: When CAD systems are linked to manufacturing equipment controlled by computers, they form an integrated CAD/CAM systems.
3. Question: _____ ?
 Answer: Thanks to CAD/CAM systems it is possible to eliminate operator errors and reduce manufacturing costs.

Lesson 4

MACHINE TOOLS

Read the text:

A **machine tool** uses a power source to modify the shape of metal components of machines. It is used as a tool in the making of other machines.

Machine tools were powered in the Middle Ages by humans and animals, and later by the energy captured by waterwheels. After the Industrial Revolution, most machine tools were powered by steam engine and nowadays by electricity.

Machine tools can be operated manually, or under automatic control. In the 1960s, computers gave more flexibility to the process. Such machines became known as computerized numerical control (CNC) machines. They could precisely repeat sequences, and could produce much more complex pieces than even the most skilled tool operators.

Let's examine the main features of some of the most commonly used machine tools.

Turning machine. The engine lathe is the most important of all the machine tools. It is used to produce external or internal cylindrical surfaces. The piece is held by the machine and is rotated while a cutting tool removes excess metal from the external diameter. Internal turning consists of enlarging and finishing a hole.

Shaper. This is a metal-cutting machine used to produce or modify flat surfaces. The cutting tool moves cutting on the forward stroke, with the piece feeding automatically towards the tool during each return stroke. Shapers can be horizontal or vertical.

Drilling machine. It is used to produce circular holes in metal with a twist drill. It also uses a variety of other cutting tools to perform the basic hole-machining operations.

Milling machine. This cuts flat metal surfaces. The piece is fed against a rotating cutting tool. Cutters of many shapes and sizes are available for a wide variety of milling operations. Milling machines may be manually operated, mechanically automated, or digitally automated via computer numerical control (CNC).

Grinding machine. This removes excessive material from parts that are brought into contact with a rotating abrasive wheel. Grinding is the most accurate of all the basic machining processes, but also the most time consuming.

Press. This is a machine tool that changes the shape of a workpiece. Historically, metal was shaped by hand using a hammer. Machine presses can be dangerous. Bi-manual controls (controls which require both hands to be on the buttons to operate) are a very good way to prevent accidents.

Band saw. It is a power tool which uses a blade consisting of a continuous band of metal with teeth along one edge. The band usually rides on two wheels rotating in the same plane. Band saws are used for woodworking, metalworking, and are particularly useful for cutting irregular or curved shapes. A constant flow of liquid is poured over the blade to keep it cool and preventing it from overheating.

Exercise 1. Read and memorize using a dictionary.

band saw _____	shaper _____
blade _____	skilled _____
drilling machine _____	steam engine _____
feature _____	stroke _____
grinding machine _____	surface _____
lathe _____	turning machine _____
overheating _____	waterwheel _____

Exercise 2. Read the text about metalworking processes and complete the table.

Machine Tool	Final result	Description
<i>turning machine</i>	external and internal flat surface	It removes excess metal from the external diameter. It enlarges and finishes a hole.
	specific shape	It cuts flat metal surfaces.
	holes	It uses a twist drill to make holes.
	flat surface	It cuts the piece.
	specific shape	It changes the shape of a workpiece.
	cut pieces	It cuts various parts using a continuous band of metal with teeth.
	finishing	It removes excessive material from parts.

Exercise 3. Decide if the following sentences are true (T) or false (F).

- Turning machines remove excess metal from the external diameter and enlarge and finish a hole. _____
- Shapers can only be vertical. _____
- Drilling machines use a twist drill to make circular holes. _____
- Milling machines can only be manually operated. _____
- Grinding machines remove excessive material from parts. _____
- Band saws use a band of metal with teeth to cut various parts. _____
- Presses are not dangerous if operated by both hands. _____

Exercise 4. 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.

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

Exercise 5. Ask questions to the given answers:

1. Question: _____ ?

Answer: Computer Numerical control (CNC) refers to the automation of machine tools in manufacturing processes.

2. Question: _____ ?

Answer: The first NC machines were built in the 1940s and 1950s.

3. Question: _____ ?

Answer: The computer checks all the operations made by the machine tools.

Exercise 6. Give the words that have similar meanings (synonyms):

1 shape _____

5 perform _____

2 power _____

6 enlarge _____

3 feature _____

7 precisely _____

4 size _____

8 particularly _____

Exercise 7. Read the texts again and write a list of all the machine tools mentioned.

Exercise 8. Pick out all international words from the text on CNC machines.

Lesson 5

WHAT IS ELECTRICITY?

Read the text:

The ancient Greeks noticed that when they rubbed a piece of amber with wool or fur, the amber attracted or picked up small pieces of leaves or dust. This was called the amber effect. The English word **electricity** comes from the Greek word electron, which means amber.

In the eighteenth century, scientists discovered that there are two types of electric charge. The American Benjamin Franklin named these charges positive and negative. It was noted that like charges repel each other and unlike charges attract each other.

A spectacular example of this phenomenon occurs during a storm. Inside a cloud, currents of air rub against the raindrops. As the electrons are rubbed off, one cloud becomes positively charged and another negatively charged. The opposite charges attract each other, and an enormous spark of electricity jumps from one cloud to another or from a cloud to the ground. Thus, lightning is produced.

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 an electric current. Electricity consists of a flow 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 charge.

Electricity needs a material which allows a current to pass through easily, which offers little resistance 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 conductors are wires, available in many sizes and thicknesses. They are coated with insulating materials such as plastic. Semiconductors such as silicon and germanium are used in transistors and their conductivity is halfway in between a conductor and an insulator. Small quantities of other substances, called impurities, are introduced in the material to reduce the conductivity. A material which contains very few electrons is called an insulator. Glass, rubber, dry wood and plastic resist the flow of electric charge, and as such they are good insulating materials.

Exercise 1. Read and memorize using a dictionary.

charge _____
coated _____
conductor _____
current flow _____
halfway _____
impurity _____

to pass through _____
property _____
semiconductor _____
shell _____
steady _____
to switch off _____

insulator _____
to orbit _____

thickness _____
valence _____

Exercise 2. 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 _____

Exercise 3. 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.

Exercise 4. Using the following words complete the text: *wire, current, rate, difference, quantity, direction, voltage, power.*

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

Direct current is a continuous flow of electrons in one 1) _____ and it never changes its direction until the 2) _____ 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 3) _____ 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 4) _____ and low current.



There are several quantities that are important when we are talking about electric current. Volts (V) - so named after the Italian physicist Alessandro Volta - measure the 5) _____ of electric potential between two points on a conducting 6) _____. 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 7) _____ of charge transferred in one second by a **steady** current of one ampere. Power is the 8) _____ 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.

Exercise 5. Read the text again and complete the table with the missing information.

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

Exercise 6. Ask questions to the given answers:

1. Question: _____ ?

Answer: Alternating current constantly changes its direction because of the way it is generated.

2. Question: _____ ?

Answer: Volts measure the difference of electric potential between two points on a conducting wire.

3. Question: _____ ?

Answer: Power is the rate at which work is performed and it is measured in watts.

4. Question: _____ ?

Answer: The term 'frequency' is used to indicate how many times the current changes its direction in one second.

Exercise 7. Match the words with their definitions:

1 shell	a) the rate at which something occurs over a particular period of time or in a given sample
2 resistance	b) a substance or device that does not readily conduct electricity
3 impurity	c) relating to or denoting electrons involved in or available for chemical bond formation
4 insulator	d) a trace element deliberately added to a semiconductor; a dopant
5 frequency	e) each of a set of orbitals around the nucleus of an atom, occupied or able to be occupied by electrons of similar energies
6 nucleus	f) the ability of a substance or an electrical circuit to stop the flow of an electrical current through it
7 charge	g) the positively charged central core of an atom that contains most of its mass
8 valence	h) energy stored chemically for conversion into electricity

Lesson 6

ELECTRIC CIRCUITS

Read the text and label the picture with the name of each part:

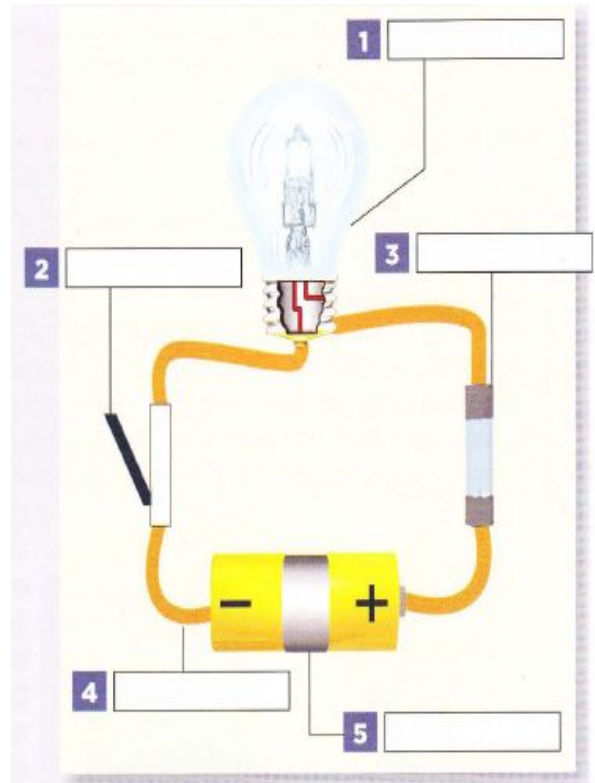
An electric circuit or network is a pathway through which the electric current can flow. A simple circuit consists of a power source, two conducting wires, each one attached to a terminal of the source and a device through which electricity can flow. This device is called a load and it's attached to the wires. If all the parts are properly connected, the current flows and the lamp lights up. This kind of circuit is called 'closed'.

On the contrary, if the wires are disconnected the circuit is called 'open' or 'broken'. The circuit can be opened and closed by a device called a switch.

Loads can turn electrical energy into a more useful form. Some examples are:

- light bulbs, which change electrical energy into light energy;
- electric motors, which change electrical energy into mechanical energy;
- speakers, which change energy into sound.

The source provides the electrical energy used by the load. It can be a storage battery or a generator. The switch interrupts the current delivered to the load by the source and allows us to control the flow.



When an abnormally high amount of current passes through a network, you get a short circuit. This may occur when there is a drop in the resistance or a broken insulation. In order to prevent short circuits, it is best to use fuses, which melt when too much current flows through them, interrupting in this way the circuit.

The standard return for electrical and electronic circuits is the earth ground. When an electrical or electronic device fails, it may open the return circuit to the earth ground. The user of the device could become a part of the device's electrical circuit by providing a return path for the electrons through the user's body instead of the circuit's earth ground. When our body becomes part of an electrical circuit, the user can be seriously shocked, or even killed by electrocution.

To prevent the danger of electrical shock and the possibility of electrocution, ground fault interrupt devices detect open circuits to earth ground in attached electrical or electronic devices. When an open circuit to earth ground is detected, the GFI (ground-fault-interrupt) device immediately opens the voltage source to the device. GFI devices are similar to circuit breakers but are designed to protect humans rather than circuit components.

Exercise 1. Read and memorize using a dictionary.

arrange _____
branch _____

power source _____
prevent _____

burn out _____
 fault _____
 fuse _____
 light bulb _____
 melt _____
 parallel circuit _____

series circuit _____
 short circuit _____
 socket _____
 switch _____
 turn into _____
 undue _____

Exercise 2. Match the words with their definitions.

- | | |
|------------------|--|
| 1 load | a) a device which interrupts the circuit |
| 2 switch | b) a circuit in which wires are disconnected |
| 3 source | c) a device which provides power |
| 4 fuse | d) a complete circuit with no breaks at all |
| 5 closed circuit | e) a device which consumes electric power |
| 6 broken circuit | f) a protective device |

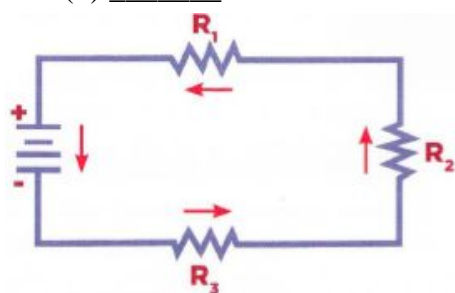
Exercise 3. Read the text again and answer the following questions.

- | | |
|--|---|
| 1. What does a simple circuit consist of? | 5. What is the function of a switch? |
| 2. What happens to the lamp in a closed circuit? | 6. When does a short circuit occur? |
| 3. Can you name some examples of loads? | 7. What can we use to prevent short circuits? |
| 4. What is a generator? | 8. How does a fuse work? |

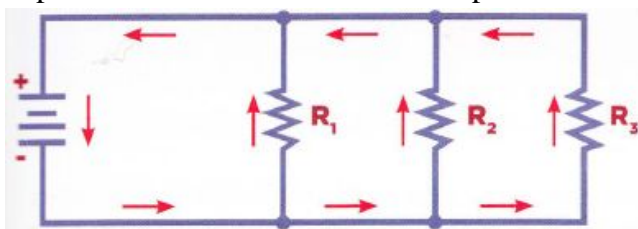
Exercise 4. Complete the texts with the words in the box.

components	current	turn on	branch	amount
positive	appliances	continue	burns out	path

The (1) _____ of a circuit can be wired in two different ways: series or parallel. If components are arranged one after another to form a single (2) _____ between the terminals and the components, the circuit is known as a series circuit. In this type of circuit, the (3) _____ flows from the negative terminal to the (4) _____ terminal, passing through all the other components of the circuit. This means that the (5) _____ of energy passing through all the components in the series is the same. The main disadvantage of a series circuit is that when a single component in the path (6) _____, the entire circuit stops operating (e.g. Christmas tree lights).



A parallel circuit consists of several paths connecting the different components. Each separate path is called a (7) _____ of the circuit. Current from the source divides and flows through the different branches. Unlike series circuits, if one of the components in the parallel circuit burns out, the other paths (8) _____ to operate. Parallel circuits are commonly used to connect (9) _____ at home, so that each socket can function independently. For example, you don't have to (10) _____ the light in your room for the TV socket to work.



Exercise 5. Read the text and find synonyms for the words below.

A fuse can be added to an electric circuit to protect it from the effects of undue power. This safety device, which is made of a heat-sensitive alloy, is connected in series with the circuit it has to protect. If an excessive amount of current flows through the circuit, the alloy will liquefy and open the circuit. A circuit breaker is fundamental in a house to protect circuits against overloading, overheating and short circuits. The advantage of a circuit breaker is that it can be reset after the overloading by replacing the fuse. A professional electrician should always provide his customers with a map of the electric circuit in the house so that it will be easier to work on it in case of faults.



- 1 excessive _____
- 2 reacting to high temperatures _____
- 3 to melt _____
- 4 loading up _____
- 5 adjusted _____
- 6 clients _____

Exercise 6. Give the derivatives to the following words:

- 1 connect _____
- 2 insulate _____
- 3 resist _____
- 4 depend _____
- 5 add _____
- 6 replace _____
- 7 differ _____

Exercise 7. Group the words that have contractive meanings (antonyms):

- 1 commonly _____
- 2 overloading _____
- 3 undue _____
- 4 rarely _____
- 5 due _____
- 6 underloading _____
- 7 excessive _____
- 8 insufficient _____
- 9 single _____
- 10 multiple _____

Lesson 7

HOW ENERGY IS PRODUCED

Read the texts about the different types of power plants and match them with the pictures:

Conventional power plants



1 Nuclear power plants

About 10% of the world's electric power is produced by nuclear power plants. Nuclear power requires little fuel and causes much less air pollution than other power plants, but it can cause severe health and environmental problems when accidents occur, with a consequent release of radioactive material. This type of energy is produced by the splitting of atoms of uranium, which releases heat. This process - called fission - produces large amounts of steam, which is used to turn the blades of turbines thus creating energy. The main problems with nuclear power are linked to the location of the power plants, as people are not willing to have these plants near their homes, and the disposal of waste material, which stays radioactive for centuries.

2 Thermoelectric power plants

They provide about 2/3 of the world's electricity. These plants burn fossil fuels, such as coal, oil or natural gas, which are all non-renewable resources. This means that in the future there will be a limited supply of these resources. The main advantage of thermoelectric power plants is that they are reliable and can meet the demand in peak periods. Electricity is generated by heating water in a boiler to create steam, which is then pressurized and used to turn the blades of giant turbines that produce electricity. These power plants cause environmental pollution because of the combustion of fossil fuels which release carbon dioxide.

3 Hydroelectric power plants

The energy produced by water can be captured and turned into electricity. The use of a dam on a river allows hydroelectric power plants to store water in an artificial lake, or reservoir. When released, the force of the water spins the blades of giant turbines, which are connected to a generator producing energy. Hydropower is one of the most important renewable energy resources, because it is reliable, efficient and does not pollute the air. Although it has high initial costs, it is cheap to operate. Unfortunately, it has a great impact on the environment, as humans, animals and plants may lose their natural habitats.

Exercise 1. Read and memorize using a dictionary

array _____
blade _____
dam _____

power plants _____
to release _____
reliable _____

damage _____
environment _____
fuel _____
greenhouse _____
hot spring _____
loss _____
maintenance _____
manure _____
to occur _____
piped _____
pollution _____

renewable _____
to require _____
splitting _____
steam _____
stump _____
supply _____
tide _____
turbine _____
waste _____
willing _____

Exercise 2. Decide if the following sentences are true (T) or false (F), then correct the false ones.

1. Nuclear power plants do not produce air pollution at all.
2. Accidents in nuclear power plants can have terrible consequences for the environment.
3. Nuclear power plants produce biodegradable waste material.
4. Thermoelectric power is generated by the combustion of renewable resources.
5. Thermoelectric power plants are environmentally friendly.
6. Dams are built on rivers to store water.
7. The water released from the reservoir flows through the generator.
8. The only disadvantage of hydropower is its high initial cost.

Exercise 3. Read the texts about alternative power sources and complete the table with the missing information.

Environmental problems such as the greenhouse effect and air pollution have led scientists to find alternative power sources which are renewable and less polluting.

Sunlight can be directly converted into electricity by solar cells made of silicon. When light strikes the cells, a part of it is absorbed by the semiconductor material. The energy of the absorbed light knocks electrons loose, allowing them to flow freely and produce electricity. The process of converting light (photons) into electricity (voltage) is known as the photo-voltaic process (PV). Solar cells are usually combined into panels and grouped into arrays. Even if the initial costs can be high, the PV system provides an independent, reliable electrical power source. It can produce energy for more than 15 years and its routine maintenance is simple and cheap.

Wind energy is one of the cheapest renewable technologies available today. The wind turns the blades of giant turbines, producing in this way kinetic energy which is then converted into mechanical power and electricity by a generator. The main disadvantage of wind energy is that there are few suitable wind sites where it is possible to have a constant production of electricity.

Tidal energy is typically used in coastal areas. The potential energy of tides is turned into electricity. Tidal power generators use rising and falling tides in much the same manner as hydroelectric power plants. Large underwater turbines are placed in areas with high tidal movements and are designed to capture the kinetic energy of rising and falling tides. The turbines are driven by the power of the sea both when the tide comes in and when it goes out. The problem with tidal power is that only massive increases in tides can produce energy and there are very few places where this occurs. Moreover, the aquatic ecosystem and the shoreline

can be damaged by the changes in the tidal flow.

In the past, people used hot springs for bathing, cooking and heating. **Geothermal** energy is based on the fact that the Earth is hotter below the surface. The hot water which is stored in the Earth can be brought to the surface and used to drive turbines to produce electricity or it can be piped through houses as heat. This energy is cheap and has a low impact on the environment, but there are few sites where it can be extracted at low cost.

Biomass is a renewable energy source deriving from plant material and animal waste. When it is burnt, it releases its chemical energy as heat. Biomass fuels include forest residues (such as dead trees, branches and tree stumps), straw, manure and even municipal solid waste. Biomass energy is a natural process, it is carbon neutral and has low initial costs. It used to be the main source of heating at home in the past and it continues to be highly exploited in the developing world. The main disadvantage of biomass is that it has a smaller potential than other energy sources and requires excellent maintenance skills.

Type of energy	How it works	Advantages	Disadvantages
			<i>high initial costs</i>
<i>Wind energy</i>			
		<i>It is a natural process because it exploits the potential energy of tides.</i>	

Exercise 4. Match the words with their definitions.

- | | |
|---------------|--|
| 1 array | a) a spot where hot water comes up naturally from the ground |
| 2 kinetic | b) unwanted material left after using |
| 3 tide | c) a group of things arranged in a particular way |
| 4 hot spring | d) waste material from animals used as fertiliser |
| 5 to pipe | e) the process of keeping something in good condition by regularly checking it |
| 6 manure | f) produced by motion |
| 7 waste | g) to send a liquid or a gas through a tube |
| 8 maintenance | h) the regular change in the level of the sea caused by gravitational attraction of the moon and the sun |

Exercise 5. Read the text about the electrical distribution system and complete it with the words in the box.

pole	demand	lower	voltages	consumers	high-voltage
power plants	delivery	appliances	network	transformer	

Electricity distribution is the final stage in the (1) _____ of electricity to end users. In order to be able to use electric power for our daily activities, electricity must be transmitted from the (2) _____ to other areas where it can be distributed to different (3) _____ . The electricity generated by power plants is increased or stepped up at substations and distributed through

(4) _____ transmission lines, in order to minimize energy losses and to economise on the

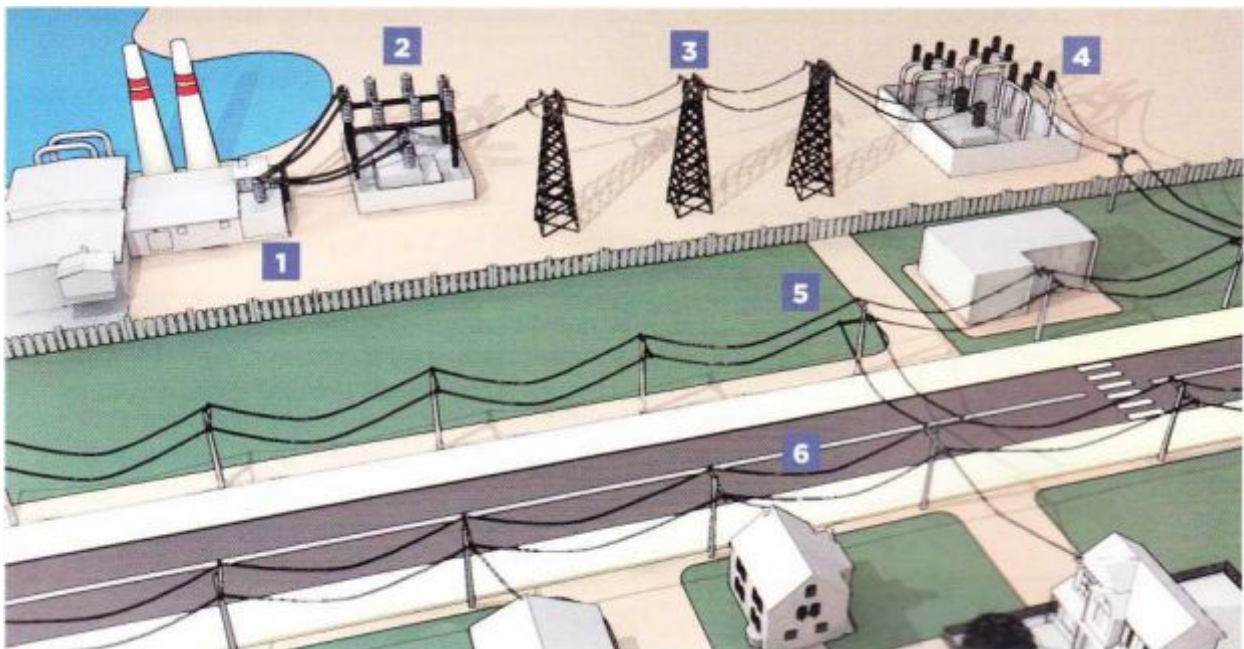
material needed for conductors. Transmission lines use voltages as high as 765,000 volts and they are usually connected in a (5) _____. This means that if a station receives an unexpected

(6) _____ for electric power, it can call on the other stations to help to meet the demand. Then electrical power is converted from high voltage to (7) _____ thanks to step-down transformers which turn electricity into different power levels. Once it is sent to your neighbourhood, another

small (8) _____ mounted on a (9) _____ converts the power to even lower levels to be used at home. The final voltage is between 110 volts - for lights, TVs, and other smaller appliances - and 240 volts for larger (10) _____ .

Exercise 6. Reorder the different stages in the distribution system and match them to the numbers in the picture.

- Transmission lines carry high-voltage electricity to different substations.
- Electricity leaves the power plant.
- Electricity is stepped down by transformers.
- Current at lower voltages is transmitted to homes and offices.
- The voltage is increased at a step-up station.
- Power levels are lowered by small transformers mounted on poles.



Exercise 7. Read the text again and match each sentence with its ending.

- | | |
|-------------------------------|--|
| 1 Power plants generate | a) convert electricity from high voltage levels to lower levels. |
| 2 Transmission lines are used | b) in case of an expected demand for electric power. |
| 3 High voltages mean | c) a reduction in energy losses during transmission. |
| 4 Step-down transformers | d) power and distribute it to substations. |

- 5 Substations can help each other e) can be safely used in businesses and homes.
6 The current transmitted by poles f) to distribute high-voltage electricity to a network of substations.

Exercise 8. What is your opinion on energy saving? What do you and your family usually do to save energy? Take this test and discuss your answers in pairs.

- | | |
|---|----------|
| 1. 1 I turn my desk lamp on only when it's dark. | Yes / No |
| 2. 2 I try to open the fridge as little as possible | Yes / No |
| 3. 3 I don't use the lift to go down the stairs. | Yes / No |
| 4. 4 My parents take the bus to work instead of driving. | Yes / No |
| 5. 5 Our house temperature is below 20°C. | Yes / No |
| 6. 6 I always turn the light off when I leave a room. | Yes / No |
| 7. 7 I turn the TV off if I am not watching it. | Yes / No |
| 8. 8 We try not to use air conditioning unless it's very hot. | Yes / No |
| 9. 9 We use rechargeable batteries. | Yes / No |
| 10. 10 We use energy-saving light bulbs. | Yes / No |

Lesson 8

WHAT IS ELECTRONICS?

Read the text:

Electronics is the branch of science which controls electricity in order to convey a signal using semiconductor materials. These signals represent numbers, letters, sounds, pictures, computer instructions or other information. Radio systems were developed to read and understand these signals and in 1920 radio broadcasting started, making it possible for electromagnetic waves to travel long distances.

More sophisticated devices were needed during the Second World War and the invention of radar (Radio Detection and Ranging) represented a further step in electronics, making it possible to determine the altitude, direction and speed of moving and fixed objects.

The invention of television in the 1920s was one of the most revolutionary and popular inventions in history and it showed the importance of electronics in certain branches of industry. For the first time in history it became possible to transmit images and sound over wire circuits.

The first computer appeared in 1946. This machine, which could solve a wide range of computing problems, was built over a period of three years by a team of American scientists working at the University of Pennsylvania. It was a huge machine weighing almost 50 tons.

The first transistor was assembled in 1957 by a team of scientists working at the Bell Laboratories in the U.S.A, and it was a real coming of age in the science of electronics because it replaced the use of valves. Transistors are very small, easy to handle, cheap, and they use little power.

The silicon chip - which followed the transistor in the 1960s - can contain up to several thousand transistors packed and interconnected in layers beneath the surface. It is really tiny (usually less than one centimetre square and about half a millimetre thick) and it has paved the way to microelectronics.

Electronics has influenced and improved the way information is stored, processed and distributed. Social and personal life has been deeply affected by these inventions and many financial, business, medical, education and political routines have been speeded up.

The **integrated circuit**, also known as a chip, is one of the most important inventions of the 20th century. Integrated circuits are used in almost all electronic equipment today, for example watches, calculators and microprocessors. It consists of millions of transistors and other electronic components combined to form a complex set on a thin slice of silicon or other semiconductor material. Chips are becoming tinier and tinier and they are produced in large quantities so that costs are reduced. Since signals have to travel a short distance, they work faster, consume less power and generate less heat. They are also more reliable given the limited amount of connections which could fail.

The microprocessor is the heart of any normal computer: it is a logic integrated circuit chip which can carry out a sequence of operations when it receives instructions from different input devices. As it doesn't contain a large memory, it can't work alone but needs to be supported by other integrated circuits to be connected with peripherals. Most microprocessors are found inside computers and are called the CPU (Central Processing Unit). In order to work properly, the microprocessor needs to receive instructions from a memory chip. These instructions are then decoded, executed and 'elaborated' so as to get the results available. The most sophisticated microprocessors can contain up to 10 million transistors and run 300 million cycles per second.

It means that the computer can perform about a billion instructions every second. As technology continues to evolve, microprocessors are becoming tinier and tinier.

Exercise 1. Read and memorize using a dictionary.

branch _____
 breadboard _____
 broadcasting _____
 convey _____
 decode _____
 further _____
 huge _____
 incoming _____
 layer _____

outgoing _____
 peripheral _____
 slice _____
 soldering _____
 to speed up _____
 spring clip _____
 tiny _____
 wave _____

Exercise 2. Complete the table with the missing information.

Invention	Year	Function
		read and understand electronic signals
Radar		

Exercise 3. Think of an electronic device (TV, radio, mobile phone, computer, etc.) you see every day. Write about its use, advantages, disadvantages and your opinion of it. Write about 60 words.

Exercise 4. Answer the questions.

1. What is a conventional circuit made of?
2. What does PCB stand for?
3. What is a breadboard?
4. What does a chip consist of?
5. What is a chip made out of?
6. What are the advantages of chips compared to conventional electronic circuits?
7. What is a microprocessor?
8. How many instructions can computers perform?

Exercise 5. Read the text again and match the words with their definitions.

- | | |
|--------------|--|
| 1 prototype | a) to convert an electrical signal into another code |
| 2 perforated | b) the act of joining metallic parts |
| 3 soldering | c) an original model used to test a circuit or a product |
| 4 to fail | d) to perform ineffectively |
| 5 peripheral | e) having a series of holes |
| 6 to decode | f) an auxiliary device that works with a computer |

Exercise 6. Read the text about mobile phones and complete it with the words in the box.

cell	lines	microprocessor	photos	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. 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) _____ memorychips 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?



Exercise 7. 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 handles all the functions.
9. Loudspeakers are controlled by the microprocessor.

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

Exercise 8. Ask questions to the given answers:

1. Question: _____ ?

Answer: A cellular phone uses radio signals to communicate between the phone and the antenna.

2. Question: _____ ?

Answer: The server area is divided into smaller areas called cells.

3. Question: _____ ?

Answer: If the phone moves to one serving cell to another, the radio signal is transferred to the actual cell without interrupting the conversation.

4. Question: _____ ?

Answer: The microprocessor handles all the functions for the keyboard, the display and the loudspeakers, and it controls the signal to the base station.

Lesson 9

TELECOMMUNICATIONS AND NETWORKS

Read the text:

Communication has always played a crucial role in human societies and over time its forms have evolved through the progression of technology, transforming itself into telecommunication. The telegraph, the telephone, the radio, the television, the radar, the fax and, more recently, the computer are all devices which were invented to communicate using electromagnetic waves. Thanks to them, we can transmit texts, pictures, sounds and images and reach everyone in any part of the world.

Ground transmission

Wires provide a cheap and effective means of communication that was predominant in the past. Wires, which are made out of copper and insulated with plastic, can be single or twisted, and they are used mainly in telephone and computer networks.

Coaxial cables consist of an inner conductor insulated with plastic and surrounded by a woven copper shield. They are used in television and radio as these cables can support about 60 channels. The inner copper cable is insulated to protect the wires from bending and crushing and to reduce the noises.

Optical fibres are used in place of simple copper wires to carry larger amounts of information. They consist of strands of pure glass as thin as a human hair. Signals travel along fibres with less loss and without any electromagnetic interference. As they permit transmission over longer distances and at a higher speed, they are used in communication systems, in some medical instruments and in a wide variety of sensing devices.

Air transmission

Antennas were invented to capture radio signals and convert them into electrical signals through the receiver. They can also receive electrical signals from the transmitter and convert them into radio signals.

These electric devices, which provide information at a cheap rate, are essential to all equipment that uses radio. They are used in systems such as radio and television broadcasting, radar, mobile phones, and satellite communications, for which they are in form of dishes.

Satellites are machines launched into space to move around Earth or another celestial body. A communications satellite is basically a station which receives signals in a given frequency and then retransmits them at a different frequency to avoid interference problems. The first satellite was launched by the Soviet Union in 1957. There are different types of satellites: low-orbit satellites, which travel at about 300 km from the Earth and observe the planet, providing accurate information about agriculture, pollution and weather forecasting; medium-altitude satellites, which travel at about 9000-18000 km from the Earth and are used in telecommunications.



Exercise 1. Read and memorize using a dictionary

backbone _____
bending _____
coaxial _____
dish _____
forecasting _____
go down _____
grant _____
hub _____
inner _____
link _____
reach _____

receiver _____
sensing device _____
share _____
shield _____
strand _____
to surround _____
token _____
transmitter _____
twist _____
up-to-date _____
woven _____

Exercise 2. Complete the table.

Means of transmission	Material	Function	Type of signal (ground or air)	Advantages
wires				
coaxial cables				
optical fibres				
antennas				
satellites				

Exercise 3. Read the text about networks and answer the questions



A network is a group of computers linked together. It consists of at least two computers joined by cables on the same desk or same office, but it can also mean thousands of computers across the world. The users of a network can share hardware (scanner, printer, fax machine, etc.), access data in other people's computers and run other programs stored in the network although not installed on their own computer.

A network consists of:

- nodes, that is to say different computers and devices;
- a connecting medium, such as cables or a wireless connection;
- routers, which are special computers enabled to send messages;
- switches, that is to say devices which help to select a specific path to follow.

Networks can be connected in different ways according to the area they cover.

A LAN (Local Area Network) is generally located in a limited space, such as a building or a campus.

On the contrary, a WAN (Wide Area Network) operates in a larger area and it can reach most of the world, so it could be described as a collection of LANs all over the world.

The exchange of information in a network is controlled by communications protocols, which define the formats and rules that computers must follow when talking to one another.

Well-known communications protocols are Ethernet, which is a family of protocols used in LANs, and the Internet Protocol Suite, which is used in any computer network.

Computer networks offer many advantages. For example, they facilitate communication, allowing people to send emails and texts, make phone/video calls and videoconference. Furthermore, networks allow people to share files, data, and other types of information as users may access data and information stored on other computers in the network.

On the other hand, networks may be difficult to set up and may be insecure as computer hackers can send viruses or computer worms to the net computer. They may also interfere with other technologies, as power line communication strongly disturbs certain forms of radio communication and access technology such as ADSL.

1. What does a network consist of?
2. What is a router?
3. What is a LAN?
4. What is a WAN?
5. What is the function of communications protocols?
6. What is Ethernet used for?
7. What are the advantages of using a network?
8. What are the disadvantages of using a network?

Exercise 4. Work in pairs. Think of different means of communication and take turns asking and answering the following questions.

1. How often do you use them?
2. What do you use them for?
3. Who do you use them with?
4. What are their advantages?
5. Can you think of any risk connected with their use?

Exercise 5. Look at the table and complete the text about telecommunication systems.

Means of transmission	
cables: wires, coaxial cables, optical fibres	radio waves: antennas, satellites

Telecommunication systems need means for the (1) _____ of any information, which is translated into electromagnetic waves that connect the transmitter to the receiver. These means can be physical media, such as (2) _____, or radio (3) _____ which are transmitted by air. Different kind of cables can be used. The simplest communication cables consist of a single pair of (4) _____ twisted together. Other types are (5) _____ cables and optical (6) _____. Radio waves need (7) _____ to be transmitted and sometimes (8) _____ are necessary for long-distance transmission.

Exercise 6. Read the texts about the different network topologies and fill in the gaps with the words in the box.

nodes	circle	network	pathway	affect	configure
small	destination	star failure	exchanging		backbone

NETWORK TOPOLOGIES

A network topology is the layout of the interconnections of the nodes of a computer network. It depends on the distance involved, the type of hardware used and the stability needed.

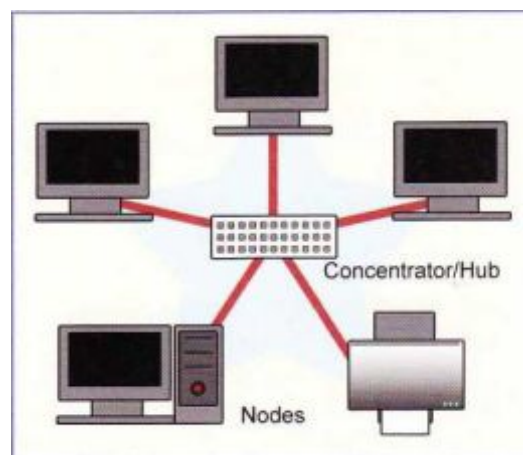
Bus network

In a bus network all (1) _____ are connected to a common medium, called backbone, as it happens with Christmas lights. Information sent along the (2) _____ travels until the destination is reached. This kind of topology is generally used only for (3) _____ networks, as it isn't able to connect a large number of computers. The main advantage offered by this topology is that if a computer or device doesn't work, it doesn't (4) _____ the others.

Star network

In a star network all nodes are connected to a special central node called the hub. Once it has received a signal, the hub passes it to all the other nodes until it reaches the (5) _____ computer. This means that all the computers and devices are joined together. This topology is commonly used in businesses because it can grant rapidity and safety in (6) _____ data.

Thanks to this topology, data is always up-to-date and if a computer doesn't work, it doesn't affect the others. The only disadvantage to it is that if the hub goes down, the whole (7) _____ doesn't work.



Ring network

In a ring network each node is connected to its left in a (8) _____. There is no central hub that holds all the data, and communication is sent in one direction around the ring through the use of a token. As it requires fewer cables, this topology is less expensive. Nonetheless, because it provides only one (9) _____ among the nodes, a single node (10) _____ may isolate all the devices attached to the ring.

Star bus topology

Star bus topology is the most common network topology used today. It combines elements of

star and bus topologies to create a more effective network. Computers in a specific area are connected to hubs creating a (11)____, then each hub is connected together along the network backbone.

The main advantage of this type of topology is that it can be more easily expanded over time than a bus or a star. On the other hand, this topology is more difficult to (12) _____ than the others and if the backbone line breaks, the whole network goes down.

Exercise 7. Read the texts again and decide if the following statements are true (T) or false (F), then correct the false ones.

- 1 The topology chosen depends only on the location of computers.
- 2 All topologies use many cables and are very expensive.
- 3 In a bus topology all the buses are connected one after the other.
- 4 In a bus topology a server controls the flow of data.
- 5 In a star network data is always updated.
- 6 The hub doesn't connect printers and other devices in a star topology.
- 7 In the ring topology each node is connected to the hub.
- 8 In the ring topology if the hub doesn't work, the network goes down.
- 9 Star bus topology combines elements of bus and ring topologies.
- 10 In a star bus topology a backbone line failure affects the whole network.

Exercise 8. Read the texts again and complete the table with the missing information.

Topology	Connection	Use	Advantages	Disadvantages
		<i>small networks</i>		
	<i>Each node is connected to the central hub</i>			
<i>ring</i>				

Lesson 10

COMPUTER TECHNOLOGY (1)

Read the text.

A computer is an electronic device that performs high-speed mathematical or logical operations and executes instructions in a program. Its main functions are to accept and process data to produce results, store information and programs and show results.

The main characteristics of these powerful machines are:

- speed, as they can execute billions of operations per second
- high reliability in the elaboration and delivery of data
- storage of huge amounts of information

A computer consists of hardware and software. The word hardware refers to all the components you can physically see such as the CPU (Central Processing Unit), the internal memory system, the mass storage system, the peripherals (input and output devices) and the connecting system. Software, instead, comprises all the computer programs and related data that provide the instructions for a computer to work properly.

The CPU is the brains of your computer and consists of ALU (Arithmetic Logic Unit), which carries out the instructions of a program to perform arithmetical and logical operations, and CU (Control Unit), which controls the system and coordinates all the operations. In order to memorize input and output data, there is an internal memory that can be distinguished into volatile and non-volatile. Volatile memory is memory that loses its contents when the computer or hardware device is off. Computer RAM (Random Access Memory) is a good example of volatile memory. It is the main memory of the computer where all data can be stored as long as the machine is on. On the contrary, a non-volatile memory contains information, data and programs that cannot be modified, or can be modified only very slowly and with difficulty. Computer ROM (Read Only Memory), for example, contains essential and permanent information and software which allow the computer to work properly. Memory storage devices are available in different options, sizes and capacities. These devices are extremely useful; they can be rewritten and offer incredible storage capacity, up to 256 GB. They can be magnetic (hard disks), optical (CDs and DVDs) or solid (flash memory cards).

We call hardware the equipment involved in the functioning of a computer. It consists of several components that can either send data to the computer (input devices) or convert and transfer data out of the computer in the form of a text, sound, image, or other media (output devices). The main input and output devices are described below.

A monitor is the display, which helps you control computer operations. It accepts video signals from a computer and shows information on a screen. The first models used cathode ray tubes (CRTs). It was the dominant technology until they were replaced by liquid crystal displays (LCDs) in the 21st century.

A keyboard is like a typewriter with an arrangement of keys corresponding to written symbols. It is generally used to type text and numbers in a word processor. However, there are some special keys or combination of keys which, pressed simultaneously, can produce actions or computer commands.

A mouse is a dynamic pointing device used to move the cursor on the screen. It consists of a plastic case, a little ball that sends impulses to the computer when rolled on a flat surface, one or more buttons, and a cable that connects the device to the computer. Modern computers are provided with built-in pointing devices that let you control the cursor by simply moving your finger over a pad.

A scanner captures images from printed pages or photos and converts them into digital data. They usually come with software that lets you resize or modify a captured image.

A printer receives text and graphics from a computer and transfers the information to paper. It may vary in size, speed, sophistication, and cost. In general, more expensive models are used for higher-resolution colour printing.

A speaker converts electrical signals into sounds and allows you to listen to music, multimedia web sites and conversations with other people.

A modem is a device or program that enables a computer to transmit data over telephone lines, by converting digital signals into analog waves. It can be either internal or external to your computer.

Disk drives are devices that allow you to read and write data on disks. They can be either mounted inside the computer and store the computer operating system and all the documents and programs, or come in the form of removable devices.

Exercise 1. Read and memorize using a dictionary

backup _____
case _____
comprise _____
compatible _____
durable _____
execute _____
perform _____

rebooting _____
robust _____
reliability _____
removable _____
storage _____
volatile _____
waterproof _____

Exercise 2. Work in pairs. Look at the picture and decide if the components are input (I) or output (O) devices.



Exercise 3. Complete the table.

Component (acronym)	Full name / Description	Function and properties
hardware		
software		
CPU		
ALU		
CU		
RAM		
ROM		

Exercise 4. Read the descriptions of the different types of computers and fill in the gaps with the words: fixed, intended, data, require, portable, surf, capabilities, reason, amounts, inside.

Desktop: this is a personal computer 1)_____ for regular use at a single location. It's designed to sit on your desk, and as such it consists of a monitor and a tower with extra drives 2)_____.

Laptop: this is a 3)_____ computer, which integrates all the usual components of a desktop computer into a single unit. Smaller versions of laptops are known as notebooks. It is useful for people who do not have a 4)_____ place to work at. They are lighter and handier than desktop computers, but they also tend to be more expensive. They require an expensive battery that needs to be recharged quite often.

Netbook: this is a portable computer, with limited 5)_____ as compared to standard laptops. It is smaller and lighter, but it also has less processing power than a full-sized laptop. It is useful for people who don't have a fixed place to work at or for those who travel, but still need to 6)_____ the Net. They use a battery which needs to be recharged often.

Palmtop: this is a small portable computer designed to have large 7)_____ of information close to hand. They are provided with light long- lasting batteries and special operating systems. They don't require any keyboard but use special pens or touch screens to enter 8)_____ and access information.

Mainframe: this is a very large and expensive computer capable of supporting thousands of users at the same time. For this 9)_____, it is used in businesses and it's the centre of computer networks. These super computers, which are usually as big as a large refrigerator, are the most powerful and expensive ones and they're used for jobs which 10)_____ enormous amounts of calculations, such as weather forecasting, engineering design and economic data processing.

Exercise 5. Answer the questions.

1. What does a desktop computer consist of?
2. Are desktop computers designed to be carried around?
3. Who are laptops useful for?
4. What is the difference between a netbook and a laptop?
5. How can you access or enter information on a palmtop?
6. What are mainframes used for?

Exercise 6. Ask questions to the given answers:

1. Question: _____ ?

Answer: In order to memorize input and output data, there is an internal memory that can be distinguished into volatile and non-volatile.

2. Question: _____ ?

Answer: It is the main memory of the computer where all data can be stored as long as the machine is on.

3. Question: _____ ?

Answer: Software, instead, comprises all the computer programs and related data that provide the instructions for a computer to work properly.

4. Question: _____ ?

Answer: Computer ROM (Read Only Memory), for example, contains essential and permanent information and software which allow the computer to work properly.

Exercise 7. Match the words and word-groups with their definitions:

1 capacity	a) strong; sturdy in construction; able to withstand or overcome adverse conditions
2 elaboration	b) the process of restarting a working computer using hardware (e.g., a power button) instead of software
3 robust	c) the maximum amount that something can contain
4 volatile memory	d) a copy of a file or other item of data made in case the original is lost or damaged
5 essential	e) the process of developing or presenting a theory, policy, or system in further detail
6 durable	f) computer storage that only maintains its data while the device is powered
7 rebooting	g) of the utmost importance
8 backup	h) able to withstand wear, pressure, or damage

Exercise 8. How much do you know about computers? Work in pairs and answer the questions.

1. What is a computer?
2. What does a computer do?
3. What are the main components of a computer?
4. Have you got a computer at home? What type is it?
5. What do you generally use your computer for?

Lesson 11

COMPUTER TECHNOLOGY (2)

Read the text about the Internet:

The Internet is a worldwide information system consisting of countless networks and computers, which allow millions of people to share information and data. Thanks to the Internet it is now possible for people all over the world to communicate with one another in a fast and cheap way. The Internet was first invented in the 1960s in the USA by the Department of Defence as an internal project to link computers. The Department wanted an extremely safe way of sending messages in case of nuclear attack. It was a British physicist, Sir Timothy Berners-Lee, who used it to make information available to everyone and created the most important media of the 21st century. In 1980 while working at CERN in Geneva - the largest particle physics laboratory in the world - he first thought of using hypertext to share and update information among researchers. Then in 1989-90 he produced a plan to link hypertext to the Internet to create the World Wide Web. He designed and built the first site browser and editor, as well as the first web server called httpd (Hypertext Transfer Protocol Daemon). Hypertext are the words or chains of words in a text we can click on to be linked to new sites whose content is related to the words. But how does this global system work? It is a network of people and information linked together by telephone lines which are connected to computers. The applications are based on a client/server relationship, in which your computer is the client and a remote computer is the server. All you need to join this system is a computer, a normal telephone line, a modem and an account with an Internet Service Provider (ISP), a company that provides access to the Internet. A user buys a subscription to a service provider, which gives him/her an identifying username, a password and an email address. With a computer and a modem, the user can connect to the service provider's computer which gives access to many services, such as WWW (world wide web), emails and FTP (file transfer protocol).

The World Wide Web has been central to the development of the Information Age and is the primary tool billions of people use to interact on the Internet. Web pages are primarily text documents formatted and annotated with Hypertext Markup Language (HTML). In addition to formatted text, web pages may contain images, video, audio, and software components that are rendered in the user's web browser as coherent pages of multimedia content.

FTP is a standard network protocol used for to transfer computer files between a client and server on a computer network.

FTP is built on a client-server model architecture and uses separate control and data connections between the client and the server. FTP users may authenticate themselves with a clear-text sign-in protocol, normally in the form of a username and password, but can connect anonymously if the server is configured to allow it. For secure transmission that protects the username and password, and encrypts the content.

A host that provides an FTP service may provide anonymous FTP access. Users typically log into the service with an 'anonymous' (lower-case and case-sensitive in some FTP servers) account when prompted for username. Although users are commonly asked to send their email address instead of a password, no verification is actually performed on the supplied data. Many FTP hosts whose purpose is to provide software updates will allow anonymous logins.

Exercise 1. Read and memorize using a dictionary

countless _____
 interfere _____
 keyboard _____
 landline _____
 laptop _____
 mainframe _____

palmtop _____
 recharge _____
 sophistication _____
 subscription _____
 tower _____
 typewriter _____

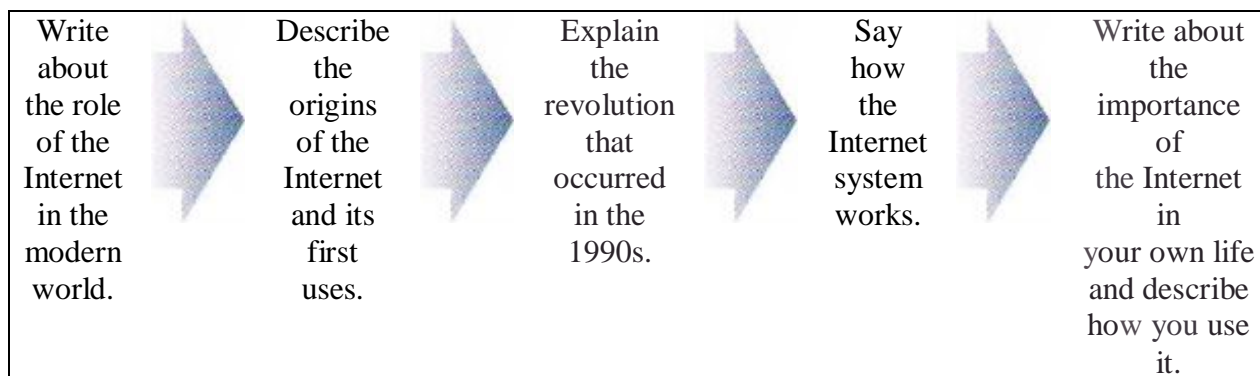
Exercise 2. Match each sentence with its ending.

1	Thanks to the Internet it is now possible for people all over the world	a	to be linked to new sites whose content is related to the words.
2	Hypertext are the words or chains of words in a text we can click on	b	which gives him/her an identifying username, a password and an email address.
3	The applications are based on a client/server relationship,.	c	to communicate with one another in a fast and cheap way.
4	The Department wanted an extremely safe way	d	in which your computer is the client and a remote computer is the server
5	A user buys a subscription to a service provider,	e	of sending messages in case of nuclear attack.

Exercise 3. Complete the sentences with the missing information.

- 1 The Internet allows people to _____
- 2 In the 1960s, the Internet was used _____
- 3 Thanks to Sir Timothy Berners-Lee _____
- 4 He created the World Wide Web by linking _____
- 5 All you need to access the Internet is _____
- 6 The ISP is _____

Exercise 4. Write a summary of the text following the flow chart.



Exercise 5. Read about the different types of Internet connections and match the words: DSL, wireless, satellite, cable, dial-up with the correct definition.

1 _____

It used to be the most common way to access the Internet. This type of connection requires you to use a landline telephone connection and a modem connected to your computer. In order to establish the connection, you must dial a telephone number provided by the ISP. Nowadays it represents the cheapest but slowest way to connect to the Internet. Another disadvantage of this type of connection is that you cannot make or receive phone calls while connected to the Internet.

2 _____

A digital subscriber line is another way to connect to the Internet through a telephone connection, but the quality and speed of the connection is significantly greater than a dial-up connection. Moreover, unlike a dial up connection, this connection is always on, which means you can still make and receive telephone calls with your landline telephone.

3 _____

In order to have this type of connection you must subscribe to an account with a local cable television provider and connect a cable modem to your computer. This connection is very fast and doesn't interfere with your telephone line.

4 _____

This is one of the newest Internet connection types. This connection does not require your computer to be connected to telephone or cable wires, as it uses radio frequency bands. You simply need a modem and an account with an Internet provider. Nowadays, many coffee shops, restaurants, public libraries and schools offer this type of connection for free. However, it is typically more expensive and mainly available in metropolitan areas.

5 _____

This type of connection allows a user to access the Internet via a satellite that orbits the earth. Because of the enormous distances signals must travel, this connection is slightly slower than terrestrial connections through cables. It represents an excellent option for people living in rural areas where other types of connections are not available.

Exercise 6. Read the text about USB flash drives and fill in the gaps with the words in the box.

plugged	backup	board	moving	disadvantage	
operating	system	case	off-site	water	pocket

Mass storage devices are available in an incredible number of options with different storage capacity up to 256 GB for some portable drives. A very popular type of removable device is represented by USB flash drives, which are much smaller and lighter than other portable drives, but which can still provide a huge storage capacity.



A USB flash drive is a flash memory data storage device integrated with a USB (Universal Serial Bus) interface. USB flash drives are removable and rewritable, and they are small enough to be carried in a (1) _____. These portable drives are faster, have thousands of times more capacity, and are more

durable and reliable than CD-ROMs because of their lack of (2) _____ parts.
 Unlike most removable drives, a USB drive does not require rebooting after it's attached, they are very robust and use very little power. They just need to be (3) _____ into a USB port to work and they're compatible with any modern (4) _____, such as Linux, Mac OS X and Windows.

A flash drive consists of a small printed circuit (5) _____ carrying the circuit elements and a USB connector, insulated electrically and protected inside a plastic (6) _____. The drive is often used as a (7) _____ medium to save data, because it is very user-friendly and it can be carried (8) _____ for safety despite being large enough for several backups. Moreover, flash drives are cheaper and less fragile than many other backup systems. Some specially manufactured flash drives are provided with a metal or rubber case designed to be waterproof and almost unbreakable. It's been tested that these flash drives can retain their memory even after being submerged in (10) _____, put in a washing machine and run over with a car.

Exercise 7. Find the synonyms for the following words in the text.

- | | | | |
|----------------|-------|---------------|-------|
| 1 long-lasting | _____ | 4 easy to use | _____ |
| 2 sturdy | _____ | 5 fabricated | _____ |
| 3 inserted | _____ | 6 hold | _____ |

Exercise 8. Decide if the following statements are true (T) or false (F), then correct the false ones.

- | | |
|---|-------|
| 1. Flash drives are provided with a very limited storage capacity. | _____ |
| 2. They are lighter than other removable drives. | _____ |
| 3. They need an external power supply to work. | _____ |
| 4. USB flash drives are compatible with few operating systems. | _____ |
| 5. A plastic case prevents the printed circuit board from being damaged. | _____ |
| 6. USB drives are convenient for transferring data between computers or for personal backups. | _____ |
| 7. They are more expensive than other backup systems. | _____ |
| 8. Some models continue to work even after being accidentally dropped into water. | _____ |

Lesson 12

AUTOMATION AND ROBOTICS

Read the text about automation and automation technologies:

Mechanisation refers to the process of providing human beings with machinery capable of assisting them with the muscular requirements of work. A further development of mechanisation 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, energy consumption)
Replacing human operators in tasks that involve hard physical or monotonous work	Sharp increase in unemployment rate due to machines replacing human beings
Saving time and money as human operators can be employed in higher-level work	Technical limitations as current technology is unable to automate all the desired tasks
Replacing human operators in tasks done in dangerous environments (fire, space, volcanoes, nuclear facilities, underwater)	Security threats as an automated system may have a limited level of intelligence and can make errors
Higher reliability and precision in performing tasks	Unpredictable costs due to research and development, which may exceed the cost saved by the automation itself
Economy improvement and higher productivity	High initial costs as the automation of a new product requires a large initial investment

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 organisational 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.

Exercise 1. Read and memorize using a dictionary.

to aid _____
beyond _____
bounce off _____
broad _____
diode _____
disabled _____
discriminate _____
go underwater _____
goods _____
handling _____
lead time _____

manufacturing _____
nowadays _____
pattern _____
pick up _____
requirement _____
shutter _____
surveillance _____
task _____
transducer _____
unemployment rate _____
work flow _____

Exercise 2. Match the words with their definition.

- | | |
|----------------------------|---|
| 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 |
| 8 lead times | h) things that are made to be sold |
| 9 handling | i) jobs in transports, communications, hospitals, energy industry |
| 10 work flow | j) the state of not having a job |

Exercise 3. What would you like to automate in your life? In pairs, discuss the impact of automation on your own life and list its main advantages and disadvantages.

Exercise 4 . Answer the questions

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?

Exercise 5. In pairs, think of what robots can do nowadays and tick the boxes below.

Nowadays robots can

get sick	see obstacles
go underwater	speak fluently
handle dangerous material	smell things
clean nuclear waste	taste food
explore volcanoes	move objects
go to space	have feelings
easily walk on two legs	

Exercise 6. Read the text about sensors and match each paragraph with a heading.

Sensor applications

Types of sensors

What is a sensor?

1 _____

Almost every industrial 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.

2 _____

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.

3 _____

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 are 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.

Exercise 7. 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

Exercise 8. Read the text about the computer mouse and underline the correct option:

A common example of the application of sensors to everyday objects is the computer mouse. The mechanical mouse has a ball which rotates and translates the (1) *motion/temperature* of our hand into signals that the computer can use.

Developed in late 1999, the optical mouse is an advanced computer pointing device that uses a light-emitting diode (LED), an (2) *acoustic/optical* sensor and a digital signal processor (DSP) in place of the traditional mouse ball and electromechanical transducer. The optical mouse actually uses a tiny (3) *camera/recorder* to take thousands of pictures at a rate of more than 1,000 images per (4) *minute/second*.

Optical mice can work on many surfaces without a mouse pad, thanks to an LED that bounces light off the surface it is on onto an optical sensor. The sensor sends each image to a digital signal (5) *processor/transistor* which examines how the patterns have moved since the previous image, determining how far the mouse has moved. The computer then moves the cursor on the

screen based on the coordinates received from the mouse. This happens hundreds of times each second, making the cursor appear to move very (6) *slowly/ smoothly*.

The best surfaces reflect but some others, for example a blank sheet of white (7) *plastic/paper*, do not allow the sensor and DSP to work properly because the details are too small to be detected.

In addition to LEDs, a recent innovation are laser- based optical mice that detect more surface details compared to LED technology. This results in the ability to use a mouse on almost any surface and to (8) *reduce/increase* the resolution of the image.

Exercise 9. Read the text again and match each sentence with its ending.

- | | |
|----------------------------|---|
| 1 A mechanical mouse | a) the optical mouse was developed. |
| 2 There are no sensors | b) provide high-resolution images. |
| 3 In late 1999 | c) can reflect light in the same way. |
| 4 An optical mouse | d) in a mechanical mouse. |
| 5 A DPS | e) has got a scroll ball mechanism inside. |
| 6 Not all surfaces | f) uses a light-emitting diode, an optical sensor and a DSP |
| 7 Laser-based optical mice | g) is a processor for digital signals. |

Lesson 13

TECHNICAL ASSISTANCE

Read the text about maintenance:

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.

Auto maintenance describes the act of inspecting or testing the condition of car subsystems (e.g.: engine, brakes, radiator, etc.) and replacing parts and fluids. Thanks to regular maintenance it is possible to ensure the safety, reliability and comfort of a car, while during preventive maintenance, a number of parts are replaced to avoid major damage or for safety reasons.

Car maintenance is usually scheduled according to different factors, such as the year or model of the car, its driving condition and driver behaviour. When scheduling auto maintenance, car manufacturers recommend keeping in mind some factors that may affect the functionality of car subsystems. Some of these factors are: the number of trips and the distance travelled every day; the exposure to particular climate conditions (extreme hot or cold); long-distance cruising and whether the car has to tow a trailer or other heavy loads.

Common car maintenance tasks include:

- car wash
- check or replace the engine oil and oil filters
- inspect or replace windshield wipers
- inspect tyre pressure and wear

- check wheel alignment
- check, clean or replace battery terminals
- inspect or replace brake pads and fluids
- inspect or replace air filter
- lubricate locks and hinges
- check all lights
- inspect or replace spark plugs
- tighten chassis bolts

Some tasks that have equivalent service intervals can be combined into one single service known as a tune-up. In modern cars, where electronics controls most of the car's functions, the traditional tune-up has been replaced by incorporated software that takes care of the engine by constantly checking thousands of sensor signals. Completed maintenance services are then recorded in a service book which is very useful for keeping track of the car service history.

Exercise 1. Read and memorize using a dictionary.

alignment _____
 bolt _____
 break _____
 break pad _____
 chassis _____
 entail _____
 exposure _____
 failure _____
 foul _____
 hinge _____
 lock _____

lubrication _____
 overhaul _____
 schedule _____
 spare wheel _____
 steering wheel _____
 tighten _____
 tow _____
 trunk _____
 trailer _____
 tyre _____
 windshield _____

Exercise 2. Answer the questions.

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?
5. What is maintenance called if it occurs after a failure?
6. Why can corrective maintenance be expensive?

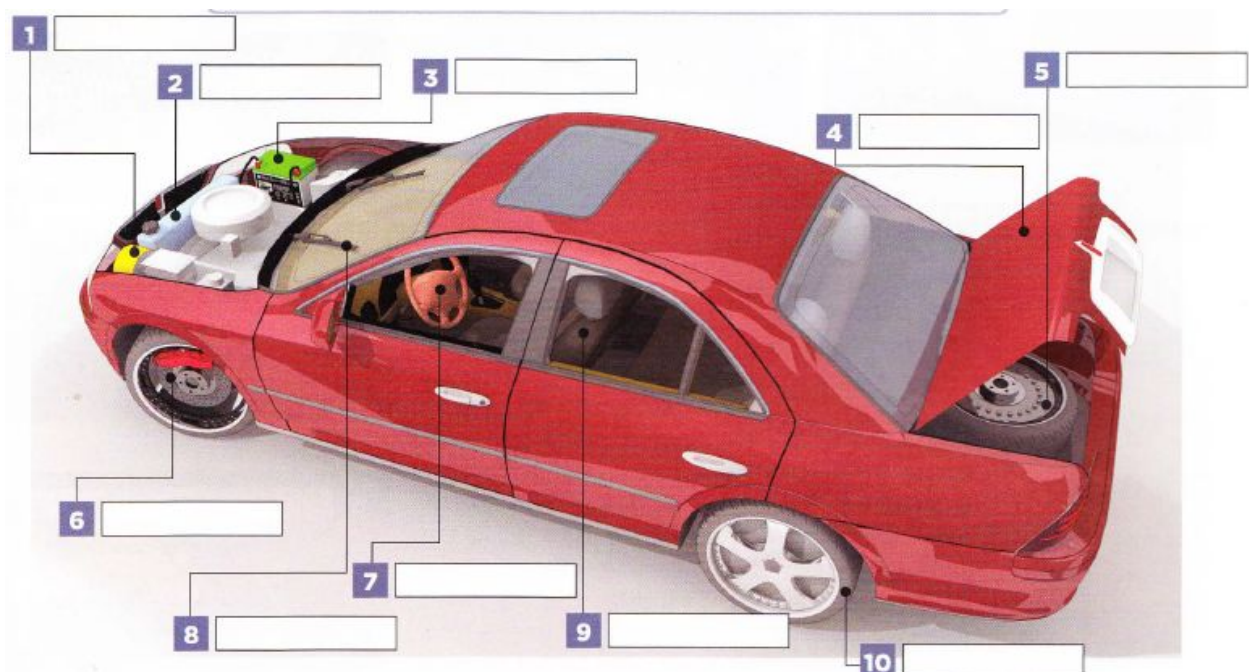
Exercise 3. Match the words with their definitions.

- | | | | |
|---|-------------|---|---|
| 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 | lubrication | 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 | a careful examination of a machinery or system that must be repaired |

Exercise 4. How well do you know the components of a car? Look at the picture and label each part with the words in the box.

seat battery radiator tyre spare wheel steering wheel
disk brake oil filter trunk windshield wiper



Exercise 5. Decide if the following rules are true (T) or false (F), then correct the false ones.

Cars are not just a luxury item to purchase one day and forget about until something happens. A properly maintained car not only lasts longer, but it is also less likely to break down unexpectedly.

1. Auto maintenance doesn't entail replacing fluid. True/False
2. It is not possible to do preventive maintenance to cars. True/False
3. Car maintenance must be scheduled keeping in mind different factors. True/False
4. The distance travelled every day doesn't affect the functionality of a car. True/False
5. If a car is exposed to extreme weather conditions, it must be checked more often. True/False
6. It is not possible to replace windshield wipers. True/False
7. Brake fluid lasts forever. True/False

8. Car maintenance tasks should never be combined in one single service. True/False

Exercise 6. Read the dialogue between Mrs. Farrell and her mechanic and complete it with the following words: *service book, start, filters, help, tune-up, good condition, engine oil, inspect, tested, replace.*

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.

Exercise 7. 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?

Lesson 14

HEALTH AND SAFETY AT WORK

Read the text:

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 for 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.

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 must you 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 areas, etc.

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

Exercise 1. Read and memorize using a dictionary.

ash _____	extinguisher _____	overall _____
assemble _____	fire fighter _____	safety _____
building site _____	flip up _____	sign _____
carelessness _____	harmful _____	spark _____
cope with _____	hazard _____	supplier _____
debris _____	injury _____	varnish _____
employee _____	lens _____	

Exercise 2. Answer the questions.

1. Why is it important to ensure a safe working environment?
2. Which law regulates workers' welfare in the United Kingdom?
3. What does the Act define?
4. What are the duties of employers?
5. Why is it important to provide employees with adequate training?
6. How can employees contribute to a safe working environment?

Exercise 3. Read the text about fire safety procedures and put the actions in the correct order.

- 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.

Exercise 4. 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

Exercise 5. This is an example of safety rules established by the workers' safety committee in a factory in Adelaide, Australia. Read the text and complete it with the words in the box.

operate	tidy	fire	gloves	damage	concentration
first aid	protection	brush	extinguishers		

SAFETY RULES
<p>MACHINERY</p> <ul style="list-style-type: none"> ▪ Be sure to understand how to (1) _____ every machine you are going to use. ▪ Never use machinery when you are in a room alone. ▪ Use all the (2) _____ required in the place of work. ▪ Check that the safety devices are working. If they are not working, ask for them to be repaired immediately. ▪ Do not talk to anybody who is operating a machine. (3) _____ is important at all times. ▪ Turn off the electricity before cleaning a machine.
<p>TOOLS</p> <ul style="list-style-type: none"> ▪ Report any (4) _____ to the tools used at work. ▪ See that tools are correctly set.
<p>DRESS</p> <ul style="list-style-type: none"> ▪ Before starting work, wear protective clothing. ▪ Always wear safety glasses, (5) _____ and boots when using a machine.
<p>WORKSHOP</p> <ul style="list-style-type: none"> ▪ Keep the workshop (6) _____, do not leave rubbish around and do not throw cigarette ends or ashes into the rubbish bin. ▪ The area around machines must be kept clear to avoid falling. ▪ Tools and protective clothing should be put away when not in use. ▪ Clean machines after use with a (7) _____, not with your hands.
<p>ACCIDENT PROCEDURES</p> <ul style="list-style-type: none"> ▪ Make sure you know where to assemble in the event of (8) _____ and where the emergency stop buttons are located. ▪ Check where the fire (9) _____ are in your workplace and how they work, in order to be able to use them in case of fire. ▪ Do not shout or run as this can lead to panic, and inform the supervisor immediately if any accident occurs. ▪ Never administer (10) _____ unless you have been trained to do so.

Exercise 6. Decide if the following rules are true (T) or false (F), then correct the false ones.

1. Use machinery only when other people are in the workplace. _____
2. People mustn't talk in the workplace. _____
3. Turn off electricity after a machine has been cleaned. _____
4. Wear safety boots before arriving in a workplace. _____
5. Always wear sunglasses when using a machine. _____
6. Damaged tools can be dangerous. _____
7. Report to the supervisor about damaged equipment. _____
8. In case of fire ask the supervisor where the emergency stop buttons are located. _____
9. In case of fire shout to catch other people's attention. _____

10. Anyone can give first aid in case of an accident.

Exercise 7. 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 minimized.

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

Exercise 8. 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

1



2



3



4









5



6



Exercise 9. Read the texts about safety equipment and match the words in the box with the correct description.

<div>hearing protection hard hats respirator safety glasses face shield overall</div>	
<p>(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.</p> 	<p>(2) _____ should be worn when working with loud power tools and machinery, in order to protect you from long-term hearing loss.</p> 
<p>(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.</p> 	<p>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.</p> 
<p>(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.</p> 	<p>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.</p> 

Lesson 15

TECHNOLOGY TRENDS

Read the text:

Artificial intelligence (AI), largely manifesting through machine learning algorithms, isn't just getting better. It's being incorporated into a more diverse range of applications. Rather than focusing on one goal, like mastering a game or communicating with humans, AI is starting to make an appearance in almost every new platform, app, or device, and that trend is only going to accelerate. We're not at techno-pocalypse levels (and AI may never be sophisticated enough for us to reach that point), but soon AI will become even more of a mainstay in all forms of technology.

Over the past decade, we've seen the debut of many different types of devices, including smart phones, tablets, smart TVs, and dozens of other "smart" appliances. We've also come to rely on lots of individual apps in our daily lives, including those for navigation to even changing the temperature of our house. Consumers are craving centralization; a convenient way to manage everything from as few devices and central locations as possible. Smart speakers are a good step in the right direction.

Though tech timelines rarely play out the way we think, it's possible that we could have a 5G network in place—with 5G phones—in a few years. 5G internet has the potential to be almost 10 times faster than 4G, making it even better than most home internet services. Accordingly, it has the potential to revolutionize how consumers use internet and how developers think about apps and streaming content. Next year is going to be a year of massive preparation for engineers, developers, and consumers, as they gear up for a new generation of internet.

By now, every company in the world has realized the awesome power and commoditization of consumer data, and next year, data collection is going to become an even higher priority. With consumers talking to smart speakers throughout their day, and relying on digital devices for most of their daily tasks, companies will soon have access to—and start using—practically unlimited amounts of personal data. This has many implications, including reduced privacy, more personalized ads, and possibly more positive outcomes, such as better predictive algorithms in healthcare.

Is your job likely to be replaced by a machine? How certain are you of that answer? AI has been advancing enough to replace at least some white collar jobs for years; even back in 2013, we had algorithms that could write basic news articles, given sufficient inputs of data. Is next year going to be the year all humans are finally replaced by their new robot overlords? Almost certainly not, but we can see the fledgling beginnings of radical job transformations. Jobs will not be fully replaced, but they will be more heavily automated, and we'll have to adapt our careers accordingly.

Exercise 1. Read and memorise using a dictionary.

artificial intelligence _____
await _____
awesome _____
consequence _____
diverse _____

mainstay _____
manifestation _____
predictive _____
rely on _____
seamless _____

exposure _____
 flawless _____
 fledgling _____
 implication _____

sophisticated _____
 streaming _____
 sufficient _____
 voice recognition _____

Exercise 2. Match each paragraph of the text with a heading.

White collar automation	AI permeation
Data overload	5G preparation
	Digital centralization

Exercise 3. Answer the following questions:

1. What is starting to make an appearance in almost every new platform, app, or device?
2. What have we seen over the past decade?
3. What is AI being incorporated into?
4. Why are consumers craving centralization?
5. When is it possible that we could have a 5G network?
6. What potential has 5G internet?
7. Who will soon have access to practically unlimited amounts of personal data?
8. What jobs has AI been advancing enough to replace?

Exercise 4. Match the left part with the right:

1. Jobs will not be fully replaced, but they will be more heavily automated,	a) including those for navigation to even changing the temperature of our house.
2. Next year is going to be a year of massive preparation for engineers, developers,	b) and we'll have to adapt our careers accordingly.
3. We've also come to rely on lots of individual apps in our daily lives,	c) including smart phones, tablets, smart TVs, and dozens of other "smart" appliances.
4. We're not at techno-pocalypse levels (and AI may never be sophisticated enough for us to reach that point),	d) and consumers, as they gear up for a new generation of internet.
5. Over the past decade, we've seen the debut of many different types of devices,	e) but soon AI will become even more of a mainstay in all forms of technology.

Exercise 5. Complete the text with the words in the box.

sophisticated	hiccups	exposure	await
unreliable	solidification	recognizing	onset
	flawless	core	

Seamless conversation. A few years ago, voice search was decent, but 1 _____. Today, voice search might as well be 2 _____. Microsoft's latest test gives its voice recognition software a 5.1 percent error rate, making it better at 3 _____ speech than human transcribers. Similarly, robotic speech and chatbots are growing more 4 _____. Next year with these improvement cycles continuing, we'll see the manifestation or 5 _____ of seamless conversation. We'll be able to communicate with our devices, both ways, without any major 6 _____ or mistakes.

UI overhauls. Next year is going to be a major year for UI; we're going to have to rethink how we interact with our apps and devices. The 7 _____ of smart speakers and better voice search has made it so it's no longer necessary to look at a screen to input data. Desktop devices are becoming less and less used as well, with mobile continuing to take over. New types of visuals and more audible clues will likely be included in next-generation UI, and consumers will adapt to them quickly, so long as they serve their 8 _____ needs.

It's hard to say how fast these trends will manifest, or what types of devices and upgrades will dictate their development, we'll see increased 9 _____ on all these fronts.

Regardless of how you feel about technology, or your primary motivations for using it, we can all be excited about the new gadgets and infrastructure that 10 _____ us next year.

Exercise 6. Ask questions to the given answers:

1. Question: _____ ?

Answer: The onset of smart speakers and better voice search has made it so it's no longer necessary to look at a screen to input data.

2. Question: _____ ?

Answer: We've also come to rely on lots of individual apps in our daily lives, including those for navigation to even changing the temperature of our house.

3. Question: _____ ?

Answer: Jobs will not be fully replaced, but they will be more heavily automated, and we'll have to adapt our careers accordingly.

4. Question: _____ ?

Answer: Consumers are craving centralization; a convenient way to manage everything from as few devices and central locations as possible.

Exercise 7. Match the words and word-groups with their definitions:

1 artificial intelligence	a) an event, action, or object that clearly shows or embodies something abstract or theoretical
2 navigation	b) the conclusion that can be drawn from something although it is not explicitly stated
3 commoditization	c) the theory and development of computer systems able to perform tasks normally requiring human intelligence
4 implication	d) smooth and continuous talk, with no apparent gaps or spaces between one part and the next
5 outcome	e) the process or activity of accurately ascertaining one's position and planning and following a route
6 seamless conversation	f) the act of making a process, good or service easy to obtain by making it as uniform, plentiful and affordable as possible
7 manifestation	g) the condition of being presented to view or made known or being subject to some effect or influence
8 exposure	h) the way a thing turns out; a consequence

Exercise 8. Give the words that have similar meanings (synonyms):

- 1) seamless -
- 2) artificial -
- 3) diverse –
- 4) sophisticated –
- 5) awesome –
- 6) sufficient –
- 7) decent –
- 8) flawless –

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Keys

Lesson 1

Ex.2. 1. Engineering is the application of science to the optimum conversion of the resources of nature to the uses of humankind. 2. Engineering is based principally on physics, chemistry, and mathematics and their extensions into materials science, solid and fluid mechanics, thermodynamics, transfer and rate processes, and systems analysis. 3. Since most resources are limited, the engineer must concern himself with the continual development of new resources as well as the efficient utilization of existing ones. 4. Engineers apply scientific principles to design or develop structures, equipment, or processes. 5. Traditionally, the main branches of engineering are chemical engineering, civil engineering, electrical engineering and mechanical engineering, and they produce chemical, civil, electrical and mechanical technologies, respectively. 6. Engineering and the development of new technologies are closely tied to science.

Ex.3. 1c, 2e, 3d, 4a, 5b.

Ex.4. 1b, 2d, 3a, 4c.

Ex.5. 1 include, 2 chase, 3 common, 4 prominent, 5 report, 6 appearance, 7 query, 8 contour, 9 awareness, 10 propose.

Ex.6. 1c, 2d, 3b, 4e, 5a.

Ex.7. 1. What areas does physical science consist of? 2. What is science? 3. What is the history of philosophy intertwined with? 4. When did the term *science* begin to be used with its modern meaning? 5. What were the major figures in the history of Western philosophy equally famous for?

Ex.8. 1T, 2F, 3F, 4F, 5T, 6T, 7F, 8F.

Lesson 2

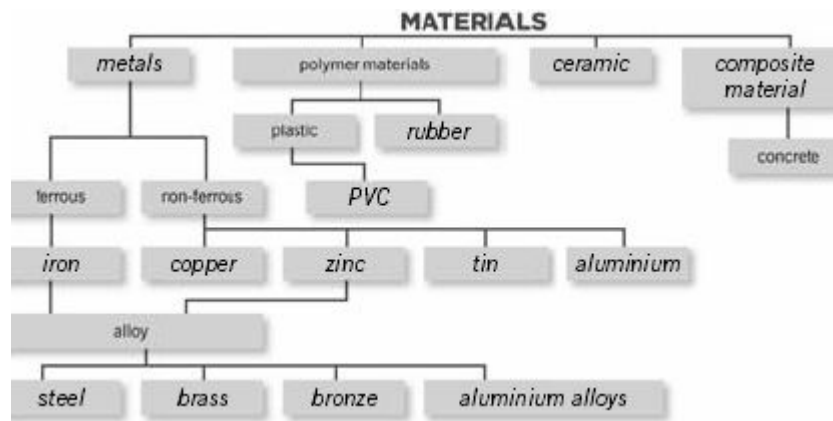
Ex.2. 1 Fluid substances solidify into moulds taking their forms. 2 Drawing is done at room temperature. 3 Heat is not essential in the drawing process. 4 In the past forging was done using a hammer. 5 Extrusion can be done with brittle materials. 6 Sheet forming is used to make many everyday objects.

Ex.3. 1 tools, 2 properties, 3 ceramics, 4 pure, 5 alloy, 6 pasty, 7 non-ferrous, 8 aircraft, 9 insulate, 10 reinforced.

Ex.4. 1 moulding, melting and casting; 2 The mould is filled with liquid metal which is left to solidify into complex shapes. 3 a series of dies; 4 sheet metal drawing, and wire, bar, and tube drawing; 5 Metal is heated and shaped by a compressive force. 6 It was done by a blacksmith using a hammer. 7 The material is passed through a pair of rollers. 8 metal, plastic, paper or glass; 9 The two main advantages of this process are its ability to create very complex cross-sections and work materials that are brittle. 10 metals, polymers, ceramics, concrete and foodstuffs; 11 Metal is formed into thin and flat pieces. 12 shape and thickness

Ex.5 1b, 2c, 3a, 4f, 5d, 6e, 7h, 8g.

Ex.6



Ex. 7. 1 ferrum , 2 air, 3 copper, 4 coins, 5 wires, 6 gold, 7 expensive, 8 ductile, 9 steel, 10 alloy, 11 carbon, 12 cooking.

Lesson 3

Ex.2 1e, 2d, 3b, 4c, 5h, 6g, 7a, 8f.

Ex.3. 1 inexact, 2 low, 3 narrow, 4 light, 5 inappropriate, 6 automatic, thick, flexible.

Ex.4. 1 C, 2 B, 3 A, 4 A, 5 B, 6 B.

Ex.5. 1 Drawing boards and manual drawing are not always precise and rapid: traditional design is usually slow. 2 Nowadays computer software can easily provide a three-dimensional drawing, which allows engineering designers to see how mechanical components may fit together without making models thus saving a lot of time. 3 When the design is ready, the CAD system can generate the detailed drawings needed to start product manufacturing. 4 Computer simulated analysis of the model helps experts find problems and defects without building prototypes, in this way saving a lot of money and time. 5 Computer-aided manufacturing (CAM) offers significant advantages over traditional approaches by controlling manufacturing equipment with computers instead of human labour. 6 CAM converts the design of a component into computer language and it gives instructions to the computer regarding machine operations.

Ex.6 1b, 2d, 3e, 4f, 5a, 6h, 7c, 8g.

Ex.7. 1. What assists the designer in the creation, modification and analysis of a physical object? 2. What do CAD systems form when they are linked to manufacturing equipment controlled by computers? 3. What are the advantages of CAD/CAM systems?

Lesson 4

Ex.2

Machine tool	Final result	Description
Turning machine	external and internal flat surface	It removes excess metal from the external diameter. It enlarges and finishes a hole.
Milling machine	specific shape	It cuts flat metal surfaces.
Drilling machine	holes	It uses a twist drill to make holes.
Shaper	flat surface	It cuts the piece.
Press	specific shape	It changes the shape of a workpiece.
Band saw	cut pieces	It cuts various parts using a continuous band of metal with teeth.
Grinding machine	finishing	It removes excessive material from parts.

Ex.3. 1T, 2F, 3T, 4F, 5T, 6T, 7F.

Ex.4. 1f, 2d, 3a, 4b, 5c, 6e.

Ex.5. 1. What does Computer Numerical control (CNC) refer to? 2. When were the first NC machines built? 3. What does the computer check?

Ex.6. 1 form, 2 strength, 3 characteristic, 4 dimension, 5 fulfil, 6 increase, 7 exactly, 8 specifically.

Ex.7. Milling machines, grinding machines, drilling machines, band saws, presses, turning machines, metal-cutting machines, lathe.

Ex.8. metal, machine, finishing, vertical, diameter, operate, control, component, computer, energy, industrial, revolution, automatic, cylindrical, horizontal, contact, material, mechanically, instruction, command...

Lesson 5

Ex.2. 1 Elements make up all substances. 2 Identical atoms compose each element. 3 Atoms consist of neutrons, protons and electrons. 4 Inside there are neutrons and protons, while outside there are electrons. 5 Shells of electrons orbit around the nucleus. 6 Valence electrons are the electrons in the outermost shell. 7 Neutrons do not have any electric charge. 8 Electricity is generated when valence electrons are free to move from one atom to another.

Ex.3. 1T; 2T; 3F Electrons can easily pass through materials which are full of free electrons. 4F Not any material is a good conductor. 5T; 6T; 7F Impurities are introduced to reduce conductivity. 8T.

Ex.4. 1 direction, 2 power, 3 current, 4 voltage, 5 difference, 6 wire, 7 quantity, 8 rate.

Ex.5. 1 Ampere (A), 2 Coulomb (C), 3 Kilowatt (kW), 4 Volt (V), 5 Watt (W)

Ex.6. 1 Why does alternating current constantly change its direction? 2 What do volts measure? 3 What is power? 4 What is the term 'frequency' used for?

Ex.7. 1e, 2f, 3d, 4b, 5a, 6g, 7h, 8c.

Lesson 6

1 load, 2 switch, 3 fuse, 4 wire, 5 power source.

Ex.2. 1e, 2a, 3c, 4f, 5d, 6b.

Ex.3. 1 It consists of a power source, two conducting wires and a load. 2 It lights up. 3 light bulbs, electric motors and speakers. 4 It is an example of loads. 5 It controls the electrical device. 6 It occurs when there is a drop in the resistance or a broken insulation. 7 We can use fuses. 8 It melts when too much current flows through it.

Ex.4 1 components, 2 path, 3 current, 4 positive, 5 amount, 6 burns out, 7 branch, 8 continue, 9 appliances, 10 turn on.

Ex.5 1 undue, 2 heat-sensitive, 3 to liquefy, 4 overloading, 5 reset, 6 customers.

Ex.6. 1 connection, 2 insulator, 3 resistance, 4 dependency, 5 addition, 6 replacement, 7 difference.

Ex.7. 1- 4, 2 – 6, 3 – 5, 7 – 8, 9 - 10.

Lesson 7

1B, 2A, 3C.

Ex.2. 1F They produce less air pollution than other power plants. 2T; 3F They produce waste material which stays radioactive for centuries. 4F It is generated by the combustion of fossil fuels, which are non-renewable resources. 5F They cause environmental pollution. 6T; 7F It flows through giant turbines. 8F The main disadvantage is its impact on the environment.

Ex.3

Type of energy	How it works	Advantages	Disadvantages
Solar energy	Solar cells made of silicon absorb sunlight, which knocks electrons loose, allowing them to flow freely and produce electricity.	The PV system provides an independent, reliable electrical power source and its routine.	High initial costs.
Wind energy	The wind turns the blades of giant turbines, producing kinetic energy which is then converted into mechanical power and electricity	It is one of the cheapest renewable technologies available today.	There are few suitable wind sites.
Tidal energy	Underwater turbines capture the kinetic energy of rising and falling tides and turn it into electricity.	<i>It is a natural process because it exploits the potential energy of tides.</i>	Only massive increases in tides can produce energy and there are very few places where this occurs. Moreover the changes in the tidal flow can damage the aquatic ecosystem and the shoreline.
Geothermal energy	The hot water stored in the Earth is brought to the surface and used to drive turbines to produce electricity or it can be piped through houses as heat.	It is cheap and has a low impact on the environment.	There are few sites where it can be extracted at low cost.

Biomass energy	Plant material and animal waste are burnt in order to release chemical energy as heat.	It is a natural process, is carbon neutral and has low initial costs.	It has a smaller potential than other energy sources and requires excellent maintenance skills.
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Ex.4. 1c, 2f, 3h, 4a, 5g, 6d, 7b, 8e.

Ex.5. 1 delivery, 2 power plants, 3 consumers, 4 high-voltage, 5 network, 6 demand, 7 lower voltages, 8 transformer, 9 pole, 10 appliances.

Ex.6. 1b, 2e, 3a, 4c, 5f, 6d.

Ex.7. 1d, 2f, 3c, 4a, 5b, 6e.

Ex.8 Personal answers

Lesson 8

Ex.2

Invention	Year	Function
Radio	1920	Read and understand electronic signals; make electromagnetic waves travel long distances.
Radar	during the Second World War	Determine the altitude, direction and speed of moving and fixed objects.
Television	1920s	Transmit images and sound over wire circuits.
Computer	1946	Do a range of computing problems.
Transistor	1957	Replace the use of valves.
Silicon chip	1960s	Improve the way information is stored, processed and distributed; pave the way to microelectronics.

Ex. 3. Personal answers

Ex.4. 1 It is made of separate components attached to a base (PCB). 2 It stands for printed circuit board. 3 It is a perforated block of plastic with several spring clips connected by copper wires. 4 It consists of millions of transistors and other electronic components combined to form a complex set. 5 It is made out of a semiconductor material, such as silicon. 6 They work faster, consume less power and generate less heat. They are also more reliable. 7 It is a logic integrated circuit chip which can carry out a sequence of operations when it receives instructions from different input devices. 8 Up to a billion every second.

Ex. 5. 1c, 2e, 3b, 4d, 5f, 6a.

Ex. 6. 1 movement, 2 radio, 3 antenna, 4 lines, 5 cell, 6 signals, 7 microprocessor, 8 flash, 9 emails, 10 photos.

Ex.7. 1T, 2F, 3F, 4F, 5F, 6F, 7T, 8F, 9T, 10T.

Ex.8. 1 What does a cellular phone use to communicate between the phone and the antenna? 2 What is the server area divided into? 3 What happens if the phone moves to one serving cell to another? 4 What does the microprocessor handle?

Lesson 9

Ex.2

Means of transmission	Material	Function	Type of signal (ground or air)	Advantages
wires	copper insulated with plastic	They are used mainly in telephone and computer networks.	ground signal	cheap and effective
coaxial cables	Inner conductor insulated with plastic and surrounded by a copper shield	They are used in television and radio.	ground signal	They can support about 60 channels; the inner cable is insulated to protect the wires from bending and to reduce the noises.
optical fibres	strands of pure glass	They are used in communication systems, in some medical instruments and in a wide variety of sensing devices.	ground signal	They can transmit signals over longer distances and at higher speed.
antennas	metal	They capture radio signals and convert them into electrical signals through the receiver. They can also convert electrical signals into radio signals.	air signal	They provide information at a cheap rate.
satellites	metal	They receive signals in a given frequency and then retransmit them at a different frequency to avoid interference problems.	air signal	They provide accurate Information about agriculture, pollution and weather forecasting. They are also used in telecommunications.

Ex.3. 1 It consists of at least two computers joined by cables. 2 It is a special computer that can send messages. 3 It is a Local Area Network. 4 It is a Wide Area Network. 5 They define the formats and rules that computers must follow when exchanging information. 6 It is used in LANs. 7 It facilitates communication and allows people to share files and other types of

information. 8 It can be difficult to set up and may be insecure. Sometimes it can interfere with other technologies.

Ex.4. Personal answers

Ex.5. 1 transmission, 2 cables, 3 waves, 4 wires, 5 coaxial, 6 fibres, 7 antennas, 8 satellites.

Ex.6. 1 nodes, 2 backbone, 3 small, 4 affect, 5 destination, 6 exchanging, 7 network, 8 circle, 9 pathway, 10 failure, 11 star, 12 configure.

Ex.7. 1 F It depends also on the type of hardware and the stability needed. 2 F The ring topology is the cheapest and requires few cables. 3 T, 4 F There is no server. 5 T, 6 F It connects all the devices. 7 F There is no hub. 8 F There is no hub. 9 F It combines elements of star and bus topologies. 10 T.

Ex.8.

Topology	Connection	Use	Advantages	Disadvantages
bus	All nodes are connected to a backbone	Small networks	If a computer doesn't work, it doesn't affect the others	It can't connect a large numbers of computers
star	All nodes are connected to the central hub.	businesses	It can grant rapidity and safety in exchanging data. Data is always up to date and if a computer doesn't work, it doesn't the others.	If the hub goes down, the whole network doesn't work.
ring	Each node is connected in a circle.	Small networks	It requires fewer cables and is less expensive than other topologies.	If one computer goes down, the whole network doesn't work.
Star bus	Computers in a specific area are connected to hubs creating a star. Each hub is connected to gether along the network backbone.	Unlimited use	It can be easily expanded in over time.	It is more difficult to configure and if the backbone line breaks, the whole network goes down.

Lesson 10

Ex.2. 1 modem: I-O; 2 monitor: I; 3 speakers: O; 4 keyboard: I; 5 scanner: I; 6 mouse: I; 7 printer: O; 8 disk drive: I-O.

Ex.3

Component (acronym)	Full name/Description	Functions and properties
hardware	components you can physically see	component
software	computer programs and related data	provide the instructions for the computer to work properly
CPU	Central Processing Unit	internal memory system
ALU	Arithmetic Logic Unit	carry out the instructions of a program to perform arithmetical and logical operations
CU	Control Unit	control the system and coordinate all the operations
RAM	Random Access Memory	store data as long as the machine is on
ROM	Read Only Memory	contain essential and permanent information and software

Ex.4. 1 intended, 2 inside, 3 portable, 4 fixed, 5 capabilities, 6 surf, 7 amounts, 8 data, 9 reason, 10 require.

Ex.5. 1 It consists of a monitor and a tower with extra drivers inside. 2 No, they are designed to sit on a desk. 3 people who do not have a fixed place to work at; 4 Netbooks have limited capabilities as compared to laptops. 5 by using special pens or touch screens; 6 They are used for jobs requiring enormous amounts of calculations.

Ex.6. 1 What can an internal memory be distinguished into? 2 Where can all data be stored as long as the machine is on? 3 What comprises all the computer programs and related data that provide the instructions for a computer to work properly? 4 What does computer ROM contain?

Ex.7. 1c, 2e, 3a, 4f, 5g, 6h, 7b, 8d.

Ex.8. Personal answers.

Lesson 11

Ex.2. 1 c, 2 a, 3 d, 4 e, 5 b.

Ex.3. 1 The Internet allows people to share information and data and to communicate in a fast and cheap way. 2 In the 1960s, the Internet was used by the US Department of Defence to link computers. 3 Thanks to Sir Timothy Berners-Lee, hypertext was used to share and update information among researchers. 4 He created the World Wide Web by linking hypertext to the Internet. 5 All you need to access the Internet is a computer, a telephone line, a modem and an account with an Internet Service Provider. 6 The ISP is a company that provides access to the Internet.

Ex.4. Personal answers.

Ex.5. 1 dial-up, 2 DSL, 3 cable, 4 wireless, 5 satellite.

Ex.6. 1 pocket, 2 moving, 3 plugged, 4 operating system, 5 board, 6 case, 7 backup, 8 off-site, 9 disadvantage, 10 water.

Ex.7. 1 durable, 2 robust, 3 plugged, 4 user-friendly, 5 manufactured, 6 retain.

Ex.8. 1 F They have a huge storage capacity (up to 256 GB). 2 T. 3 F They don't require batteries. 4 F They are compatible with any modern operating system. 5 T. 6 T. 7 F They are cheaper. 8 T.

Lesson 12

Ex.2. 1e, 2f, 3h, 4i, 5g, 6b, 7j, 8a, 9d, 10c.

Ex.3. Personal answers

Ex.4. 1 It means the use of computer systems to aid in the design, analysis, and manufacture of products. 2 It includes computer-aided design (CAD) and computer aided manufacturing (CAM). 3 Some abilities are well beyond the capabilities of computer systems; these technologies require high-skilled engineers and the synthesis of complex sensory data; initial costs can be very high. 4 Domotics and robotics. 5 In a domotic house 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. 6 They are used to move, manipulate objects and interact with the environment.

Ex.5

<input checked="" type="checkbox"/> get sick	<input checked="" type="checkbox"/> see obstacles
<input checked="" type="checkbox"/> go underwater	<input checked="" type="checkbox"/> speak fluently
<input checked="" type="checkbox"/> handle dangerous materials	<input checked="" type="checkbox"/> smell things
<input checked="" type="checkbox"/> clean nuclear waste	<input checked="" type="checkbox"/> taste food
<input checked="" type="checkbox"/> explore volcanoes	<input checked="" type="checkbox"/> move objects
<input checked="" type="checkbox"/> go to space	<input checked="" type="checkbox"/> have feelings
<input checked="" type="checkbox"/> easily walk with two legs	

Ex.6. 1 What is a sensor? 2 Sensor applications. 3 Types of sensors.

Ex.7. 1 B, 2 A, 3 C, 4 B, 5 A, 6 B.

Ex.8. 1 motion, 2 optical, 3 camera, 4 second, 5 processor, 6 smoothly, 7 paper, 8 increase.

Ex.9. 1e, 2d, 3a, 4f, 5g, 6c, 7b.

Lesson 13

Ex.2. 1 In order to avoid the risk of damage or breakdown. 2 Preventive and corrective maintenance. 3 It aims at preserving and restoring equipment before it actually fails. 4 It includes partial or complete overhauls at specified periods, oil changes and lubrication. 5 Corrective maintenance or simply 'repair'. 6 Because sometimes equipment needs to be replaced with substantial costs for the company.

Ex.3. 1e, 2g, 3f, 4h, 5a, 6d, 7b, 8c.

Ex.4. 1 oil filter, 2 radiator, 3 battery, 4 trunk, 5 spare wheel, 6 disk brake, 7 steering wheel, 8 windshield wiper, 9 seat, 10 tyre.

Ex.5. 1F, 2F, 3T, 4F, 5T, 6F, 7F, 8F.

Ex.6. 1 help, 2 tune-up, 3 good condition, 4 start, 5 service book, 6 engine oil, 7 inspect, 8 filters, 9 replace, 10 tested.

Ex.7. 1 She needs a complete tune-up for her car. 2 Because she is going to Spain by car. 3 when she last checked her car; 4 The engine oil must be replaced; filters and tyres need to be inspected and the car needs to be washed. 5 It will be ready on Friday. 6 He replaced the engine oil, the filters and the spark plugs.

Lesson 14

Ex.2. 1 In order to avoid or reduce accidents. 2 The Health and Safety at Work Act 1974. 3 It defines general duties of employers, employees, suppliers and people who manage and maintain work premises. 4 They have to ensure the health and safety at work of all the employees, visitors, the general public and clients. They have to ensure the absence of risk when handling or storing items and substances, as well as provide adequate facilities. They also have to provide employees with proper instructions and training in case of accidents. 5 So that they will be able to cope with any problem that may occur at work. 6 They should always behave responsibly at work and take care of themselves and other people who may be affected by their actions.

Ex.3. 1g, 2j, 3d, 4i, 5a, 6k, 7f, 8e, 9c, 10b, 11h.

Ex.4. 1e, 2d, 3f, 4a, 5c, 6b.

Ex.5. 1 operate, 2 protection, 3 concentration, 4 damage, 5 gloves, 6 tidy, 7 brush, 8 fire, 9 extinguishers, 10 first aid.

Ex.6. 1T, 2 F People mustn't talk while using a machine. 3 F Turn off electricity before cleaning a machine. 4 F Wear safety boots before starting work. 5 F Always wear safety glasses when

using a machine. 6 T; 7 T; 8 F You should already know where the emergency stop buttons are located.

9 F You shouldn't shout because this can lead to panic. 10 F Only people who have been trained can administer first aid.

Ex.7. 1 regulatory, 2 warning, 3 information.

Ex.8. 1d mandatory, 2b danger, 3f prohibition, 4c emergency, 5a caution, 6e general information.

Ex.9. 1 safety glasses, 2 hearing protection, 3 hard hats, 4 respirator, 5 face shield, 6 overall.

Lesson 15

Ex.2. AI permeation, 2 Digital centralization, 3 5G preparation, 4 Data overload, 5 White collar automation.

Ex.3. 1. AI is starting to make an appearance in almost every new platform, app, or device. 2. Over the past decade, we've seen the debut of many different types of devices, including smart phones, tablets, smart TVs, and dozens of other "smart" appliances. 3. AI is being incorporated into a more diverse range of applications. 4. It is a convenient way to manage everything from as few devices and central locations as possible. 5. it's possible that we could have a 5G network in place—with 5G phones—in a few years. 6. 5G internet has the potential to revolutionize how consumers use internet and how developers think about apps and streaming content. 7. Companies will soon have access to practically unlimited amounts of personal data. 8. AI has been advancing enough to replace at least some white collar jobs for years.

Ex.4. 1b, 2d, 3a, 4e, 5c.

Ex.5. 1 unreliable, 2 flawless, 3 recognizing, 4 sophisticated, 5 solidification, 6 hiccups, 7 onset, 8 core, 9 exposure, 10 await.

Ex.6. 1 What has made it so it's no longer necessary to look at a screen to input data 2 What have we also come to rely on? 3 Will jobs be fully replaced? 4 What is centralization? Why do consumers want it?

Ex.7. 1c, 2e, 3f, 4b, 5h, 6d, 7a, 8g.

Ex.8. 1 smooth, 2 synthetic, 3 different, 4 advanced, 5 impressive, 6 adequate, 7 appropriate, 8 perfect.