ΥΠΟΥΡΓΕΙΟ ΠΑΙΔΕΙΑΣ, ΕΡΕΥΝΑΣ ΚΑΙ ΘΡΗΣΚΕΥΜΑΤΩΝ
ΙΝΣΤΙΤΟΥΤΟ ΕΚΠΑΙΔΕΥΤΙΚΗΣ ΠΟΛΙΤΙΚΗΣ

VOCATIONAL LANGUAGE LEARNING

ESP Coursebook ELECTRICITY

Β΄ ΕΠΑ.Λ. ΤΟΜΕΑΣ ΗΛΕΚΤΡΟΛΟΓΙΑΣ, ΗΛΕΚΤΡΟΝΙΚΗΣ ΚΑΙ ΑΥΤΟΜΑΤΙΣΜΟΥ

ΙΝΣΤΙΤΟΥΤΟ ΤΕΧΝΟΛΟΓΙΑΣ ΥΠΟΛΟΓΙΣΤΩΝ ΚΑΙ ΕΚΔΟΣΕΩΝ
«ΔΙΟΦΑΝΤΟΣ»

ELECTRICITY

ΣΤΟΙΧΕΙΑ ΑΡΧΙΚΗΣ ΕΚΔΟΣΗΣ

ΟΜΑΔΑ ΕΡΓΑΣΙΑΣ

Β' Φάση συγγραφής
Παραγωγή του παρόντος γλωσσικού υλικού

ΣΥΝΤΟΝΙΣΜΟΣ - ΕΠΟΠΤΕΙΑ
Διαμαντίδου Αγγελική
Σχολικός Σύμβουλος Π.Ε. 6

ΚΑΘΗΓΗΤΗΣ ΕΙΔΙΚΟΤΗΤΑΣ
Ασημακόπουλος Αντώνης
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ΕΠΕΞΕΡΓΑΣΙΑ ΚΕΙΜΕΝΩΝ - ΑΣΚΗΣΕΩΝ
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Σπυροπούλου Μαρία Π.Ε. 6

Α' Φάση συγγραφής
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Κιοκπάσογλου Καλλιόπη
Μαυρίδου Άννα
Σαλαμούρη Τριανταφυλλιά
Σουβλάκη Αλεξάνδρα
Σπυροπούλου Μαρία
Χρυσοχόου Ιωσήφ

ΣΤΟΙΧΕΙΑ ΕΠΑΝΕΚΔΟΣΗΣ

Η επανέκδοση του παρόντος βιβλίου πραγματοποιήθηκε
από το Ινστιτούτο Τεχνολογίας Υπολογιστών & Εκδόσεων «Διόφαντος»
μέσω ψηφιακής μακέτας.

Οι διορθώσεις πραγματοποιήθηκαν κατόπιν έγκρισης του Δ.Σ. του
Ινστιτούτου Εκπαιδευτικής Πολιτικής

ΥΠΟΥΡΓΕΙΟ ΠΑΙΔΕΙΑΣ, ΕΡΕΥΝΑΣ ΚΑΙ ΘΡΗΣΚΕΥΜΑΤΩΝ
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ESP Coursebook

ELECTRICITY

For students of
Technical and Vocational Lycea

Η συγγραφή και η επιστημονική επιμέλεια του βιβλίου πραγματοποιήθηκε
υπό την αιγίδα του Παιδαγωγικού Ινστιτούτου

ΙΝΣΤΙΤΟΥΤΟ ΤΕΧΝΟΛΟΓΙΑΣ ΥΠΟΛΟΓΙΣΤΩΝ ΚΑΙ ΕΚΔΟΣΕΩΝ
«ΔΙΟΦΑΝΤΟΣ»

Ευχαριστούμε θερμά

Τις Εταιρείες και τους Αντιπροσώπους των Εταιρειών ELCO, FACOM, HEWLETT PACKARD, LEGRAND, SIEMENS, UNIOR και USAG, καθώς και το περιοδικό “Time” και τον Εκδοτικό Οίκο “LONGMAN” που μας επέτρεψαν να χρησιμοποιήσουμε φωτογραφικό υλικό από τα έντυπα που εκδίδουν.

Η επιλογή των φωτογραφιών που χρησιμοποιήθηκαν έγινε με βάση τις διδακτικές και λειτουργικές ανάγκες του βιβλίου.

Η Ομάδα Εργασίας

INTRODUCTION

This book aims at helping the students of the Technical Lyceum (Electrical technicians) acquire technical vocabulary in order to help them cope with technical reading and communicate in the target situation.

The texts are authentic and at approximately the same level of difficulty. They have been chosen with the help of a subject specialist from a variety of sources: textbooks, brochures, instruction manuals, magazines, advertisements, etc.

Bearing in mind: a) the students' current knowledge of the subject and b) the students' language level, the texts have been adapted and simplified in order to meet the students' needs both in class and their future jobs. Motivation was also taken into account when selecting and exploiting the texts because experience has shown that, if the texts are not motivating, the students' interest in the language is lost.

The book contains a variety of different text types, tasks and illustrations as well as a variety of different exercise types, engaging the students' interest and thinking capacity.

The exercises are divided into two categories: Those designed to develop comprehension of technical texts, in order to help the students acquire the vocabulary presented, and those focusing on grammatical points.

The first category includes skimming exercises, where the students read for general information; scanning exercises where they read for specific information; true / false exercises and comprehension questions. There are also information transfer exercises such as gap filling and labelling diagrams or tables. Other exercise types such as classification of information in grids, matching, re-ordering, completion exercises, etc. are also included in this category.

In the second category, the focus is on language items relevant to technical reading which encourage the students to produce the linguistic features of the target situation, such as the passive voice, conditionals etc. These exercises aim at reinforcing the grammatical points the students have already acquired.

At the end of most units, there are production exercises in the form of communicative activities, which allow the students to reinforce their overall competence in both the language and the ideas presented in the texts.

Apart from all the exercises described previously, some listening activities have been included as well. They aim at training the students in a variety of specific listening skills in an attempt to help them find solutions to various listening problems.

In updating this book, we considered necessary to include learner training activities, such as strategies for rapid reading, deducing the meaning of new words etc. They aim at enabling the students to discover the learning strategies that suit them best so that they may become more effective language learners and take on greater responsibility for their own learning.

The book is accompanied by a glossary containing the new technical and subtechnical terms, which will be helpful to both the teacher and the students.

It also contains the most common electrical symbols and their terms, units of measurement, useful mathematical terms and expressions as well as model letters about various matters with useful guidelines on letter-writing, which the students can use when writing letters.

A short Teacher's booklet accompanies the Student's book. It provides: a) a complete set of answers to the exercises, b) notes to the teacher on the way to approach the teaching of certain activities, c) a detailed lesson plan, and, d) all the listening texts.

As regards the methodological approach to be followed in teaching this material, we would like to point out that E.S.P. belongs to the broader context of E.L.T. Consequently the E.S.P. teacher should always bear in mind that his/her main task is not to teach the subject, but the language, following the same methodological principles applied to teaching G.E.

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• Presenting the importance of electricity	
• Describing changes and developments	• Radio and TV have improved communication.
• Comparing past and present activities	• S. Past, S. Present
• Building vocabulary (synonyms)	
• Expressing possibility	• It is possible for sb. to + infinitive + gerund • It would be impossible/ difficult for sb. to + infinitive
• Laying out a letter	
• Letter writing (Letter of complaint)	
• Expressing an imaginary situation	• 2nd Conditional
• Expressing cause and effect	• Because of due to / since… • So/as a result…

FUNCTIONS - NOTIONS - SKILLS	STRUCTURES - EXAMPLES
UNIT 2 **ELECTRICITY HOLDS THE WORLD TOGETHER**	
• Presenting basic concepts of electricity • Describing physical phenomena/ qualities • Building vocabulary (Synonyms - Antonyms - Collocations) • Producing/describing/labelling a diagram • Classifying items according to qualities	
• Expressing use	• Sth. is used to…
• Expressing parallel increase	• Comparative degree (the + comparative - the + comparative) the more…, the better…
• Expressing cause and effect	• 1st Conditional (If/when + S. Present S. Present / S. Future)
• Word formation: verb - noun - adjective	
	• Preposition
• Using nouns as qualifiers	• e.g. current flow
• Identifying terms from their definitions	

FUNCTIONS - NOTIONS - SKILLS	STRUCTURES - EXAMPLES
UNIT 3 **ENERGY SUPPLY AND DEMAND**	
• Surveying a situation • Building vocabulary (Definitions) • Presenting advantages and disadvantages	
• Expressing similarity	• All, both, also, too, as well as… • So is/are, do/does… • Neither… nor…
• Expressing difference	• Only the / while / besides…

FUNCTIONS - NOTIONS - SKILLS	STRUCTURES - EXAMPLES
UNIT 3 **ENERGY SUPPLY AND DEMAND**	
	• On the contrary / other hand… • (Al)though / however / but…
• Classifying information from general to specific	• … is / are classified into groups, that is… • … belong(s) to…
• Stating present / past events	• S. Present - S. Past
• Expressing past events with a special connection to the present	• Present Perfect
• Describing the function / structure of a system	
• Transferring information from a picture to a text	
• Identifying parts of a whole	
• Describing function	• S. Present (3rd singular)
• Presenting developments in a field	
• Attracting prospective employees	
• Clarifying meanings (shift, share)	• e.g. share the cost, equal shares, make shift, in shifts
• Expressing interest / preference	• I would be interested / I'd like…
• Letter writing (Applying for a job)	
• Carrying out a simulation	
• Stating a point of view	• I think / believe… • My opinion / point of view is…
• Justifying one's opinion	
• Suggesting / consulting	• I suggest that… should
• Agreeing / disagreeing	• I agree / disagree to / with…
• Presenting facts / arguments	• It would be better… / I'd also like to mention…
• Persuading	
• Using linking words	• e.g. To start with, first, then, in addition to, to sum up.

FUNCTIONS - NOTIONS - SKILLS	STRUCTURES - EXAMPLES
UNIT 4 **POWER DISTRIBUTION SYSTEMS**	
• Stating the objectives / qualities of a system	• The purpose of… • The basic objective of… is… • The basic factors determining…
• Describing the structure / operation of a system	• All systems operate…
• Describing the function / parts of a system	
• Describing the material sth. is made of	• They are made of…
• Labelling a diagram	• Power is equal to… ($P=I \cdot V$)
• Presenting mathematical formulas	
• Building vocabulary (Collocations)	• e.g. electric energy, energy transmission, generate energy
• Deciphering an authentic document	
• Understanding elliptical speech	
• Developing elliptical speech	
• Summarizing a text	• Passive Voice (Simple Tenses) Passive ⟷ Active e.g. The letter is written, etc.

FUNCTIONS - NOTIONS - SKILLS	STRUCTURES - EXAMPLES
UNIT 5 **TEST AND MEASUREMENT INSTRUMENTS**	
• Presenting the effects of electric current	• 1st Conditional
• Cause and effect	• When current flows → it produces… / will cause… / …is produced
• Describing the use of an item	• The instrument used to measure… is the…
	• To measure… we use a(n)…
• Identifying items from their use	

FUNCTIONS - NOTIONS - SKILLS	STRUCTURES - EXAMPLES
UNIT 5 **TEST AND MEASUREMENT INSTRUMENTS**	
• Presenting technical achievements	• Nowadays… have been replaced by… • Our firm has become the synonym of advanced technology, high quality…
• Advertising the qualities of produced instruments • Deducing the meaning of unknown words • Building vocabulary (Definitions - Synonyms)	• Easy in operation, offering versatility, reliability…
	• Passive forms
• Filling in a cutting • Making suggestions • Recommending • Persuading a friend	• It's worthwhile buying a… • You'd rather buy… • I think / believe / suggest you should buy… • If you want the best, buy… • If I were you, I would buy…
• Justifying suggestions • Persuading a prospective buyer • Presenting the advantages / properties of a product	… because + S. Present • We even provide… / we offer… • … is right for systems and bench applications • … saves time and money
• Presenting technical features / characteristics • Explaining how to do things • Giving instructions • Expressing purpose • Building vocabulary (Collocations)	• … up to 250 readings / sec on the bench, 500/sec in a system • We can + infinitive by + Gerund • Imperative • To do this, + Imperative
• Asking for and giving information / advice	• Gerund after prepositions • Which one do you recommend? • How is… done? • What does it measure? • How does it measure…? • How much does it cost?

FUNCTIONS - NOTIONS - SKILLS	STRUCTURES - EXAMPLES
UNIT 5 **TEST AND MEASUREMENT INSTRUMENTS**	
• Letter writing (Placing an order) • Developing elliptical speech (Abbreviations) • Identifying values from their symbols • Expressing measurements • Converting units of measurement • Defining location • Writing an advertisement	 • … stands for / is short for… • The symbol for / of… is … • … is presented by / with… • We measure… in… • … is measured in… • To convert… into… we divide / multiply by… • On the lower / upper part of… • On the left / right (hand side) of… • In the middle / centre of… • Over, above, below, under, between

FUNCTIONS - NOTIONS - SKILLS	STRUCTURES - EXAMPLES
UNIT 6 **ELECTRICAL MACHINES**	
• Introducing electrical machines • Expressing necessity • Stating laws of Physics • Stating principles of operation • Describing mode of action • Describing the structure and parts of a machine • Presenting the types of a machine	• The problem of distribution is solved with the use of… • We need… to step up or down… • If a conductor is moved… it will cause… • Generators operate on the principle of… • Generators convert… • Each generator consists of… • Motors are divided into… • …they are classified as…

FUNCTIONS - NOTIONS - SKILLS	STRUCTURES - EXAMPLES
UNIT 6 **ELECTRICAL MACHINES**	
• Presenting technical features and characteristics • Advertising the advantages of a product	• The main characteristic of… is its constant speed • They have a fully coordinated 200° C class insulation system
• Promoting a product	• … is an example of an innovative product
• Describing the function of the parts of a machine • Expressing parallel increase	• The brushes furnish current from the commutator to the… • The + comparative… the + comparative
• Defining items and their use	• Motors are rotating machiners which…
• Stating importance	• It is essential / important to ensure…
• Practising rapid reading • Identifying items in pictures • Arranging pieces of information in order • Transferring information into a diagram • Classifying information	
• Arranging a series of qualifiers in order	• e.g. A single-phase synchronous induction AC motor with capacitor start
• Expressing similarities / differences / contrast	• Unlike, dissimilar (to), different (from), differs from, not so… as, the opposite to / of… • While, whereas, but, on the contrary, on the other hand…
• Comparing items • Building vocabulary (Definitions - Synonyms) • Word formation (Prefix: trans / Suffixes: -ize, -tion, -ance, -tor, -er)	• Like, similar, the same as…, as… as…
	• Prepositions

FUNCTIONS - NOTIONS - SKILLS	STRUCTURES - EXAMPLES
UNIT 6 **ELECTRICAL MACHINES**	
• Expressing purpose • Classifying from specific to general	• To / in order to / so as to… • is are can/could be may/might be should be } categorized classed classified } as... into... • … belong(s) to… • … is / are a category, kind, type, form, example of a(n)…
• Identifying the causes of faulty operation	
• Taking / giving instructions	• Check mainline voltage as marked…
• Understanding / developing elliptical speech	• Stator winding grounded
• Expressing possibility	• Perhaps the line voltage is low • There may be a blown fuse
• Expressing necessity	• … should be + p.p. • 1st Conditional
• Identifying symbols • Producing a coherent text • Writing a short report • Letter writing (Inquiry letter)	• Linking words

FUNCTIONS - NOTIONS - SKILLS	STRUCTURES - EXAMPLES
UNIT 7 **ELECTRICIANS' EQUIPMENT**	
• Presenting working areas of the electrical trade	• e.g. … rewiring old buildings, electrical maintenance, repair, adjustment
• Presenting work activities	• e.g. Threading, bending conduits, crimping terminals, stripping wires.

FUNCTIONS - NOTIONS - SKILLS	STRUCTURES - EXAMPLES
UNIT 7 **ELECTRICIANS' EQUIPMENT**	
• Presenting tools and equipment	• e.g. Die, spirit lever, spring hook, pliers, saddle, terminal block
• Associating tools with work activities	• Pliers are used for tightening, loosening, holding, gripping
• Expressing use / purpose	• We (can) do this by (using)… • To + infinitive, we (can) use… • … are used to…
• Identifying items from their use	
• Giving instructions	• You must / mustn't + inf.
• Giving advice	• You should / shouldn't + Inf.
• Warning / Reminding	• Take care / be careful / try to / not to + Inf. • Make sure / ensure you / that… • Avoid + noun / gerund • Never / always + Imperative • Don't forget to + Imperative
• Transferring information	• Indirect speech • He told us to / not to… • He advises us to / not to… • He warned us to / not to / never to… • He recommended that… should… • He said that we should always…

FUNCTIONS - NOTIONS - SKILLS	STRUCTURES - EXAMPLES
UNIT 8 **ELECTRICAL DRAWING**	
• Stating the aims and developments of electrical drawings • Classifying electrical drawings • Describing the uses and characteristics of the various types of electrical drawings	

FUNCTIONS - NOTIONS - SKILLS	STRUCTURES - EXAMPLES
UNIT 8 **ELECTRICAL DRAWING**	
• Identifying electrical diagrams from their description • Contrasting • Building vocabulary (Definitions - Synonyms) • Word formation: (suffixes: -ness, -ship) • Cause / reason • Result / consequence • Presenting the usefulness of graphical symbols • Identifying items • Describing an electrical installation	• Instead of… • While… • Since/as… • Therefore / consequently / for that reason / thus…

FUNCTIONS - NOTIONS - SKILLS	STRUCTURES - EXAMPLES
UNIT 9 **SAFETY AT WORK**	
• Giving instructions (safety precautions) • Advising • Classifying instructions • Evaluating instructions according to their importance • Clarifying meanings (Definitions) • Building vocabulary (Collocations: verb + noun) • Word formation: (Prefixes: -un, -in, -dis / Suffixes: - less, -ful, -able) • Expressing unreal past situations • Expressing regret / relief • Reviewing Conditionals • Stating the cause of an event	• Imperative • You should… • Be particularly careful • 3rd Conditional (If I had + p.p. → I would have + p.p.) • As / since + Past Continuous … should have + p.p.

FUNCTIONS - NOTIONS - SKILLS	STRUCTURES - EXAMPLES
UNIT 10 **SAFETY FOR THE USER**	
• Presenting concepts of electricity	• e.g. Overloading, voltage leakage etc.
• Introducing a system and its parts	
• Describing items and their use	• It is a… • They are intended / designed to… • They are used to / in…
• Classifying an item into types	
• Classifying information	
• Clarifying meanings (Synonyms - Definitions)	
• Building Vocabulary (Collocation: adjectives + nouns)	
• Word formation: (Suffix: -ive)	
• Describing the structure, function, use of an item	
• Classifying words into thematic areas	
	• Prepositions
• Carrying out a conversation	
• Asking for and giving information	
• Expressing ability / possibility / permission / request	• Can - may

FUNCTIONS - NOTIONS - SKILLS	STRUCTURES
UNIT 11 **REPAIRING ELECTRIC COOKERS**	
• Presenting electrical items and their parts	
• Describing the function of electrical devices and accessories	
• Building vocabulary (Antonyms - Synonyms - Definitions)	
• Word formation: (Suffix: -ly)	
• Identifying faults of electrical appliances from the description of their symptoms	

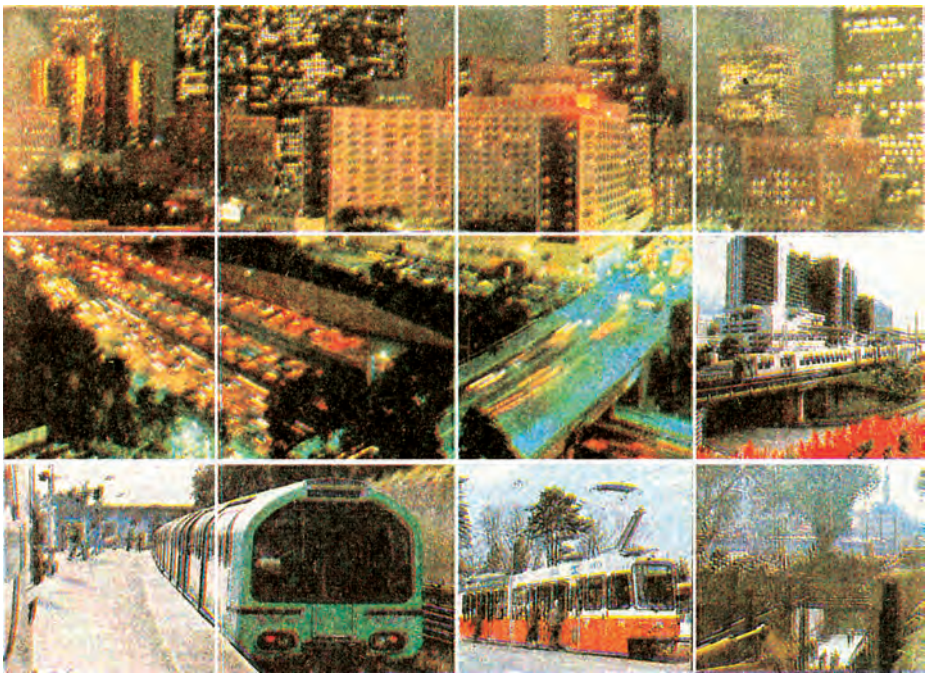
FUNCTIONS - NOTIONS - SKILLS	STRUCTURES
UNIT 11 **REPAIRING ELECTRIC COOKERS**	
• Transferring information from a text into a diagram	
	• Prepositions: of, off
• Describing the stages of a procedure	
• Producing / developing elliptical speech	
• Describing sequence of actions	• Before / after / prior to (+ Gerund)
• Classifying words into thematic areas	
• Writing a report (Describing a procedure)	• Linking words
• Taking / giving instructions	• Imperatives

FUNCTIONS - NOTIONS - SKILLS	STRUCTURES - EXAMPLES
UNIT 12 **THE ELECTRICAL TRADE**	
• Introducing the fields of a trade	• e.g. Cable installation, motor maintenance…
• Introducing a trade and its requirements (responsibilities, qualities, qualifications)	
• Clarifying meanings (Synonyms - Definitions)	
• Expressing obligation / necessity	• Must/ have to
• Asking for and giving advice	• Should / ought to / had better
• Carrying out a conversation	
• Asking for and giving information	
• Expressing opinion / preference	• I think I…
	• Though I don't like…
	• I like / prefer…
• Justifying choices	• Because…

UNIT 1

ELECTRICITY

The Power that transforms the world



Discussion

(Work in pairs or groups)

Do you agree that electricity has transformed the world? If yes, refer to the changes electricity has brought to our lives.

Read the following text to see the writer's attitude towards electricity.

Electric lighting, central heating, refrigerators, washing machines, water heaters, television, elevators, record-players, radios, telephones, computers, trolley-buses, electric trains, traffic lights, X-rays, electrocardiographs… Electricity stands behind all of them!

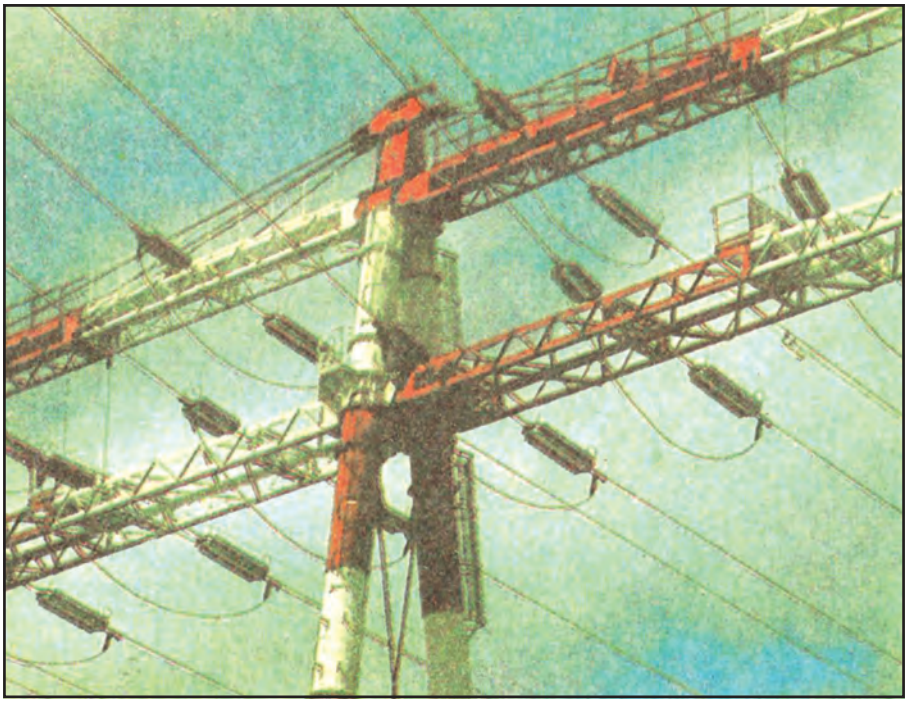
Let's see some examples of how the applications of electricity have affected our lives!

Radio and television have improved communication between different parts of the world. A person in Asia, for instance, can listen to the news from London using a radio set. Television viewers in Greece can see programmes broadcast from the United States of America. Also, traffic lights prevent the continuous traffic chaos in the centre of modern cities by controlling the heavy traffic…

Can you imagine your everyday life without electricity? It provides us with light, heat and sound. It provides factories with energy. It moves cars and trains. It stands behind electronics. Modern life would be unthinkable and… unlivable without electricity.

A power-cut would cause total confusion at home, in industry, transportation, communications, entertainment, health services, or education.

There is no energy more useful than electricity. Electricity can be sent over long distances very quickly. It can easily be converted and controlled. It is silent and clean, with no waste products.



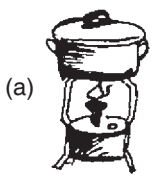
EXERCISES

1. Tick appropriately as in the example.

	FIELDS OF APPLICATION						
APPLICATIONS OF ELECTRICITY	**INDUSTRY**	**COMMUNICATIONS**	**ENTERTAINMENT**	**HOME SERVICES**	**HEALTH SERVICES**	**EDUCATION**	**TRANSPORTATION**
traffic lights							✓
X-rays							
hair-driers							
computers							
toasters							
motors							
cassette recorders							
generators							
electrocardiographs							
telephones							
door bells							
electric toys							
trolley buses							
water heaters							
teleprinters							
electroencephalographs							
overhead projectors							
video							
sterilizers							
OTHERS							

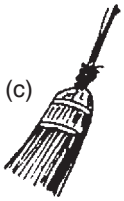
2.A. Name the items illustrated in the pictures in column B.

Column A



(a) 1. Oil-cooker

(b) 2. Gramophone

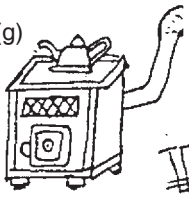


(c) 3. Broom

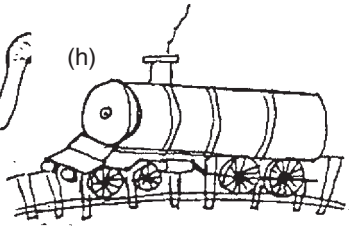
(d) 4. Mail-pigeon

(e) 5. Oil-lamp

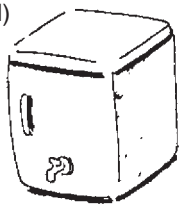
(f) 6. Wash-tub



(g) 7. Wood-stove



(h) 8. Steam-train



(l) 9. Ice-box

Column B

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

B. Match the items in column A with their modern equivalent in column B.

C. Comment on the items of both columns as in the examples.

1. Some years ago, people used oil cookers to cook their food. Nowadays they use electric cookers, instead.

2. Long ago there weren't any electric cookers. People used oil cookers to cook their food.

3. Replace the underlined words in the following sentences with words from your text.

1. All electrical devices need power to work.

2. A lamp changes electrical energy into light.

3. Electricity supplies Industry with the necessary power.

4. Lifts are used in multistorey buildings.

5. Many of the people who watch TV prefer serials.

6. The telephone has facilitated communication between people.

4. Describe the way each of the following devices has affected our lives. Begin with "It is possible for…"

***e.g.** 1. Vacuum cleaner: housewife / remove dirt / carpets, rugs / easily, quickly. It is possible for a housewife to remove dirt from carpets and rugs easily and quickly using a vacuum cleaner.*

2. Refrigerators: people / hot countries / preserve food / long.

3. Telephone: someone in Greece / communicate immediately / friends in U.S.A.

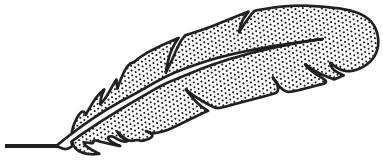
4. Video: people / see a film / whenever they wish.

5. Microwave oven: people / cook meal / few minutes.

5. Now change the previous sentences using the expressions "without…, it would be difficult / impossible…"

***e.g.** 1. Without a vacuum cleaner, it would be difficult for a housewife to remove dirt from carpets and rugs.*

Writing Activity
(Letter of complaint)



6. You are the owner of the famous restaurant "Hermes". Last month there were many unexpected and long power-cuts, which caused great damage to your business (foodstuff was spoilt / though restaurant remained closed for long hours, staff was paid / expensive advertising campaign for your restaurant on TV was not watched as expected).

As a result, you decided to write a letter to the Electric Power Corporation to complain about the inconvenience and damage and ask them: a) to inform you

in advance about similar events in the future and b) not pay the bill of the next month as the smallest contribution of the Corporation to the damage of your business.

Address your letter to:

The Electric Power Corporation
The Customers' department
23 Aharnon st.
Athens 250 21

The guidelines below will help you write your letter.

GUIDELINES

POINTS TO REMEMBER WHEN WRITING A FORMAL LETTER

- **Be polite:** Avoid imperatives when asking for something. Use expressions like: "I would be grateful if…", "Could you please…", "I would like to know…", "Let me know if / that / when…", instead.
- When **you don't know** the name of the receiver (addressee):
  - **Start** your letter with: "Dear Sir / Sirs / Madam / Madams" and
  - **End** it with: "Yours faithfully / truly*" or "Faithfully / Truly* / Very truly* yours".
- When **you know** the name of the receiver:
  - **Start** your letter with: "Dear Mr / Mrs / Miss / Ms** (his/her name)"
  - **End** it with: "Yours sincerely" or "Sincerely yours".
- **Common phrases** to **close** the letter are: "I look / am looking forward to meeting / hearing from you soon", "Please let us hear from you as soon as possible", "I would particularly like to know about…".
- **At the end** of the letter:
  - **Put** your signature.
  - **Write** your name in full, below your signature.
  - **Add:** Mr, Mrs, Miss after your name in parenthesis to help the receiver know - how you would like to be addressed.
  - **State** your occupation / post in the firm below your name.

* More common in American English.
** Use Ms if you don't know whether the woman is married or single.

SENDER'S ADDRESS _____
_____
_____
_____

DATE _____

RECEIVER'S ADDRESS _____
_____
_____
_____

Dear…

leave one-line space

(State reason for writing)

§ 1 → *As owner of the "Hermes" restaurant I am writing this letter to* _____
_____

§ 2 → *To be more specific, the refrigerators did not work…*
_____
_____
_____

(Describe damage)

§ 3 → *Despite the fact that the restaurant remained closed for*
_____
_____

§ 4 → *Furthermore, due to the power-cut, the expensive advertising campaign…* _____
_____
_____

(State claims)

§ 5 → *For all the inconvenience and loss of money mentioned above, I would like* _____
_____
_____

(Ending)

I am looking _____

Yours _____

Signature

Name in full _____

Occupation _____

Grammar Review

I. 2nd Conditional

Electricity has offered a lot of facilities to our everyday life by providing us with modern electrical appliances which save us hard work, time and money. However, have you ever thought what would happen if some of these appliances did not exist?

Look at the example

If there was *no television,* ***people would go*** *to the cinema more often.*

Now think of the previous conditional sentence and tick appropriately.

1. The sentence expresses:

a) real situation.
b) an event that is likely to happen in the future.
c) an imaginary situation in the present.
d) an event that is not likely to happen.

2. The above example belongs to the

a) 1st type of conditional sentences
b) 2nd type of conditional sentences
c) 3rd type of conditional sentences

USE

The 2nd type of Conditional sentences is used for actions or events, which are not likely to happen. It also expresses an imaginary situation in the present. It consists of two parts (hypothesis - result) which are combined as follows:

STRUCTURE

If - clause (hypothetical condition)		**Main clause (result)**	
If + Simple Past	→	would / should / could / might	+ infinitive

Now use the cues below to make sentences as in the example.

No telephone ➜ *people / see each other more often*
No telephone ➜ *people / communicate by writing letters*
No cars ➜ *people / walk more*
No cars ➜ *people / not travel so often*

No television → *people / talk more*
No television → *people / go out more often*
No refrigerators → *people / eat fresher food*

II. Cause - Effect

Power-cuts usually cause a lot of trouble and confusion to our everyday lives. Some serious effects of a power-cut are that the refrigerators, elevators, traffic lights, etc. stop working and a series of unpleasant results follow.

Look at the following table to see how this cause - and - effect relationship is expressed.

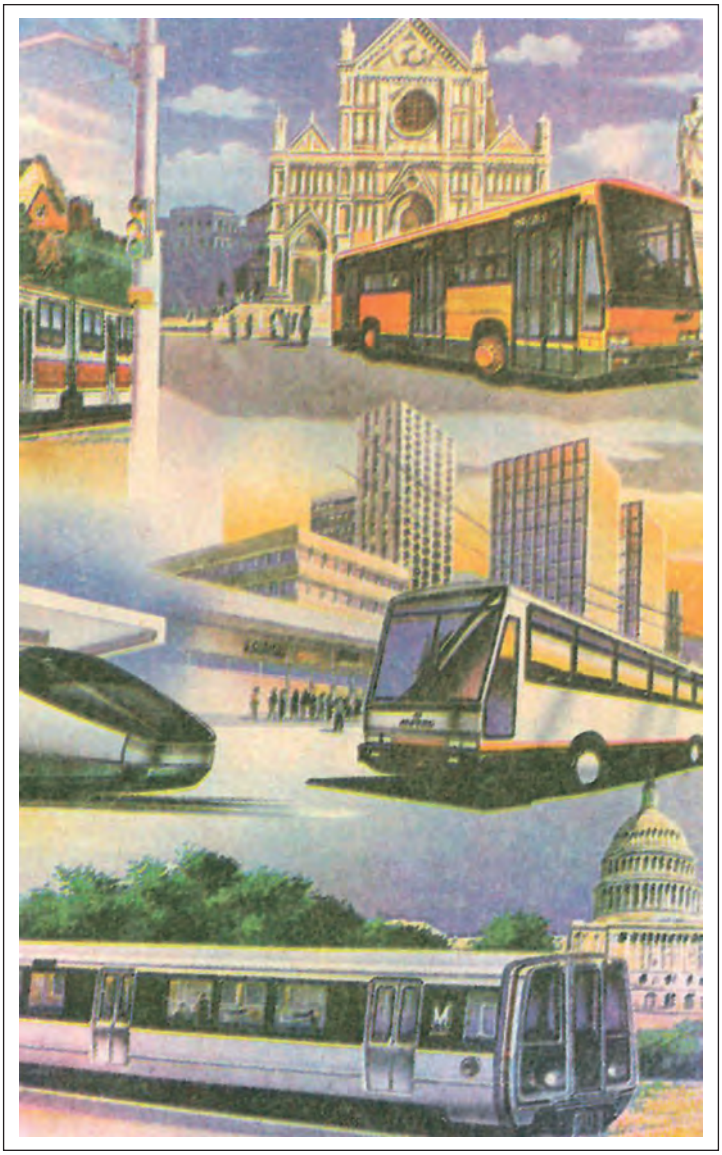
CAUSE		EFFECT
Because of a power-cut	→	the refrigerators stopped working
Due to a power-cut,	→	the refrigerators stopped working
There is a power-cut,	→	and so the refrigerators stopped working
There is a power-cut,	→	and as a result, the refrigerators stopped working
Because there is a power-cut	→	the refrigerators stopped working
Since there is a power-cut,	→	the refrigerators stopped working

Following the examples in the table, use the cues below to describe some more effects due to a power-cut.

CAUSE	*EFFECT*
long power-cuts	• *foodstuff is spoilt.* • *shopkeepers suffer serious damage.* • *people cannot watch their favourite serials on T.V.* • *companies lose a lot of money.* • *there is traffic chaos.* • *it's hard for people to go up and down the stairs of multistorey buildings.* • *people use candles / oil lamps to light their houses.*

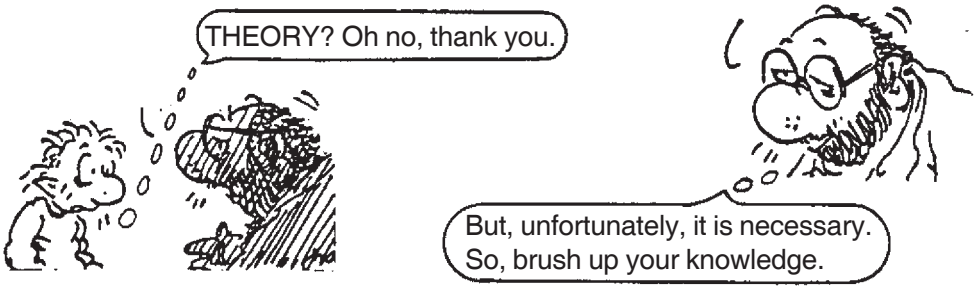
UNIT 2

ELECTRICITY HOLDS THE WORLD TOGETHER



FUNDAMENTALS OF ELECTRICITY

In the first unit we discussed the importance of electricity and its effects on society. Well, what is electricity after all? You will find the answer in this unit. Some theory is useful.



Work with your partner to find out the correct answer to the questions below. All the information you need is included in the boxes. But first, it would be helpful to find the meaning of the following words.

1. matter = _____
2. element = _____
3. molecule = _____
4. mixture = _____
5. substance = _____
6. compound = _____
7. particle = _____

Questions

1. Matter can be found in
   a) a liquid or solid state.
   b) a solid or gaseous state.
   c) all three states: liquid, solid and gaseous.

2. Oxygen (O) and Hydrogene (H) are
   a) elements.
   b) compounds.
   c) mixtures.

3. A mixture is obtained
   a) by chemical means.
   b) by physical means.
   c) by both physical and chemical means.

4. A compound
   a) can be separated by physical means only.
   b) can be separated by chemical means only.
   c) cannot be separated at all.

5. An element is a substance which
   a) can be reduced to a simpler one.
   b) can be separated by chemical means.
   c) cannot be separated by any means.

6. *The smallest particle of an element is the*
   a) atom.
   b) molecule.
   c) matter.
7. *A molecule has*
   a) all the characteristics of a compound.
   b) all the characteristics of a mixture.
   c) only some characteristics of a compound.
8. *The smallest particle of a chemical combination of elements is*
   a) a mixture.
   b) a molecule.
   c) a compound.
9. *The words "electron" and "electricity" are derived from*
   a) an ancient Egyptian word.
   b) an ancient Greek word.
   c) an ancient Latin word.
10. *The word "electron" means*
    a) copper.
    b) current.
    c) amber.

MATTER
It is everything that occupies space and has weight, e.g. air, water, our bodies.

ELEMENT
It is a substance which cannot be reduced to a simpler one by either physical or chemical means, e.g. iron, oxygen, gold.

MOLECULE
It is the smallest particle of a compound which has all the characteristics of the compound.

COMPOUND
It is a chemical combination of elements which cannot be separated by physical means, e.g. water, table salt.

MIXTURE
It is a combination of elements or compounds, not chemically combined, which can be separated by physical means, e.g. air, sea water.

ATOM
It is the smallest particle of an element which has all the characteristics of the element.

Listening Activity

STEP 1

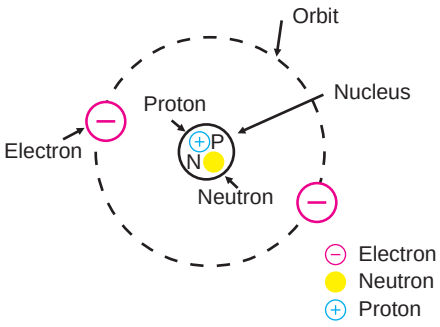
Listen to the text and answer the questions.
Do the atoms of the various elements have the same structure?
How many factors determine the properties of matter?

STEP 2

Listen to the text again and name the properties of matter.

1 _____
2 _____ > *properties of matter*
3 _____

The atom and charged bodies

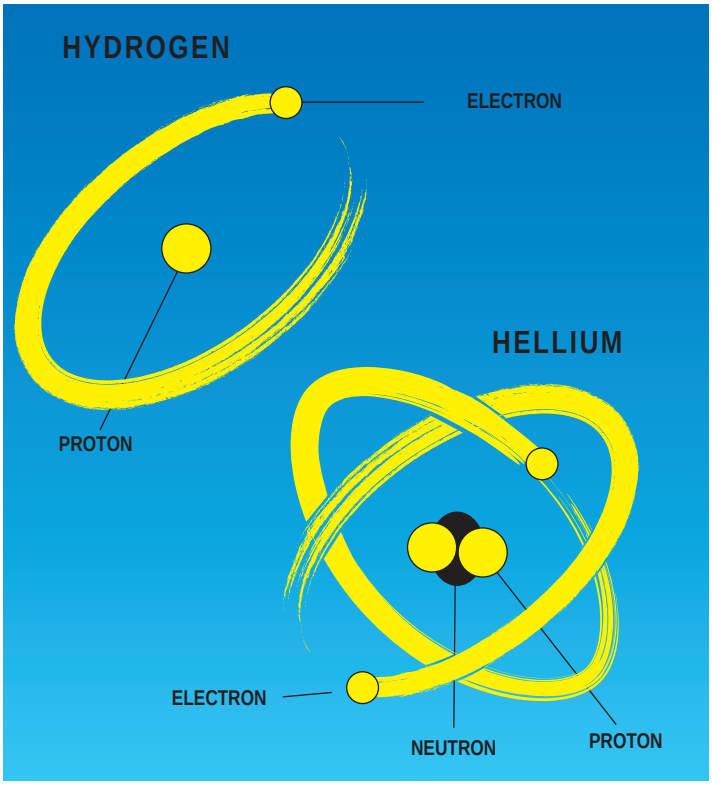


The atoms of each element are made up of electrons, protons and, in most atoms, neutrons.
Electrons are negatively charged.
Protons have a positive electric charge, equal and opposite to the charge of electrons.
Neutrons have no electric charge.
The protons and neutrons form a heavy nucleus with a positive charge, around which the very light electrons revolve in orbit, just like the planets in our solar system.
Electrons which move close to the nucleus are tightly bound to the atom. Those

moving in orbit farther from the nucleus are rather loosely bound and when influenced by an outside force, they may be drawn away from the atom. These electrons are sometimes called “free” electrons. They are not exactly free, but tend to move from one atom to another exchanging places continuously with other free electrons. Some materials, such as metals, contain many more of these so called “free” electrons than others, such as rubber and glass.

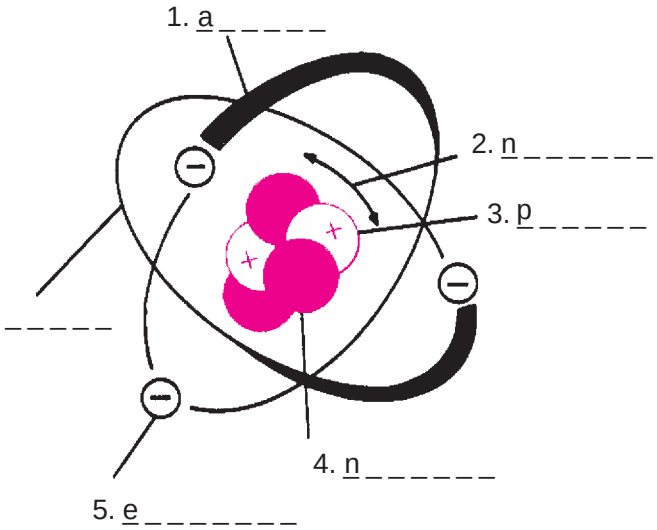
The potential difference and electric current

If two differently charged bodies come into contact, or are connected with a wire, free electrons will move from the body which has an excess of electrons to the one which has a deficiency of them. The movement of electrons is explained by the theory that an electrical pressure exists between any two bodies when one of them has a charge of greater intensity than the other. The difference in electrical pressure caused by these charges is called “potential difference” and is measured in Volts (V). The greater the potential difference, the greater the movement of electrons along a wire (conductor). This movement of electrons between two differently charged bodies is what we call “electric current”. The symbol used to represent electric current is (I), which means intensity of current flow. Current is measured in Amperes (A).



EXERCISES

1. Complete the words:



2. *A lot of scientific terms are derived from the Greek language.* ***Search your text to find 9 English words deriving from Greek***

e.g. *system = σύστημα*

3. The following statements are false. Make any necessary changes to correct them.

1. Electrons are positively charged.

e.g. *Protons are positively charged.*

2. Electrons and neutrons make up the nucleus of the atom.

3. Neutrons and electrons have equal but opposite charges.

4. Electrons which orbit far from the nucleus are tightly bound to the atom.

5. Electrons which move close to the nucleus intend to move from atom to atom and can be made to flow as electric current.

6. Electrons move from a positively charged body to a negatively charged one, when these bodies come in contact.

7. An electrical pressure exists between any two bodies when they are equally charged.

8. The lower the electrical pressure, the greater the movement of electrons across a wire.

9. Electric current is measured in Volts and is represented by the letter V.

4. Find words in the text which can be replaced by the following:

1. *move around:* _____
2. *near:* _____
3. *driven:* _____
4. *are inclined:* _____
5. *include:* _____
6. *flow:* _____
7. *stand for:* _____
8. *influence:* _____
9. *more than the normal number:* _____
10. *less than the normal number:* _____

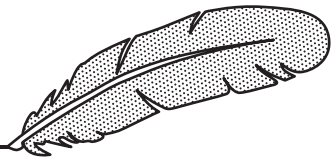
5. Match each word with its opposite

e.g. *1. positive*	*a. close*
2. equal	*b. free*
3. tightly	*c. negative*
4. far	*d. connected*
5. similarly	*e. unequal*
6. disconnected	*f. deficiency*
7. bound	*g. loosely*
8. excess	*h. charged*
9. uncharged	*i. differently*

6. Find words in your text which characterize the word "charge".

e.g. *equal charge*

Writing Activity



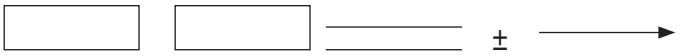
1. Write the definitions of the following terms in the boxes below.

a) Free electrons
b) Electric current
c) Potential difference

a) Free electrons are these electrons which _____ _____ _____
b) Electric current is the movement / flow of _____ _____ _____
c) Potential difference is the difference _____ _____ _____

2. These are the parts, symbols and labels you need to draw a diagram illustrating how electric current is produced.

Work with your partner a) to draw and label it b) to write a short paragraph to describe the phenomenon it illustrates.



flow of electrons
negatively charged body
conductor connecting the two bodies
positively charged body

Listening Activity

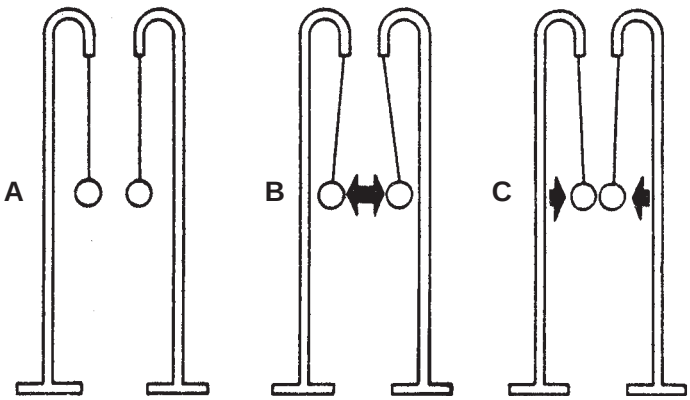
STEP 1

You are going to listen to what a teacher of Physics said during a session. After listening to it, say what the session was about.

STEP 2

Familiarize yourself with the following tasks. Listen again to what the teacher said and carry them out.

TASK 1
Write a plus (+ = positive) or a minus (- = negative) to show what the electrical charge of each body is and then fill in the blanks in the paragraphs under the pictures.



A. *The two bodies are _____, that is they have _____ electrical _____ _____ As a result, no electric _____ is developed.*

B. *The two bodies are either _____ or _____ charged, that is they have _____ charges. As a result, they _____ each other.*

C. *One of the bodies is _____ and the other _____ charged, that is they have _____ charges. As a result, they _____ each other.*

TASK 2
Write (in Greek) how ancient Greeks expressed the phenomenon illustrated in Task 1.

TASK 3
Write the symbol used for the following:
1. Force of attraction or repulsion:
2. Charge:
3. Distance:

STEP 3

Work with your partner to check your answers to the Tasks of Step 2. If necessary, ask your teacher to listen to the session (text) again.

ADDITIONAL USEFUL INFORMATION ASSOCIATED WITH ELECTRICITY

Read the following text and give titles to its paragraphs. Write them in the space provided.

_____

When two differently charged bodies are connected with a wire (conductor), current will flow only until the two bodies become equally charged. In electrical circuits, however, current must flow continuously. As a result, it is necessary to have some source which will maintain the difference of potential between the ends of the conductor. A source of this type is usually referred to as electromotive force (emf). Devices used to produce electromotive force are mechanical generators, chemical cells (batteries), photovoltaic cells or piezoelectric crystals.

The source of electromotive force is the main component of an electrical circuit. Another important component is the conductor, which connects the terminals of the source and offers a path for the electric current to flow through. Conductors are made of materials which contain a lot of free electrons and so permit a large current to flow; that is, they are materials with a great ability to conduct current (conductance). The metals, and especially silver, copper, aluminium, and tungsten belong to this group of materials. Water solutions of acids and bases or salts are conductors, as well.

There are other materials, such as glass, rubber, porcelain, mica, plastic, paper, silk, etc. which contain very few electrons and, as a result, permit relatively little current to flow. These materials are called “insulators” and are used to coat or wrap wires, to prevent two or more wires from touching each other, etc.

Some other materials, such as germanium, silicon and copper oxide, which cannot be classified either to conductors or to insulators, are called semiconductors.

Actually no material is a perfect conductor or a perfect insulator. All materials have some free electrons which will flow as a current and even the best conductors offer some opposition to current flow. This opposition is called resistance (R) and is measured in Ohms (Ω). The amount of resistance a conductor offers to current flow depends upon the type and the temperature of the material, as well as the length and the cross section of the conductor.

Finally, there is a group of materials, such as germanium-silver and nickel-chromium alloys, which, although they are conductors, have such high resistance that their principal function is to oppose current flow. They are used to add resistance to a certain point of a circuit, and are called resistors. They are especially useful in high temperature devices, such as electric heaters, toasters and other such household devices.

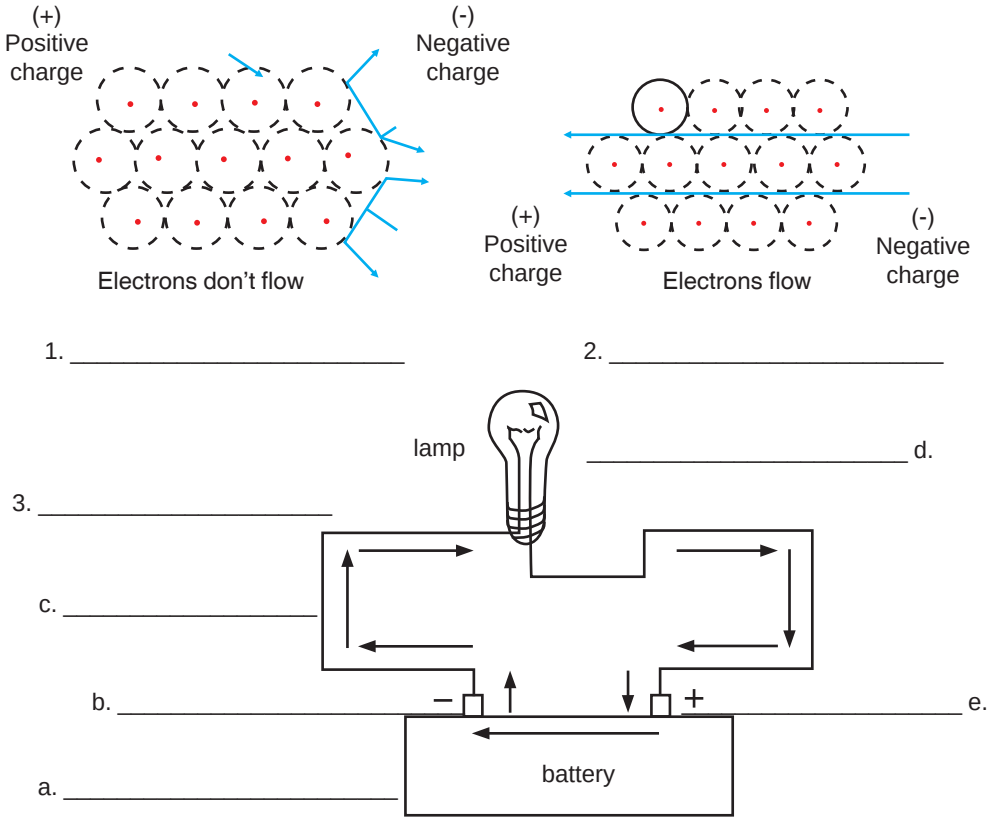
EXERCISES

1. Answer the following questions.

1. What happens when two differently charged bodies are connected?
2. What is the use of an emf source?
3. What is the difference between a conductor and an insulator?
4. What is a semiconductor?
5. Are there any materials which offer no resistance to current flow?

6. *Mention the factors which influence the amount of resistance a conductor offers to electric current.*
7. *What are resistors used for?*

2. Identify what is illustrated in the following diagrams and label them.



3. Match the English words with their Greek equivalents.

A

alloy	*οξείδιο*
base	*οξύ*
salt	*βάση*
oxide	*κράμα*
acid	*άλας*

B

zinc	*χάλυβας*
steel	*πυρίτιο*
rubber	*χαλκός*
silicon	*καουτσούκ*
copper	*ψευδάργυρος*

C

brass	*σίδηρος*
carbon	*γερμάνιο*
tungsten	*ορείχαλκος*
germanium	*βολφράμιο*
iron	*άνθρακας*

4. Classify the items or materials in the following categories. Tick appropriately.

Item or Material	Used as				
	Source of EMF	Conductor	Insulator	Semi-conductor	Resistor
water solutions of acids		✓			
chemical cell					
glass					
aluminium					
silicon					
nickel-chromium alloys					
tungsten					
porcelain					
piezoelectric crystals					
iron					
water solutions of salts					
silver					
plastics					
germanium					
mechanical generators					
water solutions of bases					
mica					
german silver					
copper					
rubber					
copper oxide					
zinc					
photovoltaic cells					
brass					
steel					

5. Use the table to make meaningful sentences.

Silver *Mica* *Mechanical generators* *German silver* *Aluminium* *Plastics* *Batteries* *Carbon* *Porcelain* *Copper*	*is / are used to*	• *maintain the difference of potential between the ends of a conductor.* • *oppose current flow.* • *offer a path for the electric current to flow.* • *add resistance at a certain point of an electrical circuit.* • *prevent the flow of electric current.* • *produce electromotive force.* • *conduct current along a circuit.* • *coat or wrap wires.*

e.g. *Silver is used to conduct current along a circuit.*

6. Match the two columns to make combinations of words found in the text.

e.g. household	temperature
chemical	alloys
piezoelectric	current
large	point
little	cell
perfect	generator
high	crystal
mechanical	device
photovoltaic	conductor
principal	insulator
nickel-chromium	resistance
certain	function

7. Odd - man out

1. *continue* ✓ *preserve* *keep* *maintain*	*2.* *principal* *basic* *principle* *main*	*3.* *function* *product* *work* *operation*
4. *classify* *group* *categorize* *divide*	*5.* *pass* *conduct* *transmit* *drive*	*6.* *oppose* *resist* *press* *face*

7.	*permit* *prevent* *let* *allow*	8.	*element* *material* *part* *component*	9.	*pack* *wrap* *cover* *coat*

8. Fill in the boxes below with the definitions of the following terms.

***Conductance** is an electrical property of matter. It is* _____
_____
_____

***Conductor** is a material which* _____
_____
_____

***Insulator** is* _____
_____
_____

***Resistance** is called the* _____
_____ *. It is the opposite of* _____
conductance _____

Electromotive force _____
_____
_____

GENERAL EXERCISES

1. EXPRESSING PARALLEL INCREASE

A. Write the comparative form of the following adjectives.

long _____ *many*_____
great _____ *much*_____
high _____ *little* _____
*large*_____ *few* _____

B. Using the cues below make sentences as in the example.

e.g. *(little) the electrical pressure / (little) the amount of electron flow.*

The less the electrical pressure, the less the amount of electron flow.

1. (little) the difference in the number of electrons / (little) the electrical pressure.
2. (great) the magnitude of charges / (great) the forces of attraction.
3. (great) the distance between two bodies / (little) the force of attraction.
4. (long) the difference of potential is maintained / (long) the electric current will flow.
5. (many) free electrons a material contains / (good) conductor it is.
6. (long) a conductor is / (high) its resistance becomes.
7. (large) the cross section of a conductor / (little) its resistance.

2. CAUSE AND EFFECT

Cause and effect can also be expressed following the structure of the 1st Conditional as in the example.

Example

If / when *two positively charged bodies come close, → they (will) repel each other.*

Use the cues below to form similar conditional sentences.

1. two or more elements / be combined chemically,
→ cannot be separated by physical means.
2. two or more elements / be combined physically,
→ form mixture.
3. a wire connects two differently charged bodies,
→ electrons flow from negatively to positively charged one.
4. a material contains lots of free electrons,
→ can be used as a conductor.
5. two differently charged bodies / be connected,
→ electrons will flow until the two bodies become equally charged.
6. a body contains atoms with same number of protons and electrons,
→ is not charged.

3. EXPANDING YOUR VOCABULARY

Most words are formed by adding prefixes or suffixes. If you know the most common of them, you can easily understand the meaning of new words and form new ones by adding the appropriate prefixes or suffixes.

A. Complete the following table.

Verb	Noun	Adjective
e.g. *oppose*	*opposition*	*opposite*
attract	_____	_____
_____	*relation*	_____
	_____	
_____	_____	*repulsive*
define	_____	_____
_____	_____	*measurable*
_____	*permission*	_____
_____	_____	*resistive*
	_____	
represent	_____	_____
_____	*action*	_____
	_____	
_____	_____	*experimental*
	_____	

B. Write the suffixes used to form nouns and adjectives.

e.g.

SUFFIXES	
NOUN	**ADJECTIVE**
-tion	

Choose the appropriate preposition from the list, to fill in the gaps.

List: *along, to, into, up, from, in, between, upon.*

e.g. *1. An electric circuit is made **up** of various components.*
2. Electrons have negative electric charge, equal and opposite _____ that of protons.

3. Electrons which move far _____ the atom are called free electrons.
4. From an electrical point of view, matter can be classified _____ conductors, insulators and semiconductors.
5. Electric current is the flow of electrons _____ a conductor.
6. The intensity of current flow is measured _____ amperes.
7. Paper, silk, glass, mica and rubber belong _____ insulators.
8. Resistors offer high resistance _____ current flow.
9. The force with which two charged bodies attract or repel each other depends _____ the charges of the bodies and the distance _____ them.

4. NOUNS AS QUALIFIERS

Nouns are often used as adjectives to qualify other nouns. **Look at the examples.**

current flow = the flow of current
book case = case for books
petrol engine = engine using petrol

Complete the following table

1. TV screen / receiver / set / control	_____
2. _____	washer for dishes
3. shop keeper	_____
4. _____	products which are washed
5. ice box	_____
6. household devices	_____
7. cassette recorder	_____
8. _____	meter for measuring Volts
9. shop window	_____
10. glass insulator	_____

5. WORDSQUARE

Your teacher is going to read the definitions of some scientific terms already familiar to you. **Listen to him, identify the terms and write their initials in the squares provided.**

	a	b	c	d
1	EC			
2				
3				

e.g. 1-a: EC = Electric current

UNIT 3

ENERGY SUPPLY AND DEMAND

WORLD ENERGY SITUATION

Electric power is a form of energy which influences all sectors and activities of modern life determining the industrial development and living standards of a country.

World energy resources can be divided into two categories:

a) the non-renewable, e.g. fossil fuels (coal, oil, natural gas, etc.) and nuclear fuels and

b) the renewable, e.g. wind and sea waves, solar, tidal geothermal and hydroelectric energy, which are also called «alternative».

Up to now, most of the world's needs for electric energy have been met mainly by non-renewable sources. However, the over exploitation of these sources has led the world supplies to run low. Furthermore, it has caused serious environmental problems by adding to the air pollution and affecting weather and climate.

In the last few decades, a lot of countries have used nuclear power to meet their demands for energy. Electric power is generated by nuclear reactors at an unbelievably economical cost, since one ton of nuclear fuel (Uranium 235) can produce as much energy as 20,000 tons of coal. Today, however, after some nuclear accidents, and especially that in Chernobyl in 1986 (reactor's meltdown and explosion), a lot of people think that nuclear power is too dangerous to be widespread. Therefore, if nuclear power is to be established, strict safety measures should be taken.

To face the expansion of world demand for energy, mankind has started to search for new energy sources and at the same time to harness economically the already known renewable ones.

Renewable sources of energy have obvious advantages in that they are inexhaustible and their exploitation does not result in chemical or thermal pollution. Besides hydropower, however, the exploitation of the other "alternative" sources of energy is still at an early stage of development. Though generation and maintenance costs at power plants using these sources are low, they require large investment, the transmission costs are high and they cannot provide constant supply of electricity.

In man's attempt to find solutions to the energy problem safely and economically, power-system engineering will play a major role in our future world.

EXERCISES

1. Split the text according to the following subtitles.

1. "Renewable sources of energy".

2. "The importance of electricity".

3. "The necessity for developing new forms of energy".

4. "The role of power system engineering".

5. *“Types of energy”.*
6. *“Problems arising from the use of fossil fuels”.*
7. *“Nuclear energy”.*

2. Complete the following table:

	TYPES OF ENERGY		ENERGY SOURCES
	NON RENEWABLE		
e.g.	RENEWABLE	*geothermal*	*heat from the earth*

3. Answer the following questions.

1. *What led mankind to search for new energy sources?*
2. *Why are renewable sources of energy, more preferable than nonrenewable ones?*
3. *What raised the nuclear power controversy?*
4. *What do you think power-system engineering deals with?*

4. Match words with definitions.

1. renewable	*a) developing or using something (e.g. natural resources) for benefit or profit.*
2. exploitation	*b) something new that can be used to replace something traditional.*
3. alternative	*c) bring something under control and use it.*
4. inexhaustible	*d) substances formed from remains of plants and used as fuel.*
5. fossil fuels	*e) something that can be replaced after it has been used or consumed.*
6. harness	*f) something found in such a large amount that cannot be exhausted.*

5. Use the words defined in the previous exercise to fill in the gaps in the sentences that follow.

1. There has been an increase in research on _____ forms of energy in the recent years.
2. Oil, natural gas and coal belong to _____.
3. Techniques to _____ the energy of the sun are being developed.
4. The _____ of fossil fuels satisfies the 90% of the world energy demand.
5. Heat from dry rocks can be used as an _____ source of energy.
6. Energy coming from the sun is _____.

6. What do the underlined expressions mean? a, b or c?

1. Fossil fuels add to the air pollution.
a. They make the atmosphere clean and healthy.
b. They are also responsible for making the atmosphere dirty and dangerous to live in.
c. They cause serious accidents.

2. Fossil fuel plants maintenance costs are high.
a. Keeping the plants in good condition costs a lot of money.
b. The expenses for installing the plants are high.
c. The pay of the staff is high.

3. Solar power plants require large investment.
a. They can produce a large amount of energy.
b. They cause environmental problems.
c. Their installation costs are high.

4. Wind power transmission costs are high.
a. The expenses for constructing the power plant are high.
b. Sending the wind energy over long distances costs a lot.
c. Generating electricity from the wind is expensive.

5. Wind power plants do not provide constant supply of electricity.
a. They do not produce electricity continuously.
b. They supply electricity alternatively.
c. They generate electricity at low costs.

6. The expansion of world demand for energy…
a. The world searches for new energy sources.
b. The world energy resources are enough.
c. The increasing requirement of mankind for energy.

7. Reactor's meltdown and explosion…
a. The reactor's emergency mechanisms were turned off.
b. The reactor was heated so much that it changed from solid to liquid and burst violently.
c. The reactor was normally checked and regulated.

7. A. Complete the chart taking information from the table below it. (The same information may be used twice).

	SOURCES	POWER PLANTS	
		Advantages (Pros)	**Disadvantages (Cons)**
NON - RENEWABLE	***Fossil Fuels***	• *Require relatively low investment costs.* • *Produce large amounts of energy.* • _____ • _____ • *Apart from diesel engine driven plants, the others don't start very quickly.*	• *Running (operation) costs are high.* • _____ • *Cause thermal and chemical pollution.* • _____ • *Do not start quickly.* • *Primary energy used is expensive.*
	Nuclear Fuels	• *Running costs are low.* • _____ _____ • _____ • *Do not cause air pollution.* • *Start relatively quickly.* • *Produce large amounts of energy.* • *Transmission costs are not high.*	• _____ _____ • *In case of accident, the radioactivity emitted:* *- contaminates whole areas,* *- causes serious health problems to people.* • _____ • *Primary energy used is expensive.*
RENEWABLE	***Hydro*** ***Tidal*** ***Sea Wave*** ***Wind*** ***Solar*** ***Geothermal***	• _____ _____ • *Energy used is inexhaustible.* • _____ • *Primary energy used is free since it comes from nature.*	• _____ • *Must be built near the source, thus raising transmission costs.* • *Apart from hydroelectric, the other plants:* *- don't provide constant supply of electricity.* - _____ _____

Missing information

Advantages	Disadvantages
• *Provide constant supply of electricity.* • *Are safe for the environment.* • *Transmission costs are not high.* • *Require little amount of primary energy to produce large amounts of electricity.* • *Operation and maintenance costs are low.*	• *Waste products severely pollute ground and sea.* • *Fuels used have run low.* • *Are at an early stage of development.* • *Affect weather and climate.* • *Require high investment costs.*

B. Use the information from the chart to comment on the characteristics of the various power plants.

Expressions to help you

In case of similarity	In case of difference
All *Both* *Also* *Too* *As well (as)* *So is / are the…* *So do / does the…* *Neither … nor*	*Only the…* *While* *Besides* *On the contrary* *On the other hand* *(Al)though* *However* *But*

Examples

• *Neither fossil nor nuclear power plants are safe for the environment.*
• *Though hydroelectric power plants provide constant supply of electricity, solar plants do not.*
• *Both running and transmission costs of a nuclear power plant are low.*

8. CLASSIFYING FROM GENERAL TO SPECIFIC

In Technical English you often have to classify information. In the tables below you can see the most common expressions used for classifying information from the general to the specific.

…	is/are can be may be could be	classified grouped arranged divided categorized	into	types classes categories classifications groups	that is… such as… for instance for example

e.g. Charged bodies can be classified into two groups, that is, the positively and the negatively charged.

Use the above patterns and the cues below to make meaningful sentences.

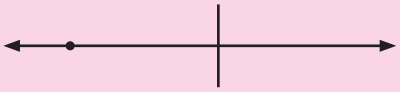
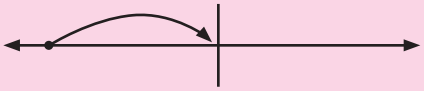
1. Matter } *solids, liquids, gases*
elements, mixtures, compounds
insulators, conductors

2. Energy sources: renewable, non-renewable.
3. Renewable energy sources: wind, solar, tidal, sea waves, geothermal, hydroelectric.
4. Non-renewable energy sources: fossil fuels, nuclear fuels.
5. Fossil fuels: coal, oil, natural gas.

Grammar Review

Verb Tenses

TENSES (Graphic representation)	**ADVERBS** commonly used with the corresponding tenses.
SIMPLE PRESENT  **e.g.** Hydroplants use the power of falling water	always ≠ never usually ≠ seldom often ≠ sometimes every day / week / month …

TENSES (Graphic representation)	**ADVERBS** commonly used with the corresponding tenses.
SIMPLE PAST  **e.g.** People used wood as a primary source of energy in the past	ago yesterday last week / month / year …
PRESENT PERFECT  **e.g.** Since the last century people have used fossil fuels to generate electricity	already just ever never (not) yet since for …

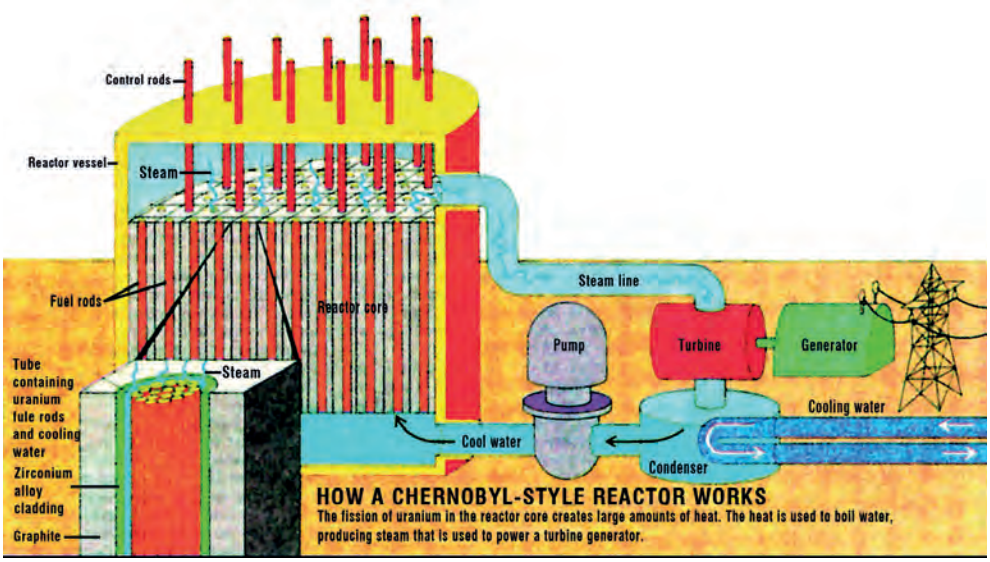
Now that you have studied the previous table, put the verbs in brackets in the correct tense.

1. *Electricity _____ us with light, heat and sound (provide).*
2. *Non - renewable sources of energy _____ weather and climate (affect).*
3. *Mankind _____ to search for new energy sources (already start).*
4. *Conductors _____ many free electrons (contain).*
5. *Radio and television _____ communication between countries (improve).*
6. *He _____ a new DVM for his workshop a month ago, but it _____ yet (order, not arrive).*
7. *Many people _____ after the accident in Chernobyl (die).*
8. *He _____ school three months ago and he _____ a job with a high salary in a well known firm (finish, already find).*
9. *Due to the over exploitation of fossil fuels in the last thirty years, their supplies _____ low (run).*

Listening Activity

STEP 1

Study the following diagrammatic picture of a Chernobyl-style nuclear reactor, and fill in the gaps in the text that follows.



_____ _____ and _____ water. Rods of boron or cadmium are inserted into the reactor core. They are called _____ _____ since they control the _____ and can also be used to shut the reactor down. Around the reactor core there is a _____ _____ _____ which is also surrounded by _____. The heat from the fission of uranium boils the water in the core producing _____. The steam is used to drive a _____ which then turns a _____ and so electricity is produced.

STEP 2

You are going to listen to a part of a newscaster's announcement on an American TV channel about the accident in Chernobyl. ***Listen to the announcement and give it a title choosing from the ones below.***

a) Effects of the accident in Chernobyl.
b) Who is responsible for the accident in Chernobyl.
c) What probably happened in Chernobyl.

STEP 3

Familiarize yourself with the pictures bellow. Listen to the announcement again and match the three phases of the accident described, with the pictures illustrating them.

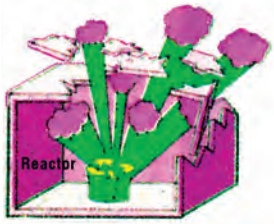
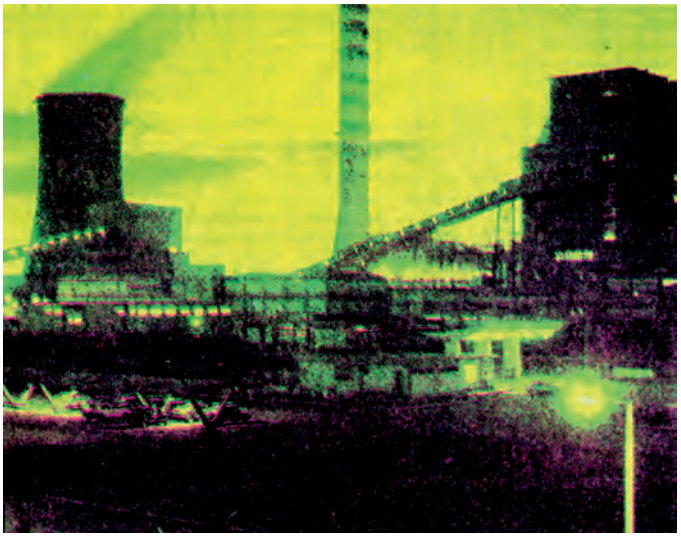


Fig. 1
Phase: _____

Fig. 2
Phase: _____

Fig. 3
Phase: _____

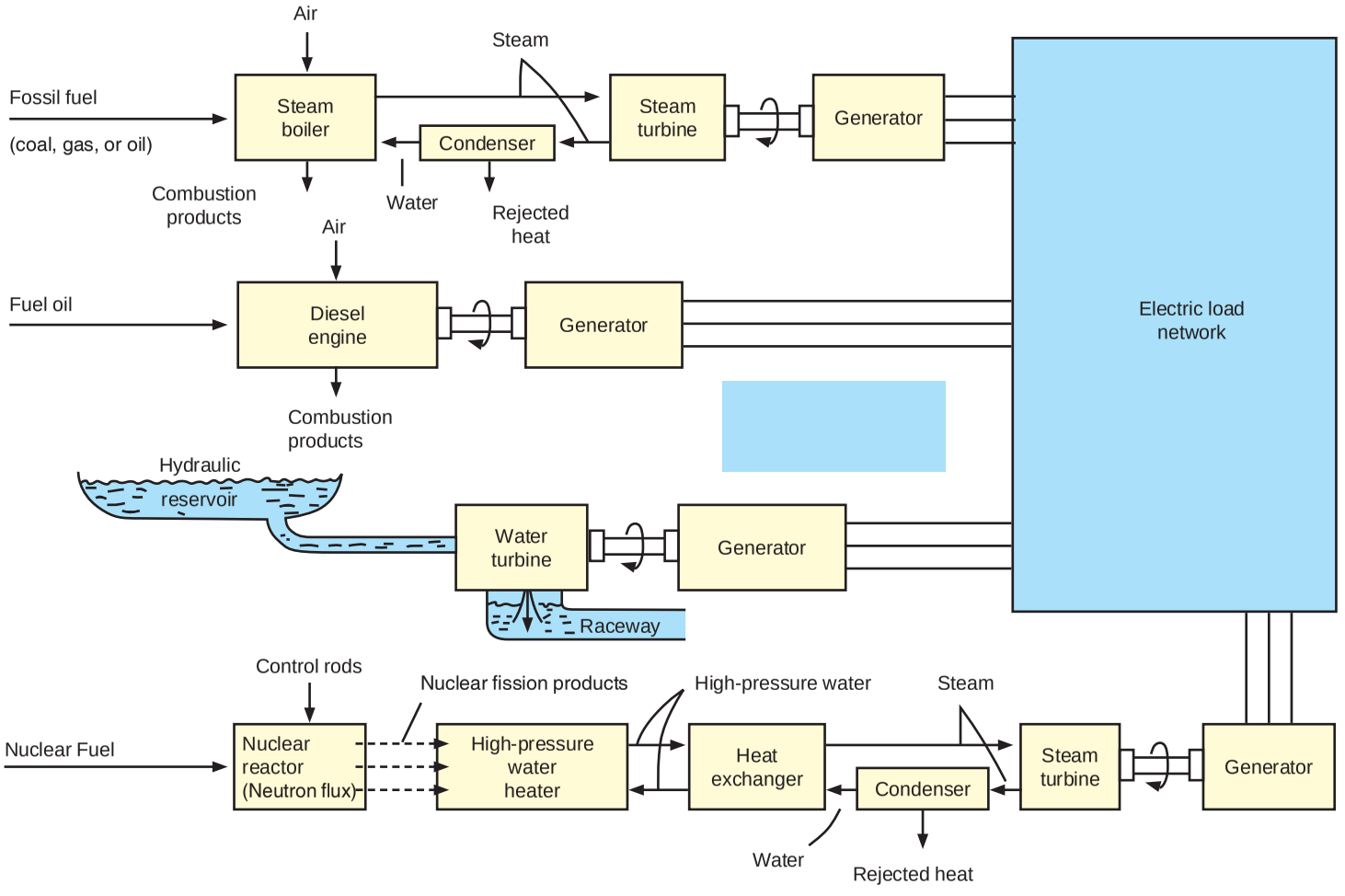
ELECTRIC POWER SYSTEMS



As mentioned before, most of the electric energy required worldwide comes from conventional power plants. Such plants contain hundreds of generators with a total power capacity of hundreds of megawatts and may distribute power throughout hundreds of square miles.

A single power system may generate power simultaneously from several different sources, such as fossil fuels, hydraulic reservoirs and nuclear fuels.

Below you can see a schematic diagram illustrating the structure of the various conventional electric power systems.


Air
Steam
Fossil fuel
(coal, gas, or oil)
Steam boiler
Steam turbine
Generator
Condenser
Combustion products
Water
Rejected heat
Air
Fuel oil
Diesel engine
Generator
Electric load network
Combustion products
Hydraulic reservoir
Water turbine
Generator
Raceway
Control rods
Nuclear fission products
High-pressure water
Steam
Nuclear Fuel
Nuclear reactor (Neutron flux)
High-pressure water heater
Heat exchanger
Steam turbine
Generator
Condenser
Water
Rejected heat

Taking your information from the diagram, fill in the gaps in the following paragraphs.

1. *In a _____ _____ energy conversion system, the energy (heat) derived from the fuel is used to generate steam in a _____. The _____ drives a turbine coupled to a _____ which delivers electric power to the electric load network.*
2. *In a _____ _____ energy conversion system, the energy derived from the fuel oil is used to operate a _____ _____. This diesel engine is connected to a _____ which delivers electric power to the electric _____ _____.*
3. *In a hydroelectric energy _____ system, the water falling from a _____ drives a _____ _____ coupled to a generator which delivers _____ _____ to the _____ _____ _____.*
4. *In a nuclear fuel energy conversion system the energy derived from the nuclear _____ heats the water in the high pressure _____ _____. This _____ _____ water then heats other, non radioactive, water in a _____ _____ to produce steam. The _____ drives a _____ connected to a generator which _____ _____ _____ to the _____ _____ _____. In other words, the _____ in a nuclear power station plays the part of the coal, or oil-fired _____ in a fossil fuel power station.*

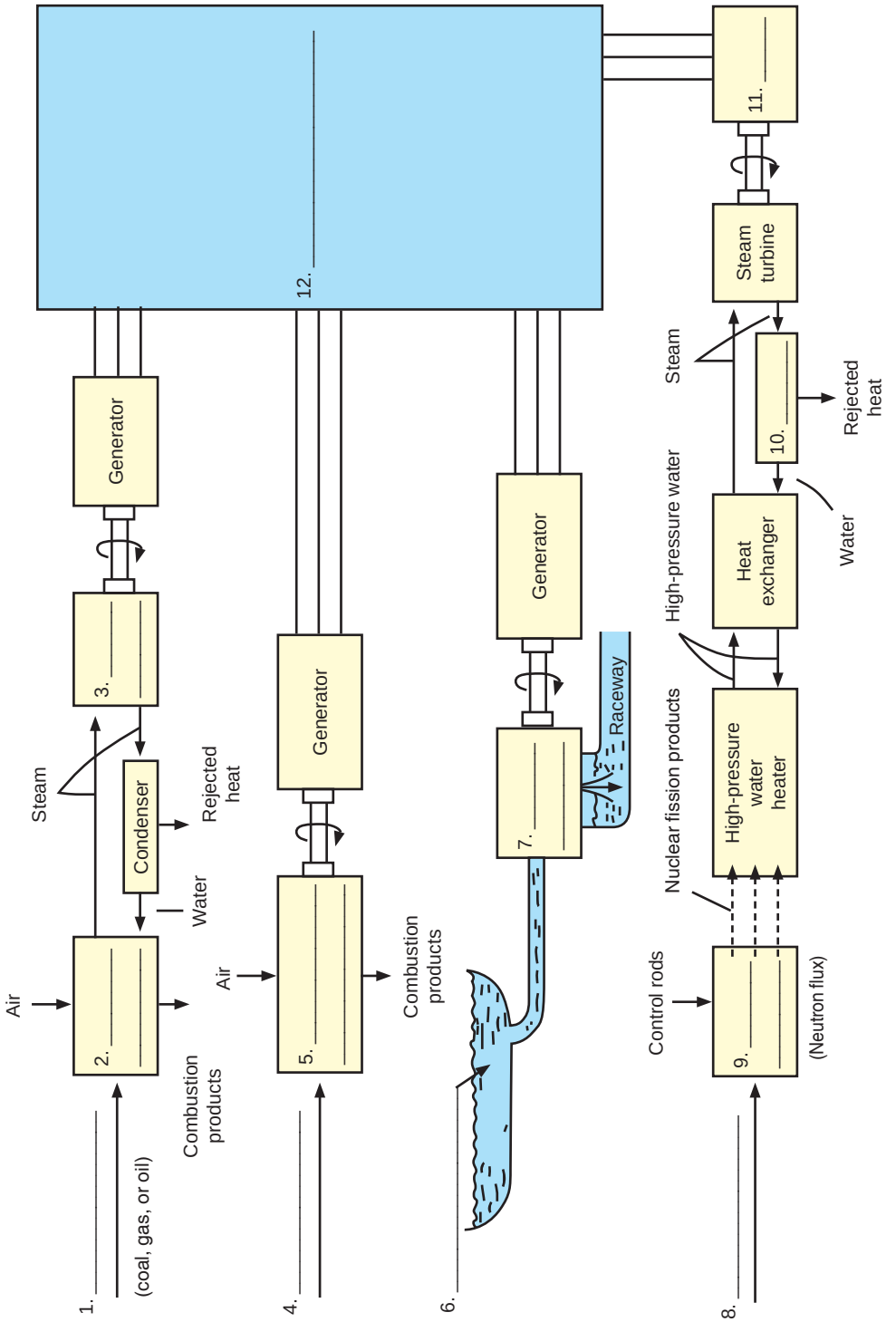
Answer the questions.

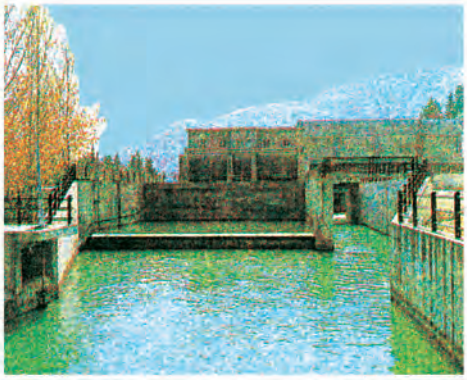
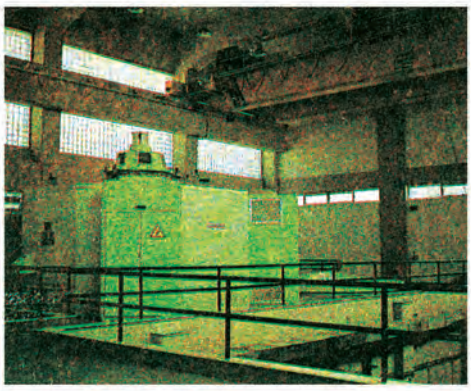
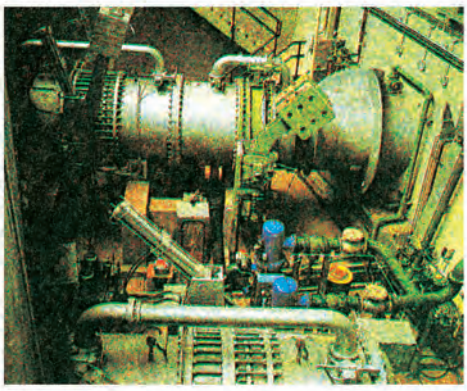
1. *What is the source of energy used in each of the power systems illustrated in the diagram?*
2. *Say how the generator is driven in each system.*
3. *Which of the systems do not comprise a steam boiler?*
4. *Is there a system without a turbine? If so, name it.*

Match parts of the electric power systems with their function.

1. Boiler	*a. It converts mechanical into electrical energy.*
2. Generator	*b. It turns the generator.*
3. Condenser	*c. It produces steam.*
4. Turbine	*d. It turns steam into water by rejecting heat.*

In the spaces provided on the diagram below, write the missing terms in Greek.



POWER GENERATION FOR FUTURE GENERATIONS

In the years to come, the world may face an energy gap. As a result, governments, power corporations and power-system engineers all over the world try to find alternative solutions to bridge this gap and satisfy the increasing world demand for energy.

The advertisement which follows gives an idea of this attempt.

Read it and answer the questions.

1. What does "P.S.C." mean?
2. What sort of company is P.S.C. ?
3. Does P.S.C. belong to the private or to the public sector? Why do you think so?

As part of our team, you'll share the pride in serving over 3.5 million customers with various types of primary energy such as coal, natural gas, wind and oil or hydroelectric, geothermal, solar tidal, and nuclear energy.

Right now, we still need oil and other fossil fuels to generate most of the electricity we produce for our customers. But the power production from our new Wind Power Unit 2, signals the beginning of a new era of decreasing dependence on oil and other fossil fuels.

With P.S.C. Wind Power Unit 2 on line and Solar Power Unit 1 in almost full operation, we will provide the same annual amount of electrical energy, equivalent to more than 20 million barrels of expensive low sulphur oil or natural gas.

If you would like to join a company with an exciting future, we have current openings for:

POWER **S**OLUTION **C**ORPORATION

Where people generate

ENERGY through INNOVATION

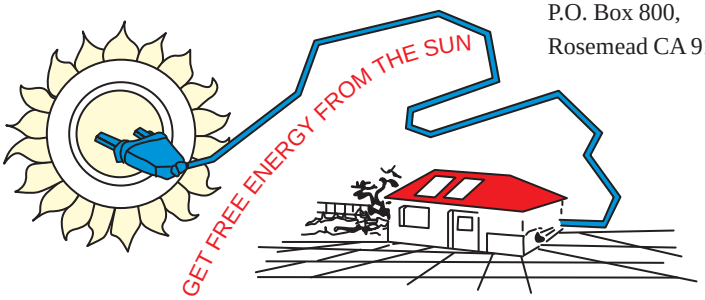
Engineers
- Civil
- Mechanical
- Electrical
- Electronics
- Telecommunications
- Computer
- Power

Others
- Sanitary Supervisors
- Training Instructors
- Shift Supervisors

P.S.C. offers a high salary and benefits package...
- the quality of life in Rosemead
- accommodation available
- *excellent working conditions*
- bonus
- four weeks annual leave

Now you know about us!
Let us know about you…
Send your Curriculum Vitae to:

George Newbit,
Dept. P. - 8 - 034,
P.O. Box 800,
Rosemead CA 91770 Canada



EXERCISES

1. Answer the following questions:

1. *How will P.S.C. decrease dependence on oil and other fossil fuels?*
2.*Why should anyone be so proud of working for this company?*
3.*What benefits does the company offer to its personnel?*
4.*Which is the post of Mr. George Newbit in the company?*
5.*Would you like to work for such a company? Why?*

2. Do you know the duties of the people doing the following jobs? Match the two columns.

Engineers - Instructors (Supervisors)	***Their duties***
	A
	a. He is responsible for the installation of the telecommunications systems.
e.g. *1. Civil engineer*	
2. Training instructor	*b. He designs and tests generators, motors, transformers and electric appliances.*
3. Telecommunications engineer	*c. He plans the design and construction of buildings, cities, highways, dams etc.*
4. Electrical engineer	*d. He is responsible for the training of the staff in a factory.*
	B
1. Mechanical engineer	*a. He is responsible for protecting the workers' health.*
2. Electronics engineer	*b. He designs and manufactures machinery, engines, tools. He also deals with heating, refrigeration and ventilation.*
3. Computer engineer	*c. He designs industrial and military electronic devices.*
4. Sanitary supervisor	*d. He is responsible for the hardware and software of computers.*

3. Find words or expressions in the text which can be replaced by the following:

marks: _____
increasing independence: _____
being part of the system: _____
in one year: _____
equal: _____
vacancies: _____

4. Share - Shift

*The words **share** and **shift** can be used either as verbs or as nouns. **Choose phrases from the lists to fill in the gaps.***

A. share

List: *share - share the cost - equal shares - shared the experience - shared - a lion's share - fair share - shared responsibility.*

1. *When we formed the company he promised that we would all have _____ in the profits, but then he found various excuses to take _____.*
2. *Ralf went upstairs to the room he _____ with his brother.*
3. *Mother gave each child his _____ of the food.*
4. *Modern couples usually _____ the washing up.*
5. *Though Jane took no part in it, she _____ with her friends and was punished with them.*
6. *The two friends _____ of travelling abroad alone.*
7. *Though he didn't have much money, he insisted that he should _____ with me.*

B. shift

List: *make shift - shift for himself - shifted the blame - shifted - in shifts - shift - on the night shift - shift the responsibility.*

1. *It was Peter who broke the jar, but he _____ to his sister.*
2. *This bag is too heavy. Help me _____ it to the other shoulder.*
3. *We must _____ with the money we have.*
4. *The wind has _____ to the north.*
5. *Don't try to _____ on me.*
6. *His parents died when he was 17. After that, he had to _____.*
7. *He works _____.*
9. *In Greece many schools work _____.*

LOOKING FOR A JOB

A. You are an electrician and think of leaving Greece to work in England. So, you've decided to write a letter to an English pen-friend and ask him to let you know if there are any vacancies in his country for the kind of job you are interested in. As you had some difficulties in writing the paragraph below in English, you wrote it in Greek first.

Try to translate it in English.

Θα με ενδιέφερε πάρα πολύ να βρω θέση σε μια εταιρεία που χρησιμοποιεί για την παραγωγή ηλεκτρισμού όχι μόνο ορυκτά καύσιμα, όπως ο άνθρακας, το

πετρέλαιο και το φυσικό αέριο, αλλά και εναλλακτικές πηγές, όπως η ηλιακή, η αιολική, η παλιρροιακή και η γεωθερμική ενέργεια. Καθώς η χρήση αυτών των πηγών σηματοδοτεί την έναρξη μιας νέας εποχής που θα οδηγήσει στην μείωση της εξάρτησης από τις συμβατικές πηγές πρωτογενούς ενέργειας, πιστεύω πως το να δουλεύει κανείς σε μια εταιρεία σαν αυτή θα είναι συναρπαστικό. Έτσι λοιπόν, αν μάθεις ότι υπάρχουν κενές θέσεις εργασίας στην ειδικότητά μου σε μια τέτοια εταιρεία, σε παρακαλώ να μου γράψεις. Θα ήμουν επίσης πολύ ευχαριστημένος αν η εταιρεία πρόσφερε υψηλές αποδοχές, μεγάλη ετήσια άδεια και διαμονή.

B. A few weeks later, you received a letter from your friend informing you that a company in the north of his country has current openings for various posts, one of which seems to meet your demands. He also enclosed the advertisement of the company in «The Guardian». You read the advertisement and decided to write a letter to the company expressing your interest.

Write the letter making any necessary changes and additions to the following sets of words and phrases.

25 Iakovidou st.
111 44 Athens
Greece

27th March 1997

The Personnel Manager
Electrical 2000
24 Shakespeare Ave.
Newcastle NCL 26 D7
England

Dear Sir,
I see advertisement / "The Guardian" 18th March / electricians / experienced alternative power systems I your new Wind Solar units / Newcastle.
I write letter / since be interested above post / and I think, / I have right qualifications. I be 26 years old / not married.
I obtain Leaving Certificate / Technical and Vocational Lyceum / Electricians Department, / 8 years ago.
When discharged army, / I attend / one-year training course / installing, maintaining Wind and Solar power stations. / Then, / I work / Wind power station / Greece / 2 years.
I speak English fluently. / I get F.C.E. 6 years ago, / and as supervisor my last job be English, / I have much practice in language.
For past three years / I work Wind power station / Greek Public Power Corporation / Samos.
Reason I leave / previous job be / I want work in England / improve knowledge of

language / and extend experience / alternative sources of energy. / I also think / attending / Polytechnic there.
Mr Robertson, / supervisor last job, / kindly agreed provide references, / photocopy / which I enclose.
I hope / you consider application favourably.
Next week / I be England / and stay there a month / so I hope / you can arrange interview, / during which / I have opportunity / give any further information you wish. I look forward / hearing / you soon.

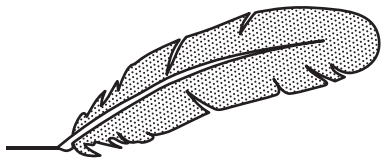
Yours faithfully,

(Signature) _____
(Name in full) _____
(Occupation) _____

P.S.*
Telephone: 03012019768
Telefax: 03012019564

*** P.S.** = Postscript

Writing Activity



Up to now you have learnt a lot of things about the various sources of primary energy, their advantages or disadvantages, their impact on the environment… Certainly you have formed an opinion about which source should be established in your country in the future. So, ***write a report of about 120-140 words to express your opinion on the matter. Support your point of view by giving as many arguments as possible.***

Expressions to help you

• *I think / believe…*	• *To start with…*
• *I agree / disagree to / with…*	• *First / then / finally…*
• *My opinion / point of view is…*	• *As a conclusion…*
• *In my opinion…*	• *To sum up…*
• *I suggest that it / we should…*	• *In addition…*
• *We'd rather / better…*	• *So / as a result…*
• *It would be better / wise / advisable to…*	• *Since because (of) / due to…*
• *I'd also like to mention / point out…*	• *In case that…*

TIME FOR FUN

Let's solve the energy problem in Greece

A SIMULATION *(optional)*

In carrying out a simulation, reality enters your classroom! You will have the opportunity to practise the language and, at the same time, have fun.

You are going to split into groups of five, each one of you taking the role of a participant in an important meeting. The aim of the meeting is to solve a serious problem for your country.

More information about your part in the discussion will be given in the form of role cards by your teacher.

If you think you will enjoy it, carry the simulation out!

THE SITUATION

The demand for electric energy in Greece is constantly increasing. Apart from lignite, however, the country's fossil fuel resources are very poor. Every year considerable amounts of money are spent on buying oil, coal and natural gas from other countries. The prices of natural gas rise from year to year and it is expected that the price of oil will increase at about 60% in the next three years. Lignite, on the other hand, has run low and it is estimated that the country's resources will not last more than ten years. After that what?

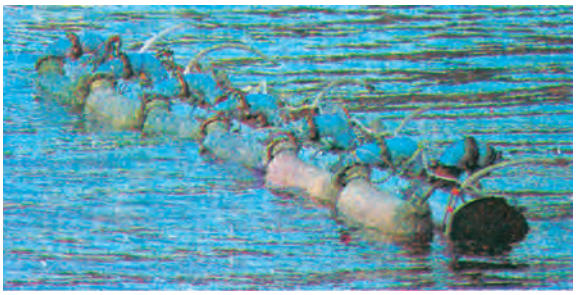
The Government is about to make some crucial decisions on what is to be done to decrease the country's dependence on fossil fuels. For that purpose, a meeting has been arranged at the Ministry of Energy and Natural Resources to discuss the issue, and make some proposals which will be taken into consideration before the final governmental decisions.

You are all invited to the meeting as experts in your field.

The information in the unit and your role card will help you develop your role and prepare your arguments so as to support your points of view and suggestions in the best possible way.

However, bear in mind that:

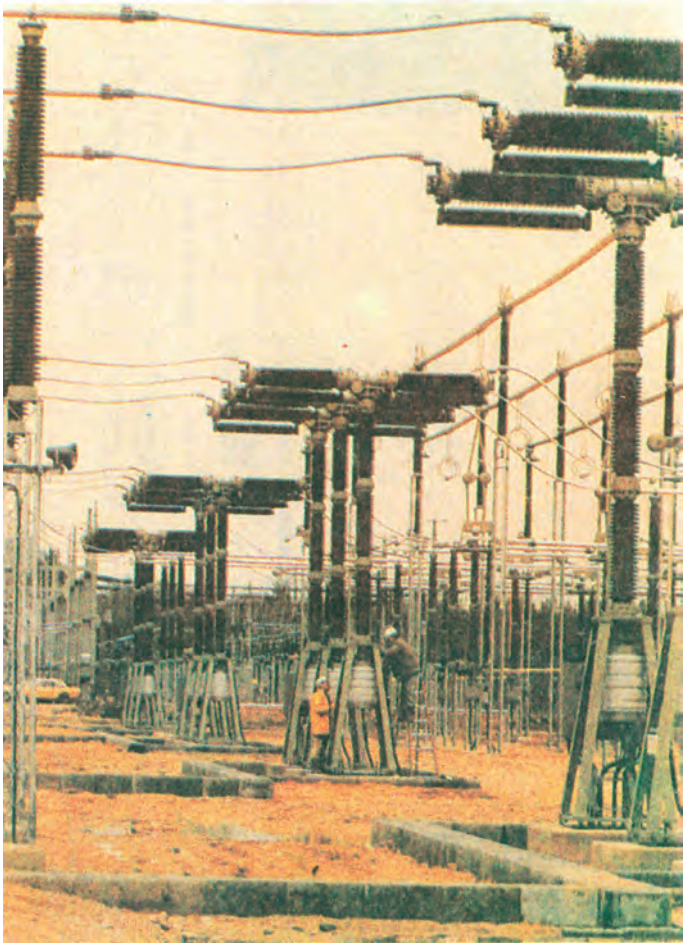
The problem you are going to discuss is quite serious, so you had better reach a general consensus.



UNIT 4

POWER DISTRIBUTION SYSTEMS

(Transmission - Distribution)

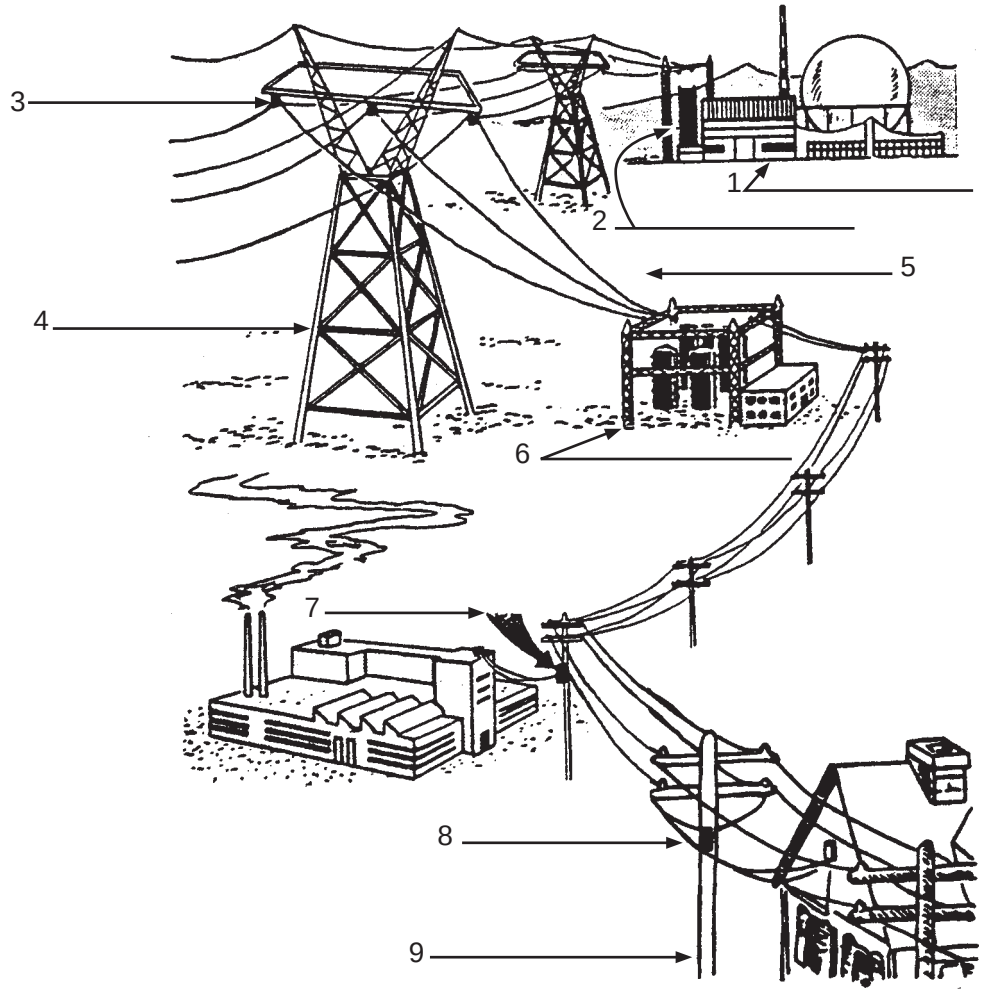


Electric energy is delivered to the various consumers following three stages: generation, transmission and distribution, which make up the electric power system.

Large-scale power distribution systems are necessary between the power plant and the consumers. This is because, regardless of the high transmission costs required, it is still more economical to build power plants where the resources of primary energy are, than generate electric power in the areas where it is to be used.

THE STRUCTURE OF POWER DISTRIBUTION SYSTEMS

The picture below illustrates the three stages of an electric power system. ***Read the text which follows, and label its parts in the spaces provided.***



The basic objective of an electric energy system is to supply electric energy to the various loads at minimum economic and ecological costs.
Three basic factors determine the quality of the delivered energy:
a) constant frequency,
b) constant voltage, and,
c) high reliability.

All transmission systems operate at various voltage levels. We can characterize these voltage levels as:
1. Transmission voltage level (150 - 66 KV),

2. Subtransmission voltage level (22 KV), and,
3. Distribution voltage level (6,6 KV - 380 / 220 V).

The above voltage levels are separated by transformers. At the power station, the transformers “step up” the voltage to very high voltages (150 KV) and send it over the transmission line. Step-up transformers are necessary to minimize the loss of power caused by the heating of the current carrying wires.*

At the other end of the line, other transformers “step down” the voltage to meet values which can be used for lighting and power by the various consumers (large, medium and small).

The electric energy is transferred from the generating stations to the consumers through underground cables and overhead lines supported by pylons or towers and poles.

In the early days of power transmission, copper was used for conductor material, but nowadays it has been largely displaced by aluminium. The most common type of high-voltage transmission lines is made of an aluminium conductor reinforced with a central core of galvanized steel wires.

Other important devices used in all transmission lines are the insulators. The most common type of insulator is made from either glass or porcelain.

NOTE

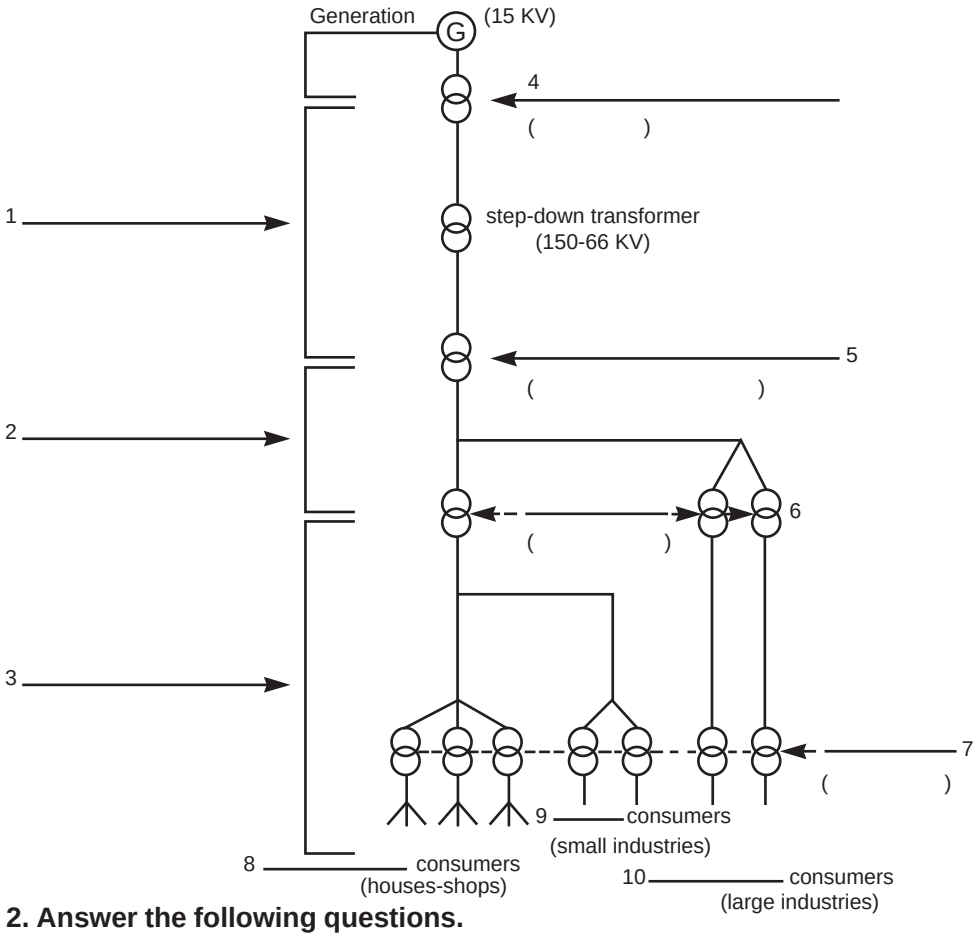
The usefulness of step-up transformers

Power is equal to the voltage, multiplied by current ($P=I \cdot V$). Therefore, equal amounts of power can be transmitted either by means of high voltage and low current, or by means of low voltage and large current. But the loss of power caused by the heating of the current-carrying wires, is equal to the square of the current multiplied by the resistance. ($P=I2 \cdot R$).

The above formula shows that it is more economical transmitting a certain amount of power in a high voltage than transmitting it in a large current.

EXERCISES

1. *The flow-chart below, illustrates the structure of the Greek Electric-Power System. Some information is missing.* ***Use your knowledge and the text to label its parts and stages.***



2. Answer the following questions.

1. *What is the purpose of a power distribution system?*
2. *Why are transformers necessary in a power transmission system?*
3. *Why is it preferable to transmit electric power over long distances than generate it in the areas where it is to be used?*
4. *What are most insulators made from?*
5. *Mention the most important qualities which should characterize the transmitted energy.*
6. *In which voltage is the current generated and in which is it delivered to the consumers?*
7. *What sort of conducting material is used in transmission lines today?*
8. *How is electric energy transmitted?*

3. Choose the appropriate form of the bold-typed words to fill in the gaps. Make any necessary changes.

1. generate - generator - generation

a) _____ and maintenance costs at power plants using alternative sources of energy are low.

b) _____ are machines that _____ electricity.

2. distribute - distributor - distribution

a) The person who supplies goods to shops is a _____.
b) The world needs a fairer _____ of wealth.
c) Power corporations _____ electricity to various customers.

3. consume - consumer - consumption

a) Since water supplies in our country have run low, water _____ should be reduced.
b) Large industries _____ a great deal of electricity.
c) Electric power corporations serve millions of _____.

4. transmit - transmitter - transmission

a) A power distribution system _____ energy to the various customers.
b) ET 5 radio _____ is out of order.
c) Nuclear power plants do not require high _____ costs.

5. transform - transformer - transformation

a) In the 20th century, serious social and political _____ have occurred.
b) Dry-type power _____ are safe and reliable.
c) The invention of television _____ our way of life.

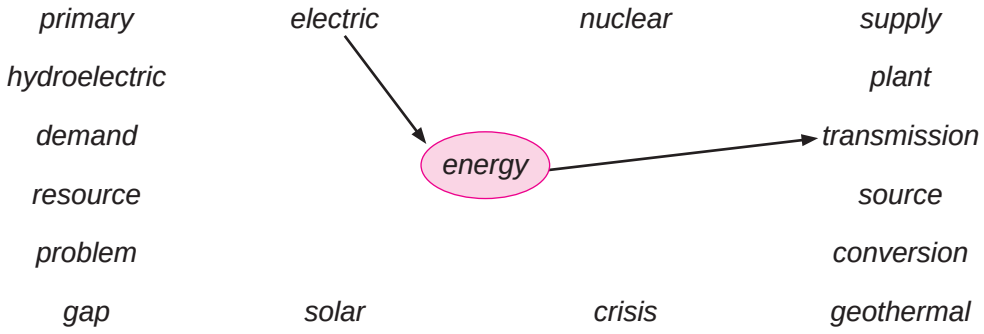
6. protect - protector - protection

a) Ecologists are _____ of wild life.
b) Greasing _____ metal parts against corrosion.
c) We need _____ from the sun's rays during summer.

7. insulate - insulator - insulation

a) Materials such as mica, glass, rubber etc. are called _____.
b) Manufacturers _____ tools intended for electricians.
c) It is covered with a thick layer of _____.

4. A. Draw arrows to show the possible combinations of the word "energy" used either as a noun or as an adjective.



e.g. *electric energy*
energy transmission

B. In which of the above combinations can the word "energy" be replaced by the word "power"?

e.g. *electric power - power transmission*

5. Choose verbs from the lists that collocate with the word "energy".

generate		*connect*
insulate		*supply*
transmit		*provide*
build	*energy*	*meet*
deliver		*transfer*
produce		*construct*
convert		*distribute*

e.g. *generate energy.*

AN ELECTRIC POWER CONSUMPTION BILL

Power corporations, either public or private, render bills to their customers to inform them about their power consumption and its cost. A bill of this kind is illustrated below.

Study it and answer the questions

1. Is the Power Corporation, which issued this bill, private or public?
2. This bill is addressed to…
a) an industrial consumer
b) a commercial consumer
c) a domestic consumer.
Justify your answer.
3. There are two unit charges in this bill. Which of them concerns night-time electricity consumption?

EPC ELECTRICITY ⓔ ***AT YOUR SERVICE***

Mr. A.N. Thompson
Shepherd's Lane
Oxford

METER READING		UNITS	PENCE	AMOUNT		STANDING		TOTAL	
THIS TIME	LAST TIME	USED	PER UNIT	£		£ CHARGE		£	
05178	03930	1248	5.16	64	40	10	14	74	54
01467	00379	88	1.90	16	70			16	70

DO NOT PAY. THIS ACCOUNT WILL BE CLEARED BY
DIRECT DEBIT OF YOUR BANK A/C ON 9 MAR. '97

YOUR CUSTOMER NUMBER	YOU PHONE US ON	PERIOD ENDING	AMOUNT DUE
ZZ 1122337799	CAMM. 88888	13 FEB 94	£91.24

To understand the information included in the bill better, match the two columns.

A.	*B.*
1. THIS ACCOUNT WILL BE CLEARED BY DIRECT DEBIT OF YOUR BANK A/C.	*a) amount of money regularly paid to the Power Corporation with each bill, regardless of the customer's consumption.*
2. AMOUNT DUE	*b) amount of electricity consumed, measured in units.*
3. UNITS USED	*c) the bank will pay the bill for you, drawing the money from your account.*
4. PERIOD ENDING	*d) amount of money which someone is obliged to pay.*
5. STANDING CHARGE	*e) date which determines the end of the period of consumption and the beginning of the next.*

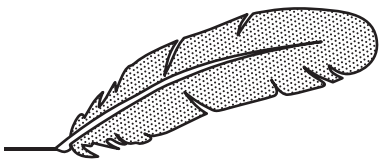
Study the bill again and complete the missing information in the text that follows.

The bill illustrated above has been issued by (1) _____ Corporation. It is addressed to a consumer with (2) _____ ZZ1122337799 and covers the period of consumption until (3) _____. The name (4) _____ is A.N. Thomson and he lives (5) _____, in Oxford.

According to the "last" and "this time" (6) _____ Mr. Thompson has used (7) _____ units of day-time electricity consumption and 88 of (8) _____. The unit charge for the day-time electricity consumption is 5.16 p. while for the cheap (9) _____ is 1.90.

Mr. Thompson has additionally been charged with a (10) _____ of £ 10.14. As a result the total (11) _____ to the company by Mr. Thompson is £91.24 which the customer will not pay directly to the company since (12) _____ on March 9, 1997. In case the customer needs any further information concerning this bill, he may (13) _____ the company on CAMM. 8888.

Writing Activity



Summarizing is a very important skill which will prove to be useful in your studies.
Practise it by writing a summary of the text on p. 67 in about 100 words.

Grammar Review

Passive Voice

It is most important to know how to use the Passive Voice since it is frequently used in English, especially in the scientific and technical fields.

I. USE

It is preferable to use the Passive Voice when:

a) The person performing the action is unknown, unimportant, obvious, or it is better not to be mentioned.
e.g. Lots of TV receivers are manufactured in Japan.

b) The emphasis is on the action rather than the agent*.
e.g. America was discovered in 1492 A.C. (by Chr. Columbus)

** The agent, if mentioned, is introduced with the word "by".*

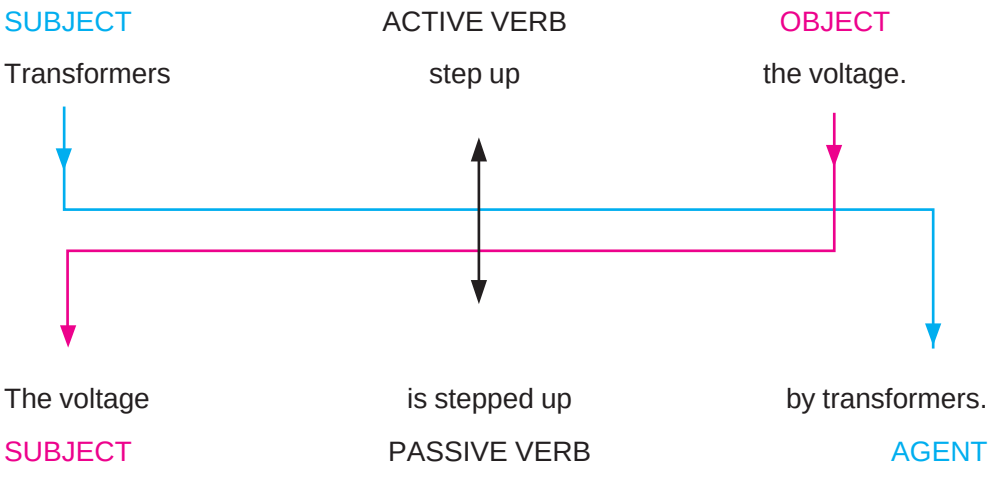
PRACTICE A

1. Think of the rules above, look at the following sentences and say which the best alternative is.

1. a. Up to now mainly fossil fuels have met the world's needs for energy.
b. Up to now the world's needs for energy have been met mainly by fossil fuels.
2. a. Electricity has changed our lives.
b. Our lives have been changed by electricity.
3. a. The company recommends lab calibration only once a year.
b. Lab calibration is recommended only once a year.

II. HOW TO CONSTRUCT PASSIVE SENTENCES

Study the following diagram.



When changing an Active sentence into Passive:

a) The **subject** of the active sentence becomes the **agent** of the passive sentence.
b) The **object** of the active sentence becomes the **subject** of the passive sentence.
c) The **active** verb becomes **passive** verb: (to be + past participle)

PRACTICE B

1. Turn the following sentences from Active into Passive.

1. *Michael Faraday discovered the principle of electromagnetic induction in 1830s.*
2. *We measure potential difference in Volts.*
3. *We represent resistance with the letter R.*
4. *Logie Baird invented the TV.*
5. *We use a plastic material for coating wires.*
6. *We call materials such as glass, mica, porcelain, etc. insulators.*

To construct Passive sentences, it is necessary to know the past participle (p.p.) of irregular verbs. In the table below the most common irregular verbs are included.

2. Complete the missing forms.

Infinitive	***Simple Past***	***Past participle***
_____	*went*	_____
say	_____	_____
_____	_____	*been*
_____	*read*	_____
_____	_____	*forgotten*
do	_____	_____
write	_____	_____
_____	*told*	_____
_____	_____	*found*
_____	*brought*	_____
feel	_____	_____
_____	*gave*	_____
_____	_____	*stolen*
_____	*took*	_____
see	_____	_____
_____	_____	*heard*
_____	*sent*	_____
_____	_____	*come*
pay	_____	_____
buy	_____	_____
_____	*sold*	_____

III. HOW TO FORM PASSIVE SENTENCES IN SIMPLE TENSES

Study the following table

Tenses	Structure	Example
S. Present	am/is/are	The letter is written
S. Past	was/were	The letter was written
S. Future	will be	The letter will be written
S. Present Perfect	has/have been + p.p.	The letter has been written
S. Past Perfect	had been	The letter had been written
Modal verbs	can/could	The letter can/could be written
	shall/should	The letter should be written
	may/might be + p.p.	The letter may/might be written
	will/would	The letter will/would be written

PRACTICE C

1. Put the verbs in brackets in the correct Tense.

1. *The inner part of the reactor _____ (call) reactor core. (S. Present)*
2. *The telephone _____ (invent) by Alexander Graham Bell. (S. Past)*
3. *The safety precautions _____ (should read) before operating any electrical appliances.*
4. *A meeting _____ (arrange) at the Ministry of Energy and Natural Resources. (S. Pr. Perfect)*
5. *The lamp _____ (illuminate) when the electric cooker is in use. (S. Future)*
6. *You _____ (invite) to the meeting. (S. Present)*
7. *Wood _____ (use) as primary source of energy before mankind started to use coal. (Past Perfect)*
8. *The proposals _____ (take) into consideration. (S. Future)*
9. *Make sure that the right voltage _____ (use). (S. Present)*
10. *The electric iron _____ (send) to the workshop for repairing two weeks ago. (S. Past)*
11. *Insulated tools _____ (must check) regularly.*
12. *Extreme safety measures _____ (take) by governments after the Chernobyl disaster. (S. Pr. Perfect)*

2. Fill in the blanks with the correct form of the Passive or Active Voice.

1. *This hairdrier _____ (design) to operate on 220V A.C. So, _____ (not operate) it on D. C. power supplies or other voltages.*
2. *This television set _____ (have) a "Quick Start Colour Picture Tube". As a result, the picture _____ (come) out in about five seconds after switching it on; no preheating _____ (require).*

3. Complete the following table.

	S. Present	***S. Past***	***S. Future***
Affirmative	.....	*You were invited*	.....
Interrogative	*Am I invited?*	.....	.....
Negative	.....	.....	*He will not be invited*

	S. Present Perfect	***S. Past Perfect***
Affirmative	.....	*They had been invited*
Interrogative	*Have we been invited?*	.....
Negative	.....	.....

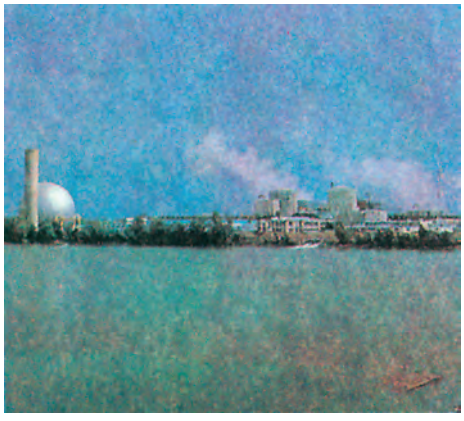
4. THE SIX FATAL ERRORS

You may know that the Chernobyl disaster ironically occurred while the operators of the plant were trying to carry out a safety test. Carrying it out, they made six fatal errors ignoring important operating regulations. If any of these errors had not been made, the accident would not have occurred.

Use the cues below to write six sentences (in Passive Voice) about the errors which resulted in the Chernobyl disaster.

1. *Operators shut off emergency cooling system to conduct test.*

2. *They lowered reactor power output too much and switched off automatic control system making it difficult to control reactor.*



3. *Workers reduced flow of cooling water and turned off power to turbines. This resulted in dangerous over-heating of unit.*

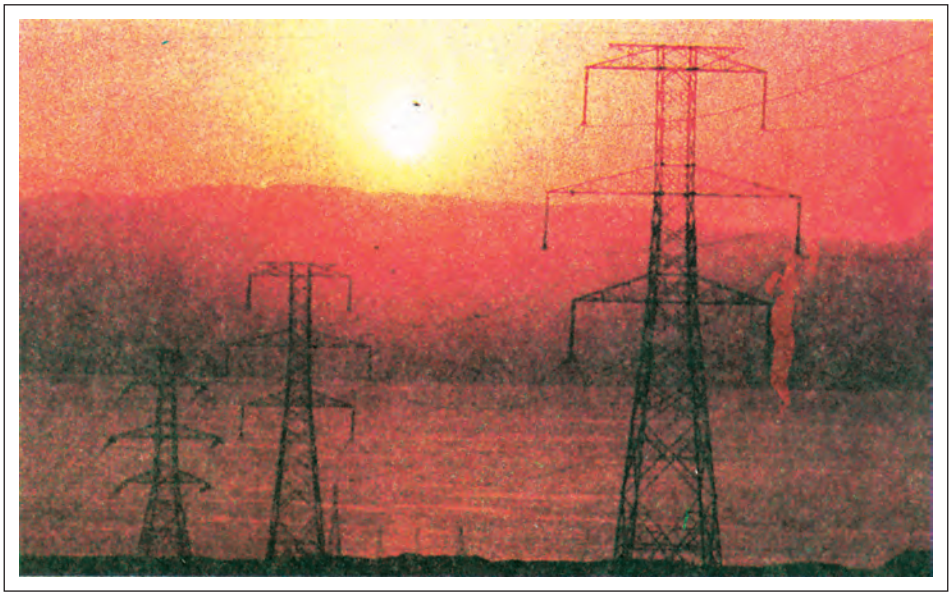
4. *They blocked automatic signal which shuts reactor down, if turbines stop.*

5. *Operators turned off safety devices which shut reactor down, if steam pressure or water levels become abnormal.*

6. *They pulled most control rods out of core.*

STEP 1

You are going to listen to a text. Looking at the following picture guess what the text is going to be about.



STEP 2

Listen to the text and say:

1. If the text is:
   a) an advertisement
   b) a part of a novel
   c) a newspaper article
2. Which is the country where the transmission system mentioned in the text has been constructed.

STEP 3

Read the text below and, while listening to your teacher, cross out any additional words you do not hear.

400 KV Transmission Line in Jordan

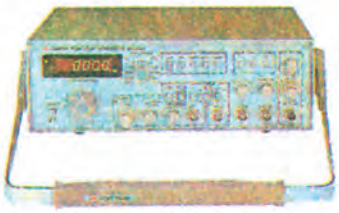
A major new 235 km long 400 KV double-circuit overhead transmission line in Jordan has just been handed over to the Jordan Public Electricity Authority. This transmission line connects the large capital city of Amman with a new 520 MW power generation station at the port of Aqaba in Jordan.

The new line is designed to very high security specifications, with twin aluminium conductors, two earthwires and thick pollution insulation. Over 18,000 tons of net steelwork were shipped from the U.K. to Aqaba port for the construction of more than 800 transmission towers and poles.

This large scale project will facilitate the increasing energy supply and demands of the national transmission system network in Jordan.

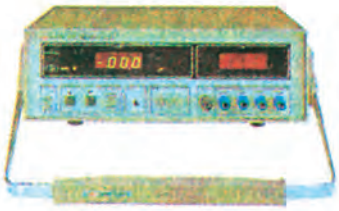
TEST AND MEASUREMENT INSTRUMENTS

SWEEP FUNCTION GENERATOR

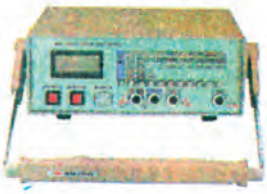


MULTI FUNCTION COUNTER

DIGITAL LCR METER



DIGITAL MULTI METER



AUDIO OSCILLATOR

PULSE GENERATOR

UNIVERSAL COUNTER

MEASURING ELECTRICITY

The flow of electric current produces four effects which indicate its presence. These effects are:
a. the Heating Effect,
b. the Electromagnetic Effect,
c. the Chemical Effect, and
d. the Physiological Effect.

***Find* which of the above effects each of the following paragraphs refers to.**

1. _____

When current flows through the body of an animal, it produces some effects, an example of which is the electric shock.

2. _____

Current produces a magnetic field around a conductor in which it flows.

3. _____

When current flows in a circuit containing resistance, heat is produced.

4. _____

Current, in passing through a chemical solution, will cause certain chemical reactions to take place.

All these four effects, however, are not commonly used for detection and measurement of electricity.

Use your knowledge and complete the table below.

Effects used to measure electric current	**Effects not used to measure electric current**

Most of the common electrical instruments, such as the Ammeter, the Voltmeter, the Ohmmeter and the multimeter or multitester make use of the above two effects as the basis for their operation. It is very important to all those who deal with electrical installations and repairs to know how to use them correctly. Check your knowledge.

Choose words or phrases from the list below to fill in the gaps.

List: *wattmeter - in parallel - ammeter - ohmmeter - multimeter - in series - voltmeter - multitester - resistance - across*

1. *The instrument used to measure current flow is the _____. To connect it properly you must break the circuit and connect the instrument _____.*
2. *To measure difference of potential or voltage, we use the _____. To measure the terminal voltage of a battery for instance, we connect the meter _____.*
3. *We measure the resistance of a circuit using a(n) _____. To measure the _____ of a resistor, you must disconnect it from the circuit and connect the ohmmeter _____ the resistor.*
4. *All the above instruments can be combined into one called _____ or _____.*
5. *Power is measured by using either a _____ or a combination of an _____ and a _____.*

Look at the schematic diagrams of circuits and say:

a) What is measured, and
b) Which instrument is used.
Follow the pattern:

"In diagram _____, _____ is measured. To measure it, we use an _____ connected _____.

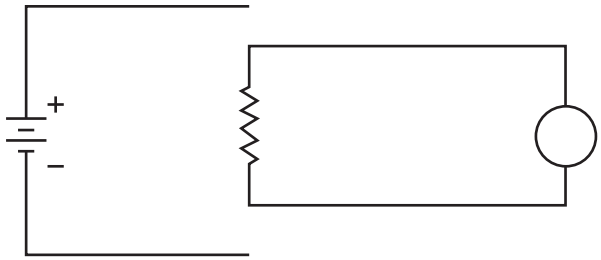


Diagram 1

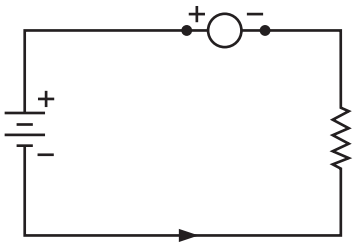


Diagram 2

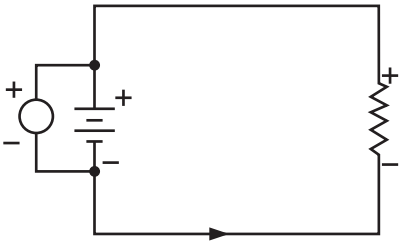


Diagram 3

NEW TECHNOLOGY

Analog instruments have served electricians and electronics technicians successfully for many years. Nowadays, however, the old analog instruments have been replaced by electronic digital ones which are much more sensitive and accurate in their measurements. To meet the growing demand of the market, companies compete in manufacturing new reliable and versatile models.

Read the advertisement of such a company and:

A. Underline words or phrases presenting the advantages and properties of its instruments.

B. Make a list of the instruments the company manufactures, and tick those used by electricians.

_____

_____

_____

_____

_____

_____

_____

Power Supply

Cable Tester

Auto D.M.M.

Sweep Function Generator

Auto Distortion Meter

MICOM

The measurement of quality:
Our company offers its customers
top quality and excellent prices

For more than 40 years our company has supplied electricians and electronics engineers with instruments of extremely high precision, sensitivity and value. During these years, we have accumulated the best technical experience and have successfully developed more than 80 models, easy in operation, and offering the versatility of various functions to meet your requirements. As a result, our firm has become the synonym of advanced technology, excellent performance, high quality and reliability in this country and all over the world.

Besides Voltmeters, Ammeters, Ohmmeters, and Multimeters, we also manufacture:

Wattmeters	Power Supplies
Oscilloscopes	Amplifiers
Universal Counters	Logic Analysers
Sweep function Generators	Word Recognizers
Oscillators	Auto Distortion Meters
Cable Testers	Auto Earth Testers

Take advantage of our abilities now. You will also get excellent technical assistance, parts and service all over the world.

If you want more information, write for a copy of our complete catalogue.
In Europe: MICOM Company, P.O. BOX 1136,
St. Gabriel Port, Guernsey,
Channel Islands.
Fax: 70260

EXERCISES

1. DEDUCING THE MEANING OF UNKNOWN WORDS

When reading a text in a foreign language, you very often meet lots of unknown words. Nevertheless, you can understand what the text is about and get, not only general, but also some specific information. This is what happened when you carried out the previous exercises.

Though some words were unknown, you were able to understand that they referred to the properties of the instruments manufactured by the advertised company. In the same way, you may guess the meaning of some more words. Try it.

Match the columns

e.g. *1. supply*	*a. make, produce*
2. accumulate	*b. demand, need*
3. requirement	*c. help*
4. advanced	*d. provide, give, offer*
5. manufacture	*e. updated, developed*
6. assistance	*f. gather, collect*

2. *In the table below you can see the most important properties of test and measurement instruments.* ***Look them up in the dictionary and find their Greek equivalent.***

ENGLISH	GREEK
Large measurement ranges *Satisfactory function* *Various applications* *Versatility* *Quick, reliable service* *High precision* *Sensitivity* *Easy operation* *Low cost*	

3. *You are interested in the instruments manufactured by MICOM so,* ***fill in the cutting below and send it to the Company.***

MICOM Company LTD
P.O. Box 1136
St. Gabriel Port
Channel Islands
Fax. 70260

☐ *Please send me the complete catalogue of your instruments.*
☐ *I want to see your instruments in action.*

NAME .....

MALE ☐ ***FEMALE*** ☐ ***ADDRESS***

AGE ....

OCCUPATION ..... ***CITY*** .....

..... ***ZIP CODE*** .....

NATIONALITY ..... ***COUNTRY*** .....

..... ***Telephone*** .....

..... ***Telex*** .....

4. PERSUADING A FRIEND

A friend of yours is about to buy some test and measurement instruments for his workshop. ***Try to persuade him to buy instruments manufactured by MICOM. Refer to their properties/advantages as well as to the company's achievements.***

Expressions to help you

- It's worthwhile buying…
- You'd rather buy…
- If I were you, I would (prefer to) buy…
- I think/believe you should buy…
- I suggest you should buy…
- It would be better to buy…
- If you want the best…

} because…

BUYING AN INSTRUMENT

In a few years, you may have a workshop of your own. You will have then to decide which instruments to buy in order to equip it, and you will read many brochures, manuals and advertisements presenting the features and advantages of the various instruments on the market. The ad which follows will give you an idea.

D.V.M.

The new 9602A digital voltmeter is just right for systems and bench applications.

Press SCALING and enter any multiplier to scale volts, ohms or amps.

Press OFFSET and add or subtract any numerical value to set your prescaled units to the right reference point.

The 9602A is fast: up to 250 readings/second on the bench, 500 readings/second in a system.

Calibration memory saves time and money. Without removing the voltmeter or taking off covers, simple recalibration is done from the front panel in a few minutes. Lab calibration is recommended only once a year, if calibration memory is used.

The five FUNCTION pushbuttons are for measuring: Ohms, Volts AC, Volts DC, Amperes AC or Amperes DC.

We even provide diagnostic error codes to keep you out of trouble by identifying mistakes and hardware errors.

For systems use, we offer more interface options than anyone.

U.S. base price: $ 2595.

For more information, contact any one of the more than 100 Luke offices or representatives, world wide.

EXERCISES

1. Say if the following sentences are true of false.

e.g. *1. This DVM is faster on the bench. F*
2. You can use the 9602A digital voltmeter both in systems and on the bench.
3. It has seven function pushbuttons.
4. The 9602A DVM is an analog one.
5. The company offers many interface options for systems use.

2. Match the two columns taking your information from the text.

e.g. *1. Calibration memory*	*a. It is recommended only once a year.*
2. 9602A digital Voltmeter	*b. They identify mistakes and hardware errors.*
3. Simple recalibration	*c. It saves time and money.*
4. Lab calibration	*d. It is right for systems and bench applications.*
5. Diagnostic error codes	*e. It is done from the front panel in a few minutes.*

3. Write a sentence defining DVM 9602 A.

4. Look at the properties of test and measurement instruments on p. 84 and say which of them characterize the 9602 A DVM.

5. Find words or phrases in the DVM advertisement to replace the bold-typed ones in the sentences below.

e.g. *1. The 9602 A model is the most* ***updated*** *DVM on the market.* ***(advanced)***
2. You can ***spend less*** *time and money if calibration memory is used.* _____
3. LUKE ***suggests*** *lab calibration only once a year.* _____
4. Diagnostic error codes ***find out*** *hardware errors.* _____
5. This device has many ***uses****.* _____
6. The company can ***supply*** *you with any additional information at any time, day and night.* _____
7. You can find representatives of our firm ***all over the world****.* _____

6. DESCRIBING HOW TO DO THINGS

Look at the examples and then use the cues to make similar sentences.

Examples

a. To measure Ohms, press one of the five function pushbuttons.
b. We can measure Ohms by pressing the five function pushbuttons.

Cues

1. (scale Volts, Ohms, Amps) – (press scaling and enter any multiplier).
2. (set the prescaled units to the right reference point) – (press offset and add or subtract any numerical value).
3. (save time and money) – (use calibration memory).
4. (identify hardware errors) – (use the diagnostic error codes).
5. (get more information) – (contact Luke offices or representatives worldwide).
6. (get measurements faster) – (use the 9602A DVM in a system).

7. Make word combinations according to the text.

	panel	*errors*	*options*	*applications*	*voltmeter*	*units*	*recalibration*	*error codes*	*value*	*calibration*	*point*	*memory*
digital					✓							
numerical												
prescaled												
front												
diagnostic												
simple												
lab												
calibration												
interface												
hardware												
reference												
bench												

8. Search your text for the English equivalent to the following:

e.g. 1. *Διαγνωστικοί κώδικες λαθών: _____*
2. Σημείο αναφοράς: _____
3. Αριθμητική τιμή: _____
4. Εργαστηριακή διακρίβωση (ρύθμιση): _____
5. Μνήμη αυτοδιακρίβωσης (αυτορρύθμισης): _____
6. Εφαρμογές του πάγκου: _____
7. Προδιαβαθμισμένες (προεπιλεγμένες) μονάδες: _____
8. Εξοικονομώ χρόνο και χρήμα: _____
9. Συνεχές ρεύμα: _____
10. Εναλλασσόμενο ρεύμα: _____
11. Κουμπιά λειτουργίας: _____

Grammar Review

A. Look at the sentences below and identify the form of the underlined verb.

a) Infinitive b) Participle c) Gerund

1. Simple recalibration is done without removing the voltmeter or taking off covers.
2. The five function pushbuttons are for measuring Ohms Volts or Amperes.
3. Our diagnostic error codes keep you out of trouble by identifying mistakes.

REMEMBER

When a verb comes immediately **after a preposition** it must be in the **gerund** form.

B. Now choose a verb from the following list, put it in the right form and fill in the gaps.

List: *work – get – repair – replace – operate – make – connect – hear – buy*

e.g. *1. He is thinking of **replacing** his old voltmeter with the new 9602 A DVM.*
2. He is tired of _____ his old TV set so often.
3. He is afraid of _____ a mistake while fixing this complicated device.
4. Are you interested in _____ more detailed information about LUKE measurement instruments?
5. What about _____ a CD player?
6. I am looking forward to _____ from you soon.
7. He is used to _____ for long hours.
8. He had difficulty in _____ the video to the TV receiver.
9. Don't forget to switch off the cassette recorder after _____ it.

Oral Practice *(pair work)*

You want to buy a voltmeter for your workshop. A few days ago you saw an advertisement of LUKE measurement instruments in a magazine. You would like to get some more information about the company's voltmeters, so you decided to call LUKE Sales Manager in England.
Below is the dialogue between you and the Sales Manager (S.M.).

Complete the missing information and act it out with your partner.

S.M.: *Luke Company, good morning. Can I help you?*

YOU: *Good morning, sir. I' m calling from Greece.*
(Say why you are calling)
_____
_____
_____
_____
_____ *. Which one do you recommend?*

S.M.: *Well, the _____, I'd say. It's not only a _____, you know, but a _____, as well.*
(Ask him to be more specific and to tell you what it measures exactly)

YOU: _____
_____

S.M.: _____

(Ask if it is simple in operation)

YOU: *Oh, I see. That's interesting* _____
(Say that you can send him the operation manual to get an idea)

S.M.: *Very simple, sir.* _____
_____

YOU: *Yes, I'd be grateful if you could send it as soon as possible. And something*
(Ask how often lab calibration is required)
else now, sir. _____

S.M.: *Well, that's another advantage of this model. If* _____
_____
_____
(Ask if it is easy to do simple recalibration)

YOU: _____*?*

S.M.: *Oh, yes. Very easy. You can do it from* _____
_____*without* _____

(Ask if there is anything else he can tell you about this model)

YOU: *Very easy, indeed.* _____
_____*?*

(Tell him that it is one of the fastest on the market, and

S.M.: *Yes, I think you should know that* _____
can be used for both systems and bench applications. Also tell him about the diagnostic
_____
error codes)
_____

YOU: *Oh good, I really think it's one of the best on the market. And one more thing*
(Ask about the price)
now. _____*?*

(Say that it's not very expensive and tell him the price)

S.M.: *In fact,* _____

(Ask if there is a representative of the company in Greece)

YOU: *Well, it's a reasonable price, I think.* _____
_____*?*

Sales Manager

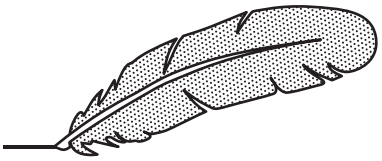
S.M.: *Our office in Athens will open next month, but there is no need to wait until then. You can order it and we'll send it to you as soon as possible.*

YOU: *Thank you very much, sir. You've been very helpful.*

S.M.: *It's my pleasure. And you can call me again if you need anything else. Good bye, sir.*

YOU: *Good bye! And thank you again.*

Writing Activity
(Letter for placing an order)



1. A few days later you decided to buy the 9602 A DVM so you are writing a letter to LUKE Company to order it.

The address is: *LUKE Company LTD*
The Sales Manager
15 Tottenham Rd.
London S.E. 4567
England

The cues below will help you write your letter. Also, if necessary, have a look at the letter-writing guidelines on p. 27.

§ 1. Thank him for the informative operation manual he sent you.
§ 2. Say that you have considered the various points you discussed on the phone and decided to order 9602 A DVM to equip your electronic workshop.
§ 3. Tell him that you want to know the terms of payment, so that it is delivered as soon as possible, since it is extremely useful to you.
§ 4. End the letter.

Write the letter

_____
_____
_____ _____
_____ _____
_____ _____
_____
_____

Dear _____,

§ 1 *Thank you* _____
_____
_____
_____

§ 2 _____
_____
_____
_____

§ 3 _____
_____
_____

§ 4 _____

Yours _____

Measurements and their Units

1. Use the table to make meaningful sentences

A.

W		*Farad*
Ω		*Volt*
Hz	*stands for*	*Ohm*
V	*is short for*	*Watt*
A		*Hertz*
F		*Henry*
H		*Ampere*

B.

p		*nano*
n		*picco*
μ	*stands for*	*Mega*
m	*is short for*	*micro*
k		*Giga*
M		*milli*
G		*kilo*

e.g. *W stands for / is short for Watt.*

2. A. Tick the appropriate symbol for the following:

e.g.

	V	**F**	**R**	**I**	**P**	**C**	**L**
Resistance			✓				
Voltage							
Current							
Power							
Frequency							
Capacitance							
Inductance							

B. Now use the table to make sentences as in the examples.

- *The symbol of/for resistance is R.*
- *Resistance is represented with/by the letter R.*

3. A. In the last column write what is measured by the following units.

UNITS									
1			µA	mA	A	KA	MA	GA	I (current)
2			µV	mV	V	KV	MV	GV	
3			µW	mW	W	KW	MW	GW	
4					Ω	KΩ	MΩ	GΩ	
5	pF	nF	µF	mF	F				
6				mH	H				
7					Hz	KHz	MHz	GHz	

B. Use the table to make sentences as in the examples

- *We measure resistance in Ohms*
- *Resistance is measured in Ohms*

4. A. Look at the pattern.

To convert (*Volts* / *Megavolts*) *into* (*Megavolts* / *Volts*) *you* (*divide* / *multiply*) *by*

B. Now use the cues below to write sentences following the pattern.

1. *Watthours – KiloWatthours (103)*
2. *Henries – milliHenries (105)*
3. *Ohms – MegaOhms (106)*
4. *Farads – piccoFarads (10-12)*

Listening Activity

STEP 1

Listen to the text and decide which of the following would be an appropriate title for it.

a) Testing circuits
b) The parts of a device
c) Transistors

STEP 2

Familiarize yourself with the following words. Then, while listening to the text, tick the words you hear.

frame panel *power supply*

plug *knob*

jack

microprocessor

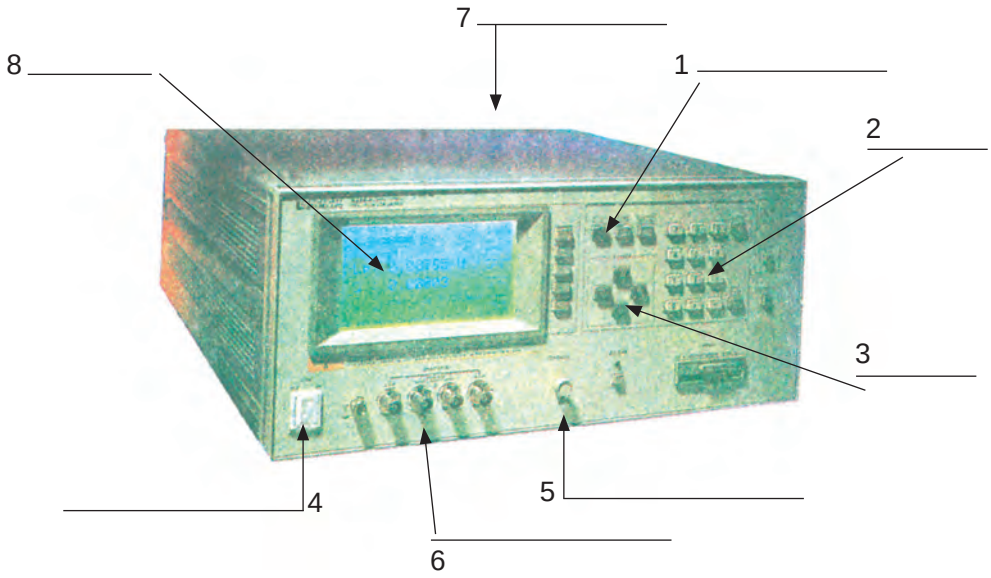
display

cable

socket

STEP 3

Listen to the text once more and label the parts of the device in the order you hear them.



FOLLOW UP

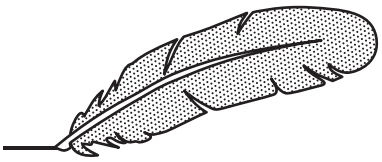
Describe where exactly each part of the device is located.

Expressions to help you

On the lower/upper part of…
On the left/right (hand side) of…
Over/above…
Below/under…
Between…
In the middle/centre of…

e.g. *The display is on the left-hand side of the device.*

Writing Activity
(An advertisement)

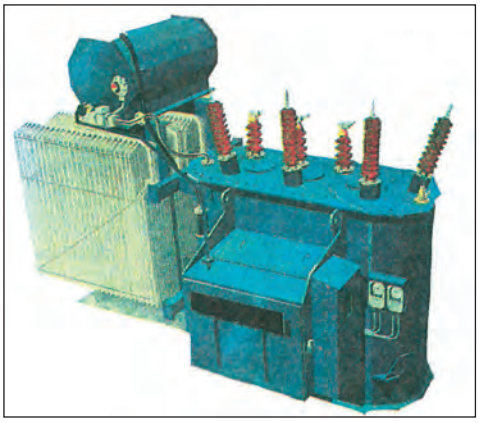


WINNING A PRIZE

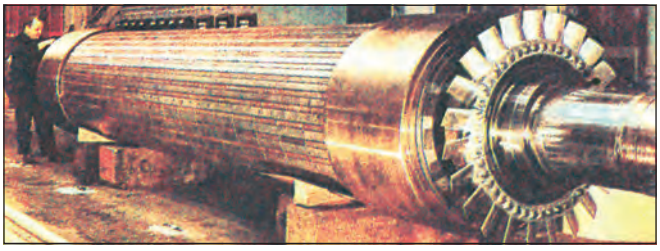
A big Company intends to start an advertising campaign for a new model of DVM it has manufactured.
The publicity department of the company has announced a prize of £ 200 for the best advertisement (ad).
You are interested in winning the prize, so
Work in groups of three and make your own advertisement.
The ads of MICOM (p. 83) and LUKE Company (p. 86) include a lot of useful information and expressions to help you. ***Do your best. Good luck!***

UNIT 6

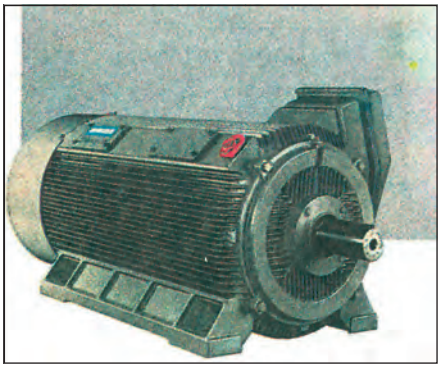
ELECTRICAL MACHINES



Transformer



Rotor of electric generator

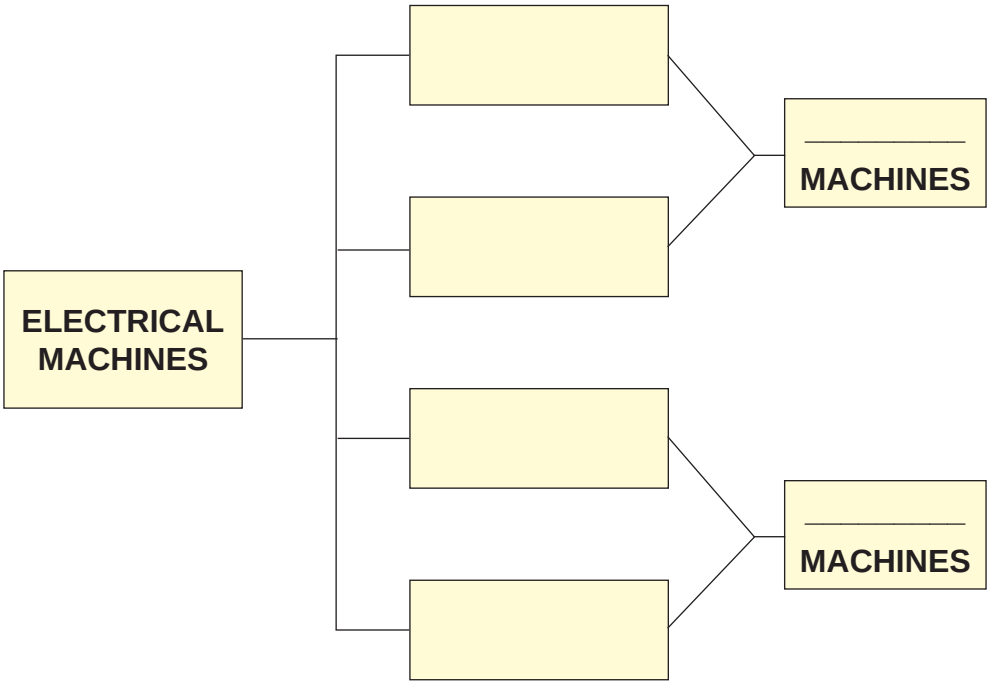


Motor

Listening Activity

STEP 1

Listen to the following text and complete the diagram below.



STEP 2

The statements that follow are incomplete. Listen to the text once again and complete them.

1. _____ convert electrical into mechanical energy.
2. _____ step up or down the voltage at the appropriate value.
3. _____ convert AC into DC current.
4. _____ convert mechanical energy into electrical.

GENERATORS

Strategies for rapid reading

When you read a text searching for specific information, you usually go through it very quickly trying to locate the part which includes the information you are looking for. Then, you read this part more carefully.

A. Practise rapid reading

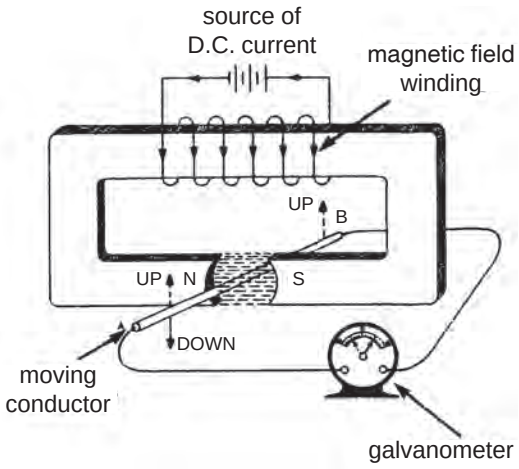
Familiarize yourself with the questions below. Then go through the paragraphs about generators on the next page as quickly as you can and find which paragraphs include the answers to the questions. On the right of these paragraphs, write the number which corresponds to the question they answer.

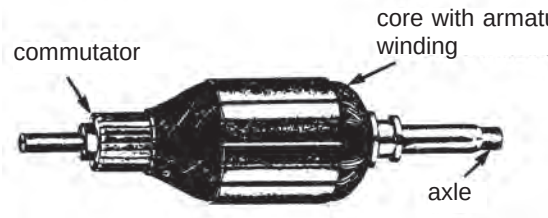
Questions

1. What is the use of generators?
2. Which principle do generators operate on?
3. What moves the rotor of a generator?
4. What is the function of the armature winding?
5. Which are the main subdivisions of AC generators?

B. After you have matched the paragraphs with the questions, read these paragraphs carefully and answer the questions.

____ Both types of DC and AC generators operate on the principle of electromagnetic induction according to which, if a conductor is moved in a magnetic field cutting its lines of force, it will cause an emf to be produced, that is to be induced across the conductor. An emf will also be induced across it, if the conductor is held stationary and it is the magnetic field which is moved cutting the conductor with the lines of force of its magnetic field.



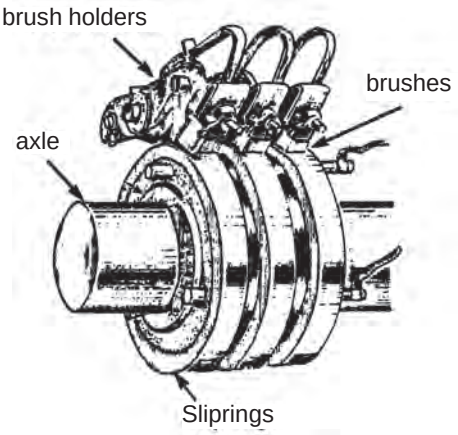


Rotor of a DC generator

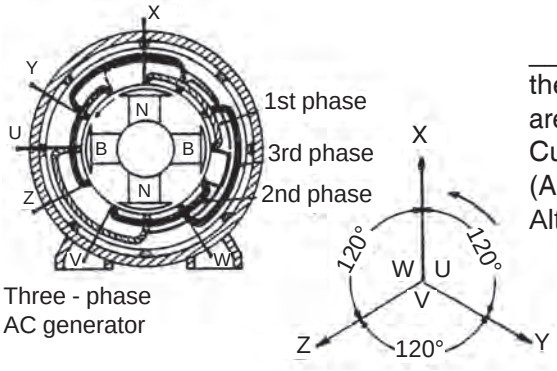
____ A DC generator needs a commutator to produce D.C. current and brushes to furnish it from the commutator to the external load circuit.

____ In order to produce emf, a generator needs two winding: a) the magnetic field winding (exciter) which is supplied with DC current and produces the necessary magnetic field, and b) the armature winding which produces either AC or DC current according to the structure of the generator.

____ Alternators also have brushes, but instead of a commutator, they have sliprings.

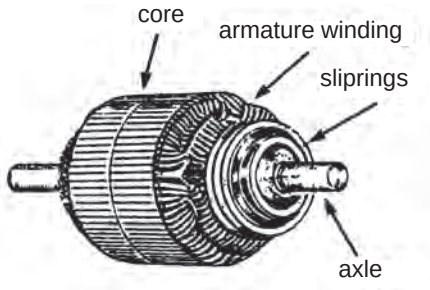


____ Generators are rotating machines which convert mechanical into electrical energy. They are used not only in power plants to generate electricity, but also in order to produce power for emergency use in installations which are not allowed to stop operating.



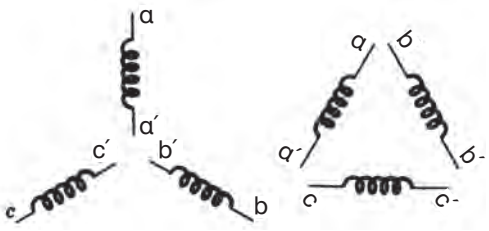
Three - phase AC generator

____ Each generator consists of two main parts: the stator, which is the fixed part, and the rotor, which is the rotating part of the generator. The rotor is driven by a turbine (water or steam) or an internal combustion engine.



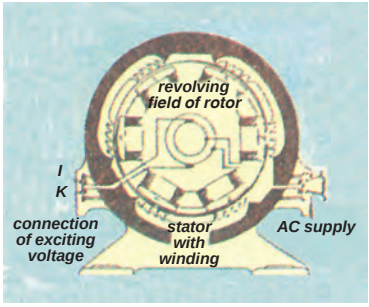
Rotor of an AC generator

____ The two main types of AC generators are the single-phase and the three-phase generators which produce either one or three-phase AC current. In the three-phase AC generators two types of connections are used: star (Y) and delta (Δ).



Star (Y) connection Delta (Δ) connection

____ According to their structure and the current they produce, generators are classified into two categories: Direct Current (DC) and Alternating Current (AC) generators, which are also called Alternators.



Single-phase AC generator

NOTE

> ***Factors determining the amount of the induced emf***
>
> The amount of the induced emf across a conductor depends on the strength of the magnetic field, the length of the armature winding and the rate at which the conductor cuts or is cut by the magnetic lines. The greater the field strength, the longer the winding (coils) and the greater the rate of cutting, the greater the induced emf will be.

Arranging Information

The information included in a text is presented in meaningful units, the paragraphs. The coherence of the text depends on how this information is arranged. A usual way of arranging it is to start from the general and go to the more specific.

The flow of information in the text about generators, for instance, might be as follows: It may start by giving the definition of the machine and its uses, and go on by classifying generators into types or by stating the principles of their operation. Then, a description of the parts of the machine and a comparison of its types, according to their structure, may follow. The text could end by presenting further classifications of these types and their characteristics. There are, however, also other possible ways of arranging this information, so,

Arrange the paragraphs about generators into a coherent text by adding numbers in the spaces provided.

EXERCISES

1. The following statements are false. Correct them.

1. *Generators convert electrical energy into mechanical.*
2. *DC generators are also called alternators.*
3. *When a conductor is moved in a magnetic field, an emf will be induced in the magnetic field.*
4. *The stator is the rotating part of the generator.*
5. *The magnetic field winding produces either AC or DC current according to the structure of the generator.*
6. *The magnetic field winding is supplied with AC current.*
7. *Alternators need a commutator while DC generators need sliprings to produce current.*
8. *Only DC generators have brushes to furnish current to the external load circuit.*
9. *According to their structure and the current they produce, generators are classified into two types: single-phase and three-phase generators.*
10. *In the single-phase AC generators, two connections are used: Y and D.*

2. *The two diagrams below illustrate the structure of the two main types of generators.*

A. Identify the generator type illustrated in each figure.

B. Label their parts in the spaces provided.

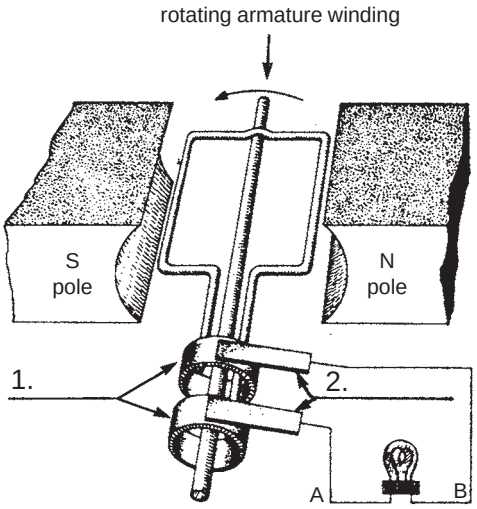


Figure 1

Essential parts of a(n) ..... generator

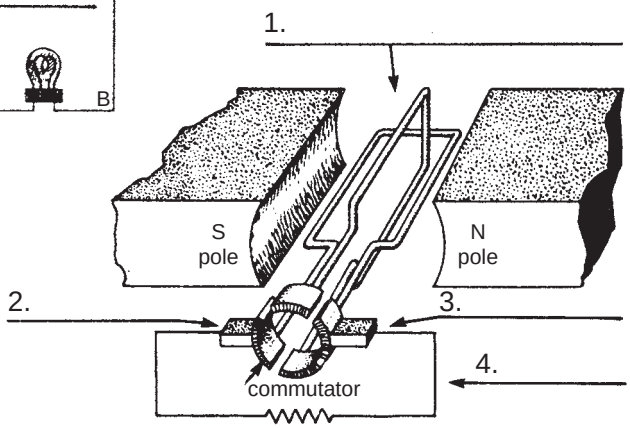


Figure 2

Essential parts of a(n) ..... generator

C. *The two diagrams below present, in a different way, the two types of connections used in the three-phase AC generators.* ***Identify them.***

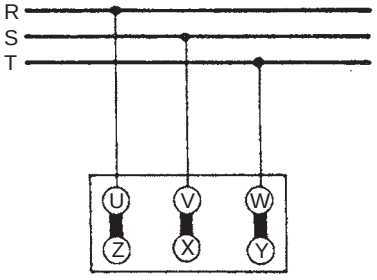


Figure 1:.....

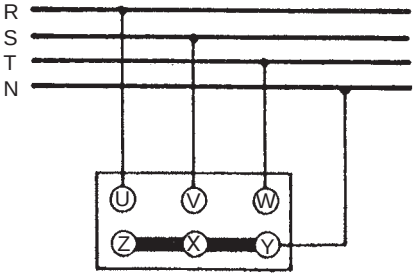
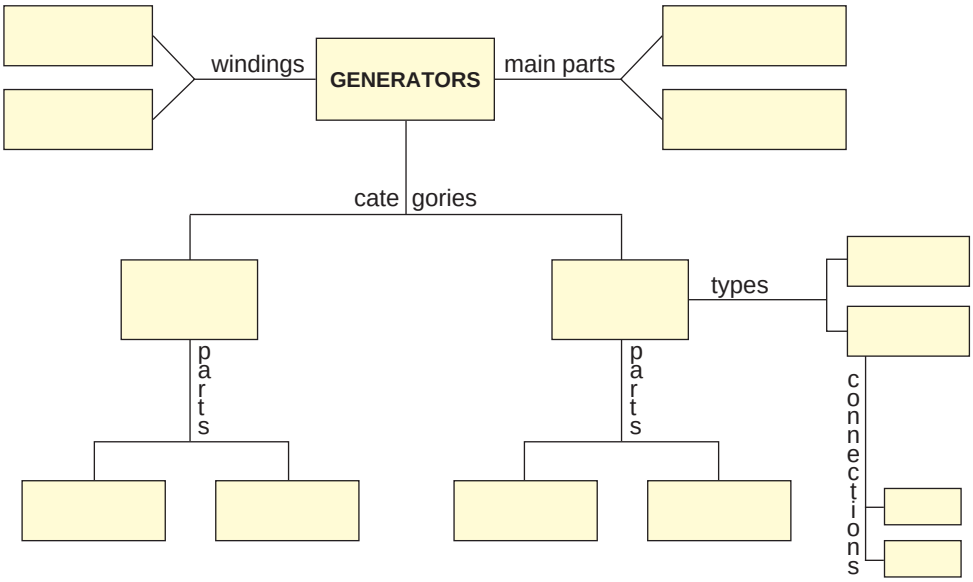


Figure 2:.....

3. Use your knowledge about generators to label the flow chart below.



4. Compare the two types of generators by ticking the grid appropriately.

e.g.

Characteristics	GENERATORS	
	AC	DC
• *AC current production*	✓	
• *armature winding*		
• *magnetic field winding*		
• *commutator*		
• *DC current production*		
• *sliprings*		
• *brushes*		
• *rotor*		
• *stator*		
• *Y and D connections*		

5. EXPRESSING CONTRAST/DIFFERENCE

The examples in the table below show ways of expressing difference or contrast.

Electrons are negatively charged	while / whereas / but	protons are positively charged
Electrons are negatively charged	On the contrary / On the other hand,,	protons are positively charged

State the differences between the following items using the structures of the above table.

1. a. Generators convert mechanical into electrical energy.
b. Motors…
2. a. The magnetic field winding is supplied with current.
b. The armature winding…
3. a. The stator is the stationary part of a generator.
b. The rotor…
4. a. DC generators have commutators.
b. AC generators…
5. a. AC generators produce AC current.
b. DC generators…
6. a. Generators and motors are rotating machines.
b. Transformers and rectifiers…

6. Find words in the text which mean the same as:

1. change: _____
2. categorized: _____
3. supply or provide: _____
4. move round a central point: _____
5. not movable: _____
6. a piece of wire wound into rings: _____
7. is moved: _____
8. generated: _____

Many words in modern languages derive their suffixes from Latin or ancient Greek. Some English verbs, for instance, are formed by adding the suffix **-ize (ise)**, which comes from the Greek suffix **-ιζω**.
The suffix **-ize** means:

- make
- treat somebody or something in the way of…
- do or follow a certain practice or method

7. Find out which of the following words form a verb ending in -ize.

real	*class*
synthesis	*category*
insulation	*organ*
systematic	*action*
product	*character*
magnet	*criticism*

8. Complete the sentences with the missing prepositions.

1. *World energy resources can be categorized _____ renewable and non renewable.*
2. *A car dynamo operates _____ the principle _____ electromagnetic induction.*
3. *Nowadays electric energy production greatly depends _____ fossil fuels.*
4. *Generators belong _____ electrical machines.*
5. *According _____ its conductivity, matter can be classified _____ conductors, insulators and semiconductors.*
6. *Conductors contain a large number of free electrons that can move _____ atom _____ atom.*

9. EXPRESSING PURPOSE

The examples in the table below show ways of expressing purpose.

A DC generator needs a commutator { to / in order to / so as to } produce DC current

{ To / In order to / So as to } produce DC current, a DC generator needs a commutator

Use your knowledge and the cues below to make sentences expressing purpose. Choose either of the two patterns.

1. *A generator needs two windings…*
2. *Both AC and DC generators need brushes…*
3. *Power stations use transformers….*
4. *Step-down transformers are necessary…*
5. *Many countries have used nuclear power…*
6. *Mankind has started to search for new energy sources…*
7. *Solar power plants use the energy of the sun…*
8. *Electricians use multimeters…*

Bicycle dynamo

Another application of the principle of electromagnetic induction is the bicycle dynamo, which is a simple generator. Do you know how it works?

Read the text and find out.

A bicycle dynamo has a toothed wheel which grips the side of the tyre. When the cyclist pedals, it turns round. An axle connects the wheel to a cylindrical magnet.

Around this is a U-shaped iron core (iron increases the magnetism of a magnetic field) with a wire wound round it. As the wheel turns, the magnet spins, inducing an electrical current in the wire (coil). One end of the coil is connected to the lamp through an external wire; its other end is connected to it (the lamp) through the metal frame of the bicycle, which acts as the return pathway (ground), to complete the circuit.

The dynamo produces a tiny current. The stronger the magnet used in it and the more wire coils there are, the larger the amount of current generated. The current can also be raised by increasing the speed at which the magnet rotates.

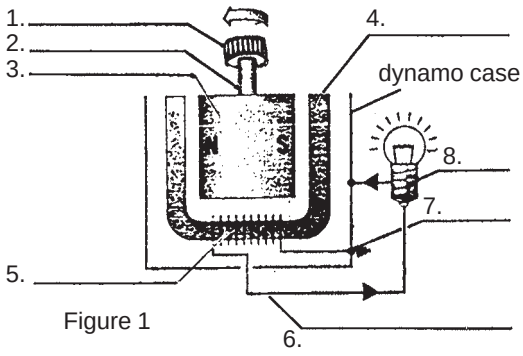


Figure 1

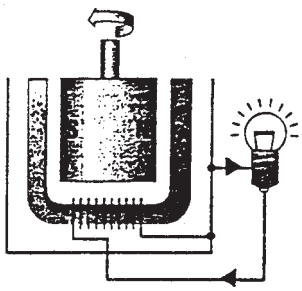


Figure 2

EXERCISES

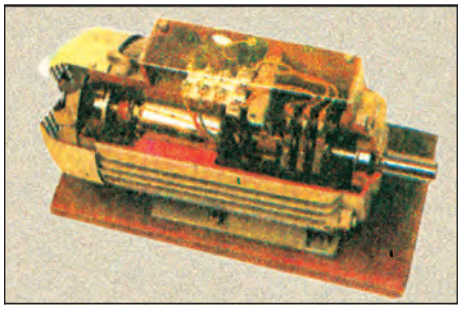
1. Label the parts of the dynamo in figure 1.

2. Answer the following questions.

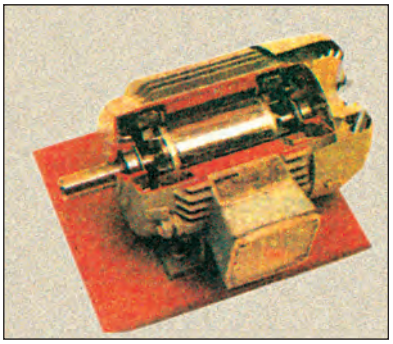
1. *How is the magnet of the dynamo driven?*
2. *Which is the rotating part of the dynamo, the conductor or the magnet?*
3. *How is emf produced in the bicycle dynamo? (Try to relate your answer to the principle of electromagnetic induction).*
4. *Is the polarity of the magnetic field changing as the magnet rotates within the iron core? (see pictures).*
5. *In which category of generators does the bicycle dynamo belong to, AC or DC? Justify your answer.*

6. *Which factors determine the brightness of the bicycle lamp?*
7. *The NOTE on p. 101 states the factors which determine the amount of emf induced in a conductor according to the principle of electromagnetic induction. Match them with the factors determining the brightness of the bicycle lamp.*
8. *What can a cyclist do to increase the brightness of the lamp?*
9. *When the cyclist stops pedalling, the light will go out. Why? (Again try to relate your answer to the principle of electromagnetic induction).*
10. *Why is it enough to use only one wire to connect the dynamo to the lamp?*

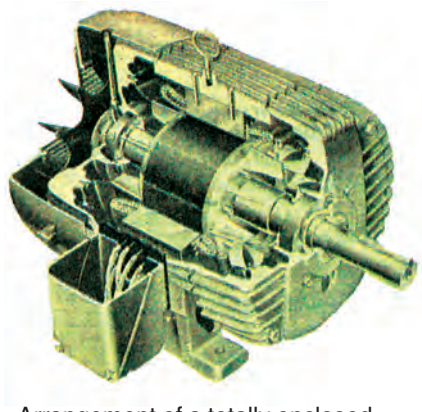
MOTORS



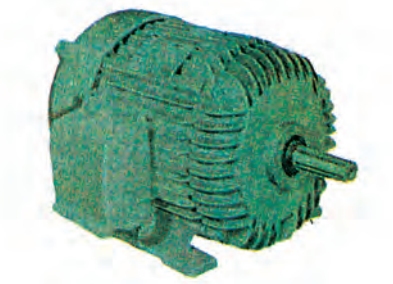
Three-phase induction motor with slip-ring rotor



Three-phase induction motor with squirrel-cage rotor



Arrangement of a totally enclosed, externally fan-cooled polyphase squirrel-cage induction motor



View of a totally enclosed fan-cooled enclosure for an induction motor

Strategies for rapid reading

Pictures, diagrams and flowcharts are used in scientific and technical texts to illustrate certain pieces of information.

Look at the pictures, read the text about motors quickly and match the pictures with the corresponding information in the text.

Motors, like generators, belong to the rotating electrical machines. They operate on the principle of electromagnetic (fields) interaction, according to which: if a conductor lying in a magnetic field (main) is supplied with current, it will experience a mechanical force which urges it to move out of the field. This force is the result of the interaction between the main magnetic field and that produced around the conductor, when it is supplied with current.

It is obvious that the action of a motor is exactly the opposite to that of a generator. In generators, mechanical force is applied to produce an electric current, whereas in motors, an electric current is applied to produce a mechanical force. Since motors convert electrical energy into mechanical, they are used where mechanical power is needed to drive machines in factories and workshops, vehicles, household appliances or other electrical devices.

Like generators, motors consist of two essential parts: a rotor and a stator. According to their structure and the kind of current they are supplied with, motors are classified into two main categories: DC and AC motors.

The structure of a DC motor and that of a DC generator is exactly the same. DC motors, just like generators, are further classified into series, compound, shunt and separate excitation motors, according to their magnetic field winding arrangement.

Each of the above types has its own characteristics of operation and, therefore, different applications. The main characteristic of the shunt excitation motor, for instance, is its constant speed, regardless of the amount of load applied. The series excitation DC motor, on the other hand, is characterised by a high starting torque, and is, therefore, used in trolley-buses and electric trains.

The other category of motors, the AC, is used even more widely. It is subdivided into two main types: a) the three-phase synchronous and b) the induction or asynchronous motors which are further divided into: a) the single, b) the three-phase and c) the asynchronous motors with commutator.

Figure 1
Arrangement of a D.C. motor

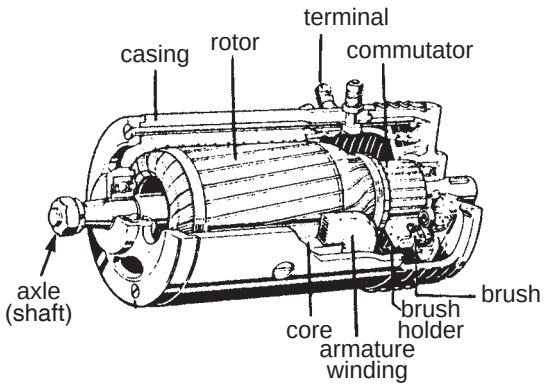
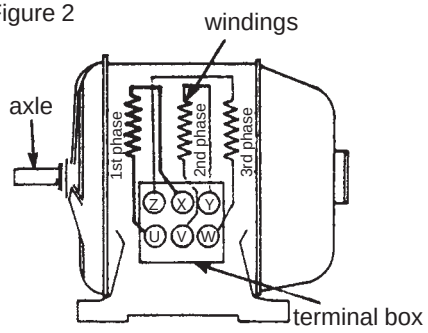
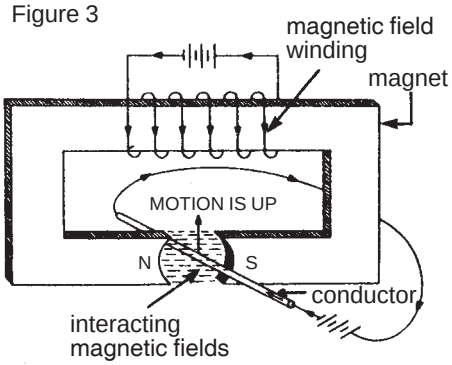


Figure 2



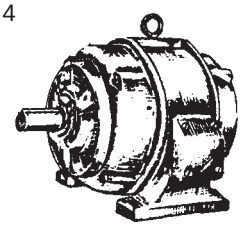
Windings of a three-phase asynchronous AC motor

Figure 3



Producing mechanical force by passing current through a conductor lying in a magnetic field

Figure 4

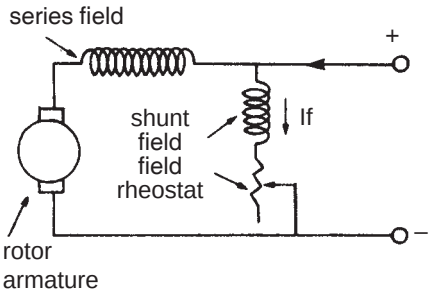


View of a three-phase induction motor

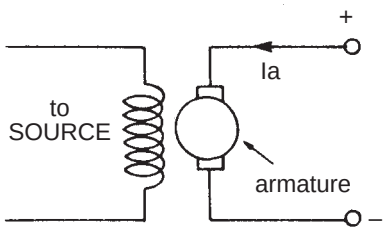
Figure 6

Magnetic field interaction

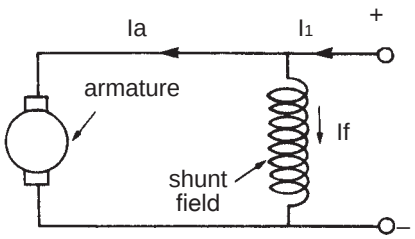
Figure 5
Schematic diagrams of the various types of DC motors



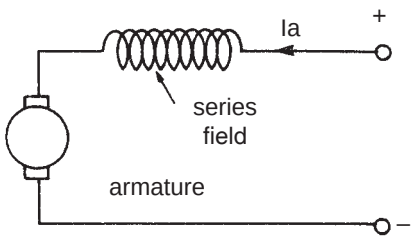
a) Compound excitation DC motor



b) Separate excitation DC motor



c) Shunt excitation DC motor



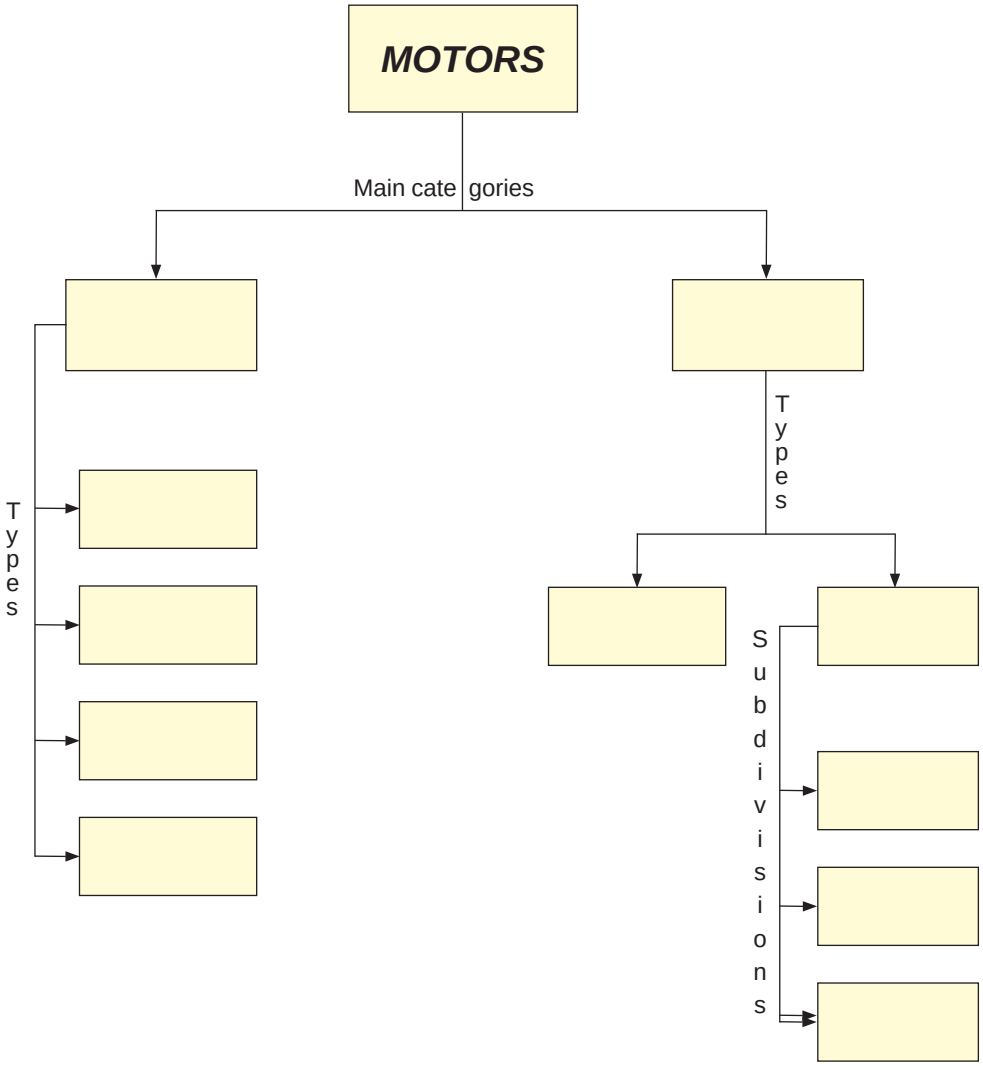
d) Series excitation DC motor

EXERCISES

1. *The following subtitles state the main ideas around which the paragraphs of the text are built up.* ***Find which subtitle corresponds to each paragraph.***

1. Structure and types of DC motors
2. Classification of AC motors
3. Characteristics and use of some AC motor types
4. Categories and essential parts of motors
5. Motors action and uses
6. Definition and principle of operation of motors.

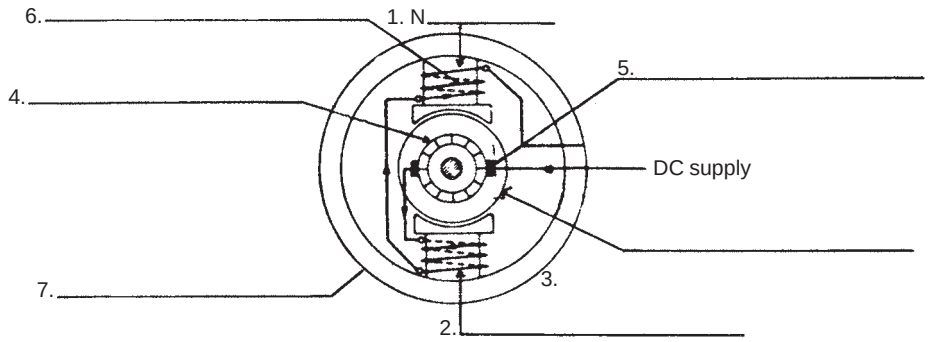
2. Fill in the flowchart below with the various types of motors.



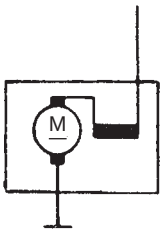
3. Answer the questions:

1. Which are the two essential parts of a motor?
2. Mention the main parts and windings of a DC motor.
3. Is the function of these parts the same as in DC generators?
4. Which is the appropriate type of motor to be used
a) as the starter of a car?
b) in a certain electrical application in which a steady speed of rotation is required?
Justify your answers.

4. Label the parts of the DC motor in the schematic diagram below.



5. Identify the type of DC motor illustrated in the diagram.



6. *The two paragraphs below state the differences between the principles motors and generators operate on.* ***Choose the correct phrase from the list to fill in the gaps.***

List:

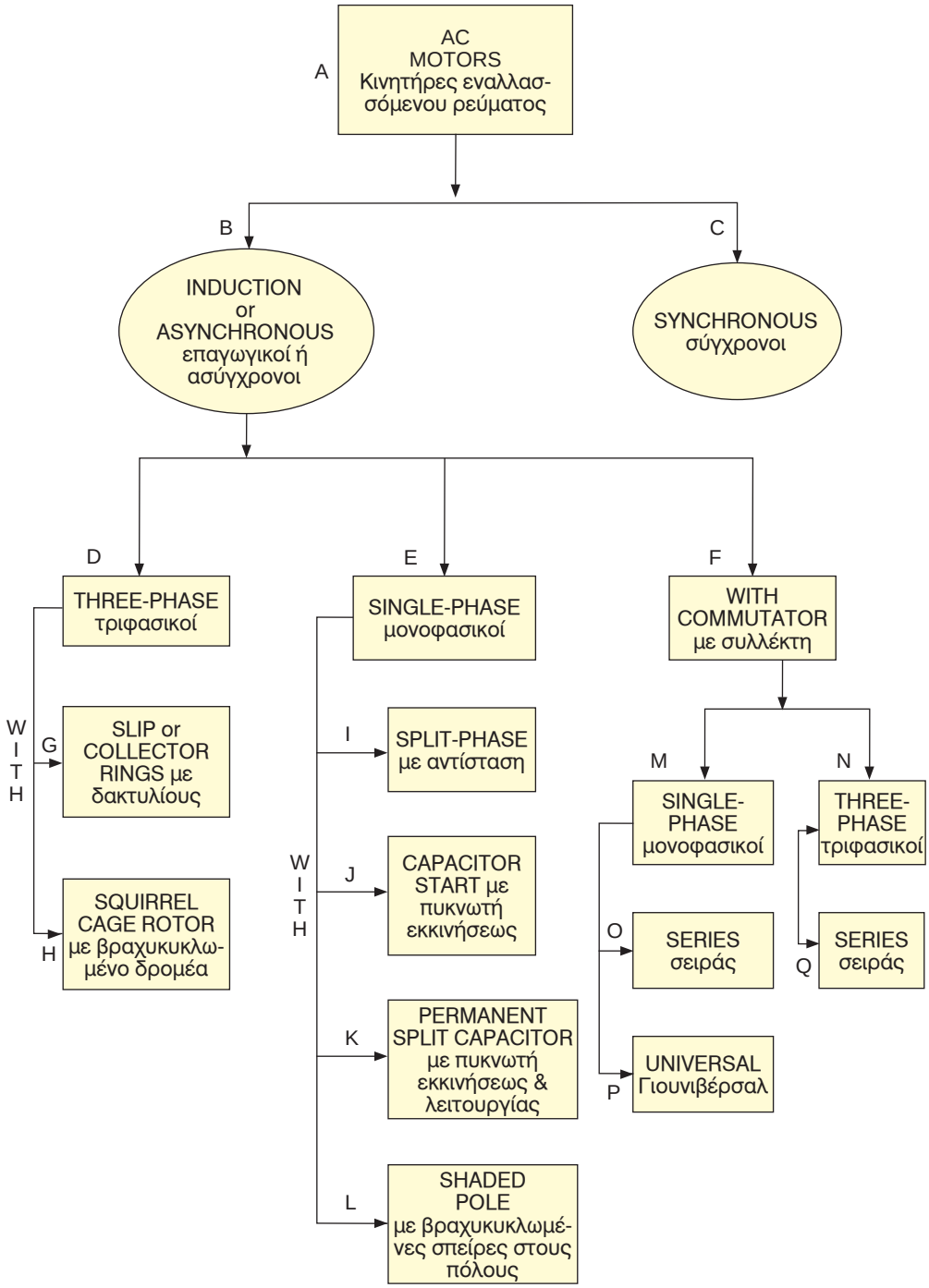
- *producing a magnetic field around it*
- *driven by mechanical power*
- *producing mechanical power*
- *producing electric current*
- *current is supplied to*
- *the lines of force of its magnetic field*

A. *In a generator, a conductor _____ (1) cuts the lines of force of a magnetic field, thus _____ _____ (2). The result is the same if it is the magnet which is moved cutting the conductor with _____ (3).*

B. *In a motor, on the contrary, _____ (1) the conductor, thus _____ (2) which interacts with the main magnetic field _____ (3).*

7. TYPES OF AC MOTORS

The flow chart below presents the most widely used types of AC motors.



Naming AC motors

Naming AC motors is quite complicated because the term used for each type is the combination of various qualifiers placed in a certain order. The correct order to place them, in order to produce the terms, is to start from the more specific qualifier and gradually go to the more general. The «with» phrase is always added at the end.

Examples

a) A single-phase asynchronous AC motor with (a) capacitor start (EBAJ)
b) A universal single-phase asynchronous AC motor with (a) commutator (PMBAF)

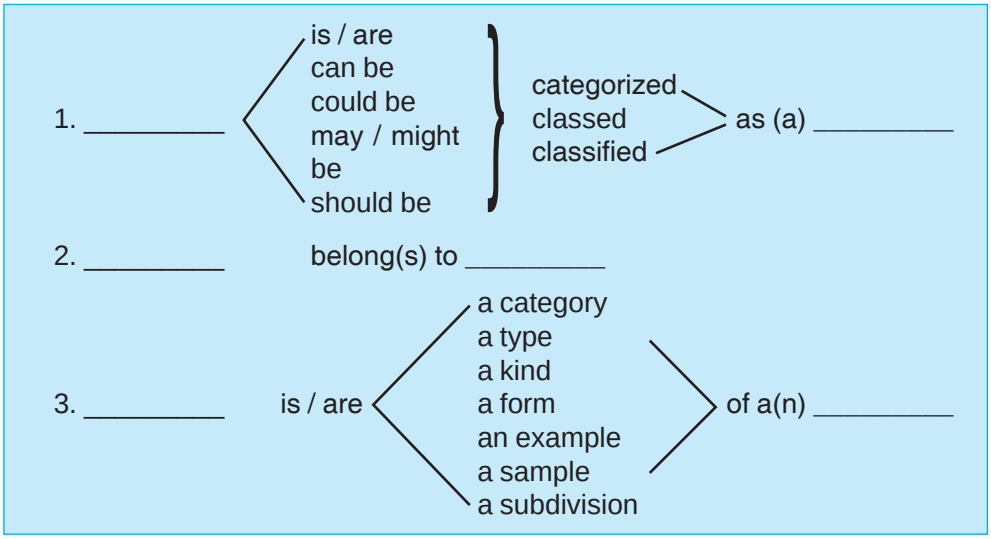
Practise the English term for the various types of AC motors by replacing the letters with the corresponding qualifiers in the boxes on their right.

DBAH	*4. QNBAF*
EBAL	*5. CA*
DBAG	*6. EBAK*

Continue in the same way. Give two combinations of letters to your partner to replace.

8. CLASSIFYING FROM SPECIFIC TO GENERAL

In the table below you can see some sentence patterns often used to classify an item to the category it belongs to.



Examples

- *Generators can be classified as «rotating electrical machines».*
- *Rectifiers belong to static electrical machines.*
- *Wood is a form of solid.*
- *The three-phase synchronous motor is a subdivision of AC motors.*

Choose expressions from the table to make sentences out of the cues below.

1. Bicycle dynamo → AC generator
2. Copper → conductor
3. Transformer → static electrical machine
4. Combination pliers → tool commonly used by electricians
5. Universal → asynchronous AC motor with (a) commutator
6. Hydrogen → gas
7. Ohmmeter → measurement instrument
8. Shunt excitation motor → DC motor
9. Coal → fossil fuel

9. COMPARING (SIMILARITIES - DIFFERENCES)

Some of the most often used words or phrases when comparing items are:

In case of	
Similarity	**Difference**
like similar the same (as) as+adjective+as as	unlike dissimilar (to) different (from) differ(s) (from) (the) opposite (of/to) not so/as+adjective+as

Examples

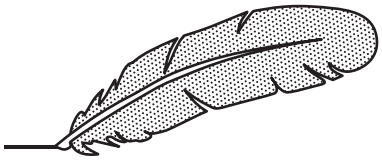
- *Motors, like generators, belong to the rotating electrical machines.*
- *Unlike renewable sources of energy, fossil fuels add severely to environmental pollution.*
- *Aluminium is almost / isn't as good a conductor as copper.*
- *A coal fired power plant is similar to a lignite fired one.*
- *Solutions of salts are different / differ from solutions of bases.*

Use expressions from the table to make sentences out of the cues:

1. Motors ⟷Generators (operate as energy conversion machines)
2. DC generator ⟷DC motor (structure)
3. Motor ⟷Generator (action)
4. Oxygen atom ⟷Helium atom (structure)
5. Tin ⟷Gold (heavy)
6. Ammeters ⟷Voltmeters (measurement instruments)
7. Generators ⟷Motors (principle of operation)
8. Geothermal ⟷Wind power (renewable sources of energy)

9. Electrician's knife ⟷Cutter (use)
10. Motor ⟷Generator (essential parts)
11. DC motors ⟷AC motors (widely used)
12. Water ⟷Oxygen (important to our lives)

Writing Activity



You are going to write a text to compare Generators with Motors. The guidelines and cues that follow will help you.

I. Guidelines for producing a coherent text

- ***Arranging information***
- ***Paragraphing***
- ***Connecting sentences and paragraphs***

To produce a coherent text, first you have to think and decide which ideas / information should be included in it. Then it is advisable to make an outline arranging the ideas / information so as to present them in a logical order, depending on the topic (starting from the general and going to the more specific or vice versa).

When writing do not forget to divide your text into paragraphs. Bear in mind that paragraphs make reading faster and the information included in the text clearer and more comprehensible. A text without paragraphs is repulsive to the reader.

Also do not forget to use linking words to connect your sentences and paragraphs. The use of the appropriate linking words signals how one idea leads on from another one and the relationship between them contributing to the coherence of the text.

II. Gathering information

The following grid will give you the information needed to produce the text in question.

A. Tick it appropriately to find the similarities and differences between Generators and Motors.

	CUES	GENERATORS	MOTORS
1.	*Electrical rotating machines.*		
2.	*Their purpose is electromechanical energy conversion.*		
3.	*Operate on the principle of electromagnetic induction.*		

	CUES	GENERATORS	MOTORS
4.	*Operate on the principle of electromagnetic (fields) interaction.*		
5.	*Mechanical force is applied to generate electric current.*		
6.	*Electric current is supplied to produce mechanical energy.*		
7.	*Used in power plants to produce electricity and in various installations for emergency use.*		
8.	*Used where mechanical power is needed to drive machines in industries, vehicles, household appliances, etc.*		
9.	*Their two main parts are a rotor and a stator.*		
10.	*Are classified into AC and DC according to the current they are supplied with.*		
11.	*Are classified into AC and DC according to the current they produce.*		

B. Write your text. Develop your paragraphs by combining the information included in the above table. Add any other information you think necessary.

Do not forget that a paragraph is a complete piece of writing made up of sentences built up around one main idea or piece of information.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

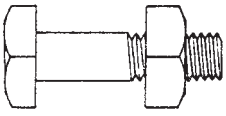
Fixing and maintaining motors

Fixing and maintaining motors properly ensure continuous running and excellent performance. It is essential, for instance, to make sure that motors are correctly fixed in position and foundation bolts do not work loose. It is also very important to check bearings for lubrication, to remove dust deposits, etc. Needless to say that maintenance procedure should extend to control equipment such as starters, safety devices, contactors…

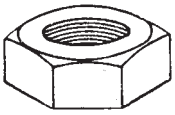
A few general hints on finding malfunctions and damages and how to remedy them are given in the fault-finding chart.

Vocabulary to help you understand the chart better.

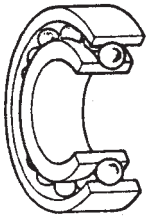
fuse



bolt



nut



bearings

ATTENTION

Due to misprinting, some items from this fault-finding chart were missing. The publisher later printed a table including them, but without defining their appropriate place in the chart.

So, find where these items should be placed.

FAULT-FINDING CHART

	SYMPTOMS	CAUSES	REMEDY
1	***Motor doesn't start***	*1. _____* *2. Fuse blown* *3. Load too heavy* *4. Control system stuck open* *5.* Faulty centrifugal switch* *6.** Single-phasing at starter*	*1. Check power supply* *2. Replace fuse* *3. _____* *4. Repair or replace control device* *5. _____* *6. Check source of power supply*
2	***Motor hums excessively***	*7. _____* *8. Low line voltage* *9.* _____* *10.* Circuit in starting winding open* *11. Stator winding grounded*	*7. Check wiring against electrical diagram* *8. Check main line voltage as marked on nameplate* *9. Replace starting capacitor* *10. Check stator winding terminals for open circuit* *11. _____*
3	***Motor starts, but starting winding does not get off***	*12. _____* *13. Improperly wired* *14. Defective starting relay*	*12. Check main line voltage as marked on nameplate* *13. Check wiring against electrical diagram* *14. _____*
4	***Starting relay burnt out***	*15. _____* *16. Low/excessive line voltage* *17.* Incorrect running capacitor*	*15. Replace starting relay with another properly selected for motor characteristics* *16. Check main line voltage as marked on nameplate* *17. _____*

5	***Motor vibrates***	*18. Incorrectly coupled load* *19. _____*	*18. _____* *19. Tighten nuts to foundation bolts*
6	***Motor overheats***	*20. _____* *21.** _____* *22. Inadequate ventilation* *23. Dust or dirt deposits around winding, casing or vent openings* *24. Bearings worn due to lack of lubrication*	*20. Reduce load or replace with motor of greater capacity* *21. Check source of power supply* *22. _____* *23. Remove dust or dirt* *24. _____* *_____*

Table with missing information

	CAUSES		**REMEDY**
1.	*Low line voltage*	*1.*	*Check load and couple correctly*
2.	*Motor not properly fixed to base*	*2.*	*Lubricate bearings or replace, if necessary*
3.	*Single phasing*	*3.*	*Check if motor starts without load. If yes, reduce load or replace with motor of greater horsepower*
4.	*Starting capacitor defective*	*4.*	*Replace with running capacitor of correct µF capacitance*
5.	*No power supply*	*5.*	*Check stator winding terminals for grounding using Ohmmeter* *Check relay, and, if defective, replace*
6.	*Overloading*	*6.*	*Check ventilator and flow of ventilating air*
7.	*Improperly wired*	*7.*	*Check mechanism of centrifugal switch ensuring contacts can open and*
8.	*Incorrect starting relay*	*8.*	*close freely*

Note

** Items marked with one asterisk refer to symptoms and the corresponding cause and remedy of a single-phase motor.*

*** Items marked with two asterisks refer to three-phase motors.*

EXERCISES

1. Look at the columns of symptoms and say which ones you can a) hear (H) b) see (S) c) feel (F).

2. Find phrases or words in the chart which mean the following:

1. The circuit in the starting winding is not complete and, as a result, current is not flowing.
2. The voltage supplied in the line is lower than that required for the operation of the motor.
3. One of the three phases is not supplied with current, it is disconnected or open and as a result the motor operates as a single-phase one.
4. As it is indicated on the label placed on the casing of the motor which contains all its technical data (specifications).
5. Bearings damaged due to lack of lubrication.
6. Motor and load are not joined correctly.
7. The bolts fixing the strong base which the motor is based on.
8. Fuse melted, perhaps due to overload.
9. The property of a capacitor which opposes any change of voltage and is measured in Farad.

3. ELLIPTICAL SPEECH

In technical and scientific language parts of a sentence easily understood are often omitted. The omitted parts are usually articles, verbs, pronouns (personal, relative), the subject or the object of the sentence. As a result, elliptical speech is not always clear and should be developed for the message to be understood.

Example

Sentence in elliptical speech

Check if motors starts without load. If yes, reduce load or replace with motor of greater horsepower.

Sentence developed

Check if the motor starts without load. If it starts without it, reduce the load or replace the motor with another (motor) of greater horsepower.

Familiarize yourself with elliptical speech by developing the following:

1. Faulty centrifugal switch.
2. Load too heavy.
3. Motor improperly wired.
4. Low / excessive line voltage.
5. Dust or dirt deposits around winding, casing or vent openings.
6. Reduce load or replace with motor of greater capacity.

Check main line voltage as marked on nameplate.
Check stator winding terminals for open circuit.
Check relay and, if defective, replace.

4. Odd-man out

1.	*damaged* *coupled* *worn (out)* *defective*	*2.*	*marked* *indicated* *reduced* *shown*	*3.*	*incorrect* *improper* *faulty* *heavy*
4.	*switch* *breaker* *insulator* *relay*	*5.*	*ventilators* *bolts* *nuts* *bearings*	*6.*	*mechanism* *device* *appliance* *fuse*

5. Work with your partner to ask and answer questions about the various symptoms of the motor and their possible causes and remedies. *Do not forget to develop elliptical speech. Your exchanges should follow the patterns indicated in bold-typed letters in the example below.*

A. What may be the cause if / in case the motor doesn't start?

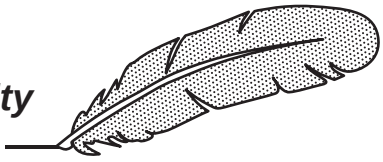
B. There may be / Perhaps there is > *a low line voltage*

The / Perhaps the > *line voltage* < ***may be / is*** > *low*

A. What should be done in that case / then?

B. It should be checked if *the line voltage is the same as that marked on the nameplate.*

Writing Activity
(A short report)



Usually, when you are employed to maintain and repair machines, you are asked to write a report of the procedure you followed.
Imagine that you were employed by the production manager of «Mevis Co» to repair one of their motors.

Choose one of the symptoms from the fault-finding chart to write your report to the company following the pattern below.

To: *«Mevis Co Ltd»*

Kind of job: *Repair of Motor No 0638*

Cost of job: _____

I was employed by the production manager of your company to repair a motor driving one of the factory's machines.

The motor (symptom)_____. I examined all the possible causes, that is if the + (S. Past) (cause)_____

_____.

Finally I found that the damage was due to (cause)_____, I (repair)_____ and so the damage was remedied.

*The cost mentioned above includes a) price of spare parts b) labour c) V.A.T.**

(Signature) _____

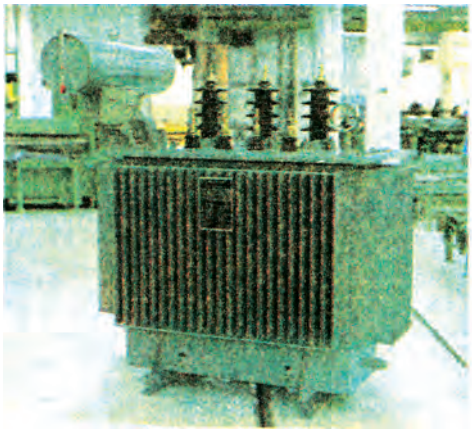
(Date)

_____

(Name in full)

* Value Added Tax

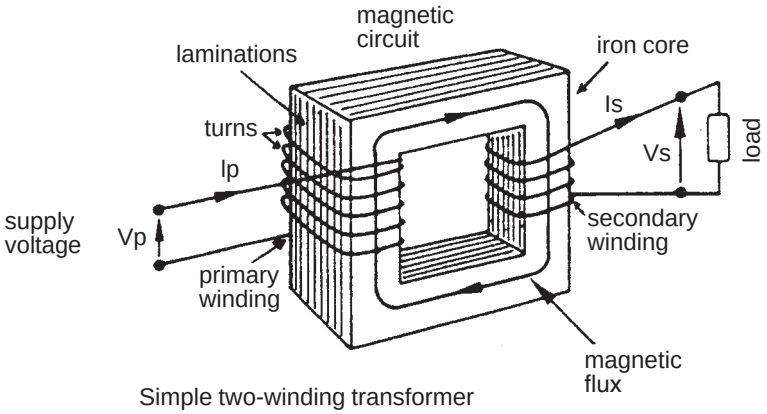
TRANSFORMERS



Read the text about transformers below and give subtitles to its paragraphs.

The third kind of electrical machines is the Transformer. Unlike generators and motors, a transformer is a static device whose purpose is to step up or down an alternating current or voltage, that is to transfer voltages and currents from the given to the required values.

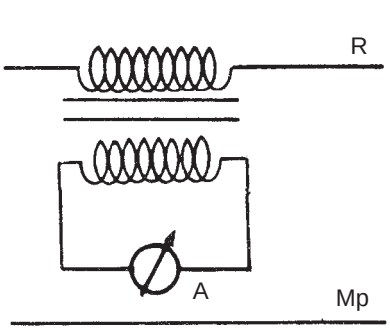
The operation of transformers is based on a combination of the electromagnetic principles also applied to the operation of motors and generators.



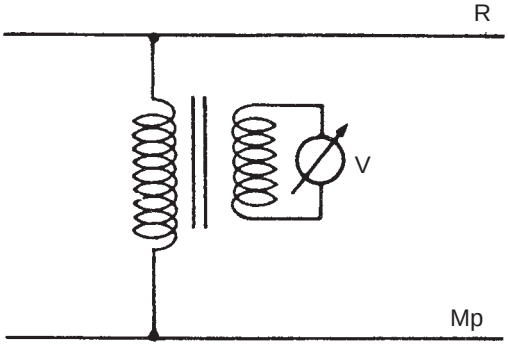
Simple two-winding transformer

Fundamentally, a transformer consists of two or more windings placed around a common core. One of these windings is connected to a source of AC power and is called primary, while the other is connected to the load and is called secondary. There is no electrical connection between the primary and the secondary winding. The coupling between them is through magnetic fields. The core is usually made of thin iron sheets called laminations.

From the view point of operation, transformers are classified as: Current and Voltage, or Power transformers.



Current Transformer



Voltage/Power Transformer

According to their function and the number of turns of the secondary winding, voltage transformers are distinguished into step-up and step-down.

Like AC motors and generators, transformers are also classified into «single-» and three-phase, according to the type of AC current their primary winding is supplied with.

Finally, they are classified into liquid-insulated and dry-type, according to the way they are cooled. Liquid-insulated transformers are immersed in a special kind of oil which acts as coolant. Dry-type, on the other hand, are cooled by the free movement of air.

Adding information to the text

The information included in the boxes can be inserted in the text about transformers. ***Find the appropriate point to insert it, and mark its place by writing the number which corresponds to each box.***

1 The liquid is used not only as a coolant, but also as part of the insulation dielectric.

2 Alternating current is supplied to the primary winding producing a magnetic field around it. Via the iron core, the magnetic flux is transferred to the secondary winding inducing a voltage in it, which is delivered to the load.

3 Due to their function, voltage transformers are used in power transmission systems: a) in the power plants to step up voltage, and at the same time step down current, in order to minimise power losses during transmission and b) along the transmission line to step down the voltage again in order to meet values safe for domestic and industrial use.

4 Current transformers are used in low-current measurement instruments, such as ammeters*, in relays and control devices.

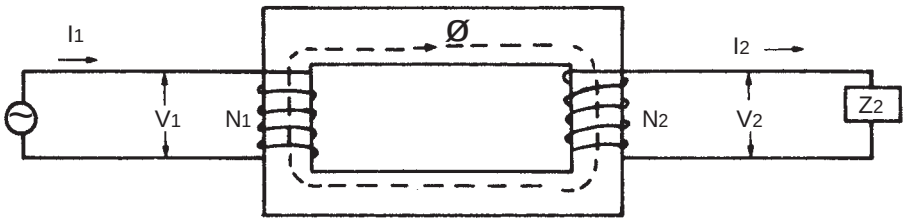
5 They are lighter than the liquid filled transformers, and therefore more widely used.

6 If the secondary winding has more turns than the primary, the transformer is operating as a step-up. If the secondary has less turns than the primary, the transformer is operating as a step-down.

7 not to convert one form of energy into another, but

EXERCISES

1. Fill in the boxes with the corresponding symbols from the diagram.



1. ☐ *magnetic flux*
2. ☐ *primary voltage (applied AC / supply voltage)*
3. ☐ *secondary voltage (induced AC voltage)*
4. ☐ *primary current*
5. ☐ *secondary current*
6. ☐ *number of turns of primary winding*
7. ☐ *number of turns of secondary winding*
8. ☐ *load*
9. ☐ *AC source*

2. Identify the types of voltage transformers represented in the two diagrams below.

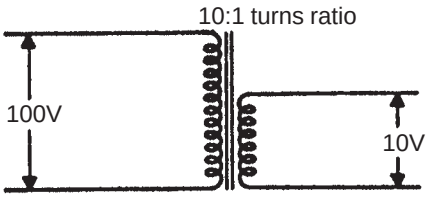


Figure 1 .....

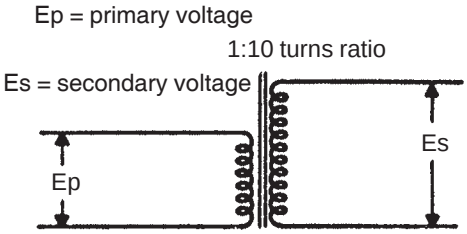
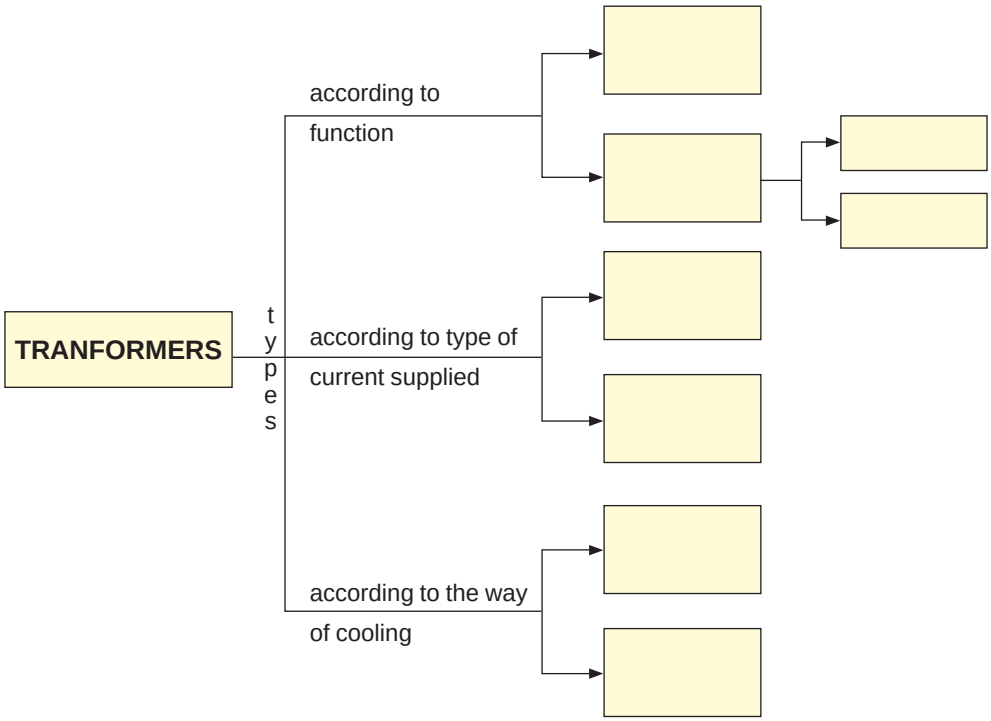


Figure 2 .....

3. Complete the inequalities with the right subscript.

a) If N_ > N_ we have a step-down transformer.
b) If N_ < N_ we have a step-up transformer.

4. Label the chart with the various classifications of transformers.



5. Fill in the gaps. Try not to look at the text or the information in the boxes.

1. *The _____ of a transformer is connected to an AC source of power, while the _____ to the load.*
2. *_____ transformers are immersed in oil which acts as _____.*
3. *The thin sheets of iron the _____ of a transformer is made of are called _____.*
4. *Transformers are _____. Their purpose is to _____.*
5. *The function of a step-up transformer is to _____ and step _____ in order to reduce _____ during transmission.*
6. *The _____ transformer is cooled by _____, and as it is _____ than the _____ type, it is _____ used.*
7. *The function of step-down transformers is to _____.*
8. *_____ are used in _____ voltage measurement instruments, in _____ and _____.*
9. *The magnetic flux _____ from the primary to the secondary winding via the _____ inducing a _____ in it, which is then transferred to the _____.*

6. WORD FORMATION

The prefix trans-

You have often come across words beginning with this prefix. Have you ever thought what it means?

trans- = across, on the other side, beyond

Write as many words as you can remember beginning with this prefix.

_____

_____

7. Match words with their definition.

1. deliver	*a. being at rest, not moving*
2. coolant	*b. move, carry from… to*
3. immerse	*c. basically, essentially*
4. flux	*d. by way of, through*
5. static	*e. put under the surface of water*
6. domestic	*f. a means for removing heat*
7. fundamentally	*g. of the home, household*
8. transfer	*h. flow*
9. via	*i. take something to whom or what it is addressed to*

Grammar Review

Wh- questions

Wh- questions are questions beginning with: why, when, where, how (much/many), who, whose, which, what.

They are always **followed by an interrogative verb**.

e.g.
Why is this DVM the best on the market?
When did you buy your TV set?
Where do power transmission systems deliver electric energy?
How does a motor operate?

IMPORTANT

who **which** **what** **whose**	When they are **used as subjects** they **are followed by an affirmative verb,** not an interrogative one.

e.g.
The personnel manager interviewed Peter
***Who** interviewed Peter?* — **Subject** (S)
***Who did** the personnel manager interview?* — **Object** (O)

Transformers step up or down voltage

e.g. ***What*** *steps up or down voltage?* **Subject**

What do *transformers step up or down?* **Object**

DO NOT FORGET

In questions **prepositions** are usually placed **at the end.**

e.g. *Which parts does a DC generator consist of?*

Use the following sentences to ask questions beginning with the words in parentheses.

1. *Generators operate on the principle of electromagnetic induction. (Which machines/Which principle).*
2. *Voltage transformers are distinguished into step-up and step-down. (Which types).*
3. *Three factors determine the brightness of a bicycle dynamo. (How many).*
4. *Single- and three-phase generators belong to the category of AC generators. (Which types/Which category).*
5. *Electrons move around the nucleus of the atom in orbit. (What/Around what/ How).*
6. *The motor stopped operating when the fuse was blown. (What/When/Why).*
7. *A nuclear accident will cause a serious environmental pollution. (What (S)/ What(O)).*
8. *The new DMM he bought cost £50. (What/How much).*
9. *The metal frame of the bicycle acts as the return pathway to complete the circuit. (What/How).*
10. *It took him three hours to repair the motor. (What/How long).*
11. *The operation of transformers is based on a combination of electromagnetic principles. (What(S)/What(O)/Whose).*
12. *Due to their function, step-up transformers are used in power systems to reduce power losses during transmission. (Why/Where).*

Dry-Type Transformers

Due to their various advantages, dry-type transformers are widely used. Companies manufacturing them try to promote their products and publish brochures and leaflets advertising their quality and technical characteristics. Such an advertisement of an innovative dry-type transformer is given below.

1. Before reading the advertisement, look at the following adjectives and say which of them can characterize dry-type transformers.

compact	*light*	*well insulated*
easily installed	*safe*	*accurate*
sensitive	*versatile*	*innovative*
manually operated	*reliable*	*well cooled*

2. Read the advertisement now and find which of the above properties characterize Anderson dry-type transformers.

YOU CAN DEPEND ON ANDERSON DRY-TYPE TRANSFORMERS!

The Anderson Electric line of Electrical Power Equipment (E.P.E.) dry-type power transformers is an example of an innovative product.

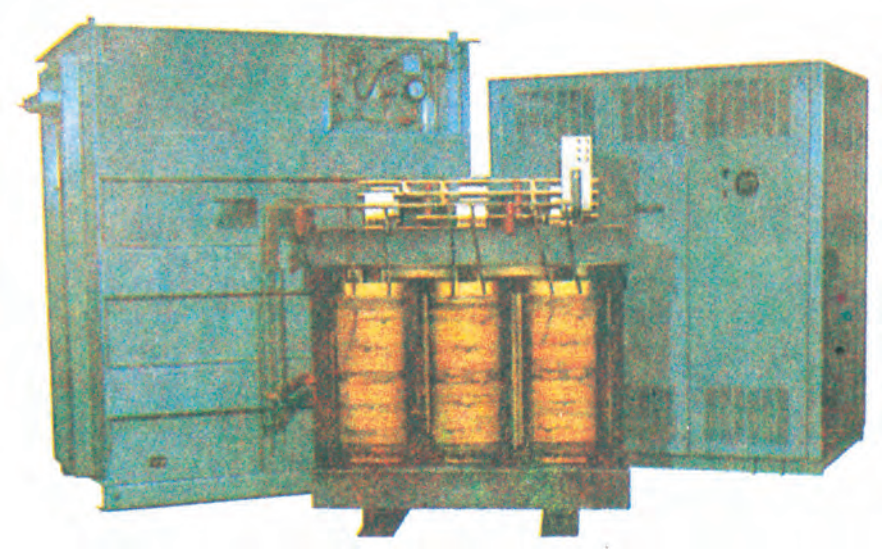
E.P.E. dry-type transformers are designed to be easily installed, safe and reliable. Four basic types are available: ventilated, weather resistant, totally enclosed and sealed.

Ranging in sizes from 112 1/2 to 7,500 KVA, they all meet or exceed ANSI* and IEEE* standards.

E.P.E. dry-type transformers have an innovative, fully coordinated 200 °C, class H insulation system. This results from using only high quality insulating materials with well-cooled primary and secondary windings so, optimum transformer life and high reliability are provided. And every E.P.E. transformer receives a Quality Control (Q.C.) test before leaving the plant.

Now, that's quality you can depend on!

For more information, call our nearest district office which is listed in the yellow pages under: «Electrical Equipment Manufactured».



EXERCISES

1. Find words in the text which mean:

1. *Something new, bringing changes:* _____
2. *Completely synchronized:* _____
3. *Something used as a measure for the required value:* _____
4. *Tightly closed:* _____
5. *The best possible:* _____

2. Answer the following questions.

1. *What is the main characteristic that makes the dry-type transformers of the advertisement an innovative product?*
2. *Why is the insulation of Anderson dry-type transformers of high quality?*
3. *Which types of Anderson dry-type transformers are available?*
4. *What guarantees the high quality of every dry-type transformer manufactured by Anderson?*

3. WORD FORMATION

Suffixes usually determine the meaning of words.
Which are the most common suffixes characterizing nouns expressing: a) action, b) agent?

Complete the tables

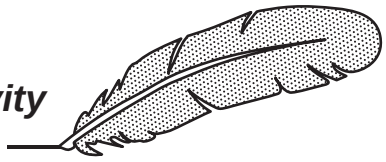
	Verb	Noun (action)	Noun (agent)
e.g.	*ventilate*	*ventilation*	*ventilator*
	resist	_____	_____
	produce	_____	_____
	coordinate	_____	_____
	transform	_____	_____
	distribute	_____	_____
	radiate	_____	_____

SUFFIXES	
Noun (action)	*Noun (agent)*
_____	_____
_____	_____

4. Find 8 words in the puzzle hidden horizontally, vertically and diagonally.

	1	2	3	4	5	6	7	8	9	10	11	12
1	A	J	I	N	N	O	V	A	T	I	V	E
2	C	V	L	X	O	S	F	E	G	M	S	T
3	E	B	E	I	R	A	D	X	W	S	P	A
4	T	R	A	N	S	F	O	R	M	E	R	E
5	L	A	B	S	T	E	L	N	J	A	F	W
6	M	D	Z	U	Y	I	M	A	Z	L	O	P
7	E	I	A	L	U	S	L	T	O	E	R	I
8	N	A	F	A	S	E	L	A	B	D	S	N
9	I	T	O	T	A	J	E	R	T	A	B	I
10	Y	O	L	I	R	W	I	N	D	I	N	G
11	P	R	Z	O	M	Y	M	Z	E	R	O	F
12	X	O	A	N	E	P	L	A	N	T	E	N

Writing Activity
(Inquiry letter)



After you had read the advertisement about Anderson dry-type transformers, you found the product interesting. As an electrician, you are always interested in new products, so you decided to write a letter to Anderson company to ask them: a) to sent you a catalogue and a price list of all their models available with their technical characteristics and specifications, and b) to inform you in the future about any new products of their company by sending you brochures and leaflets containing information about them.

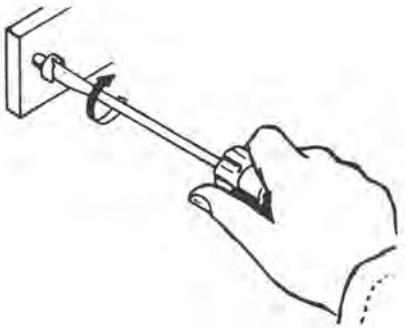
Address your letter to:
The Sales Manager,
Anderson Co. Ltd.,
Ferguson Lanes,
London W.E. 306,
England.

UNIT 7

ELECTRICIANS' EQUIPMENT

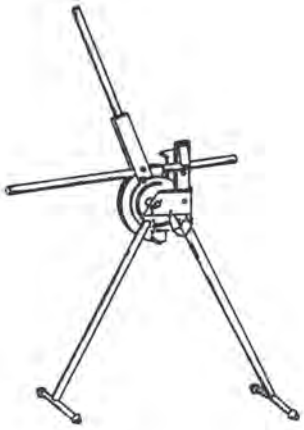
TOOLS AND ACCESSORIES

The electrical trade involves areas such as installations in new buildings, rewiring of old ones, electrical maintenance, repair and adjustment, troubleshooting of electrical equipment, etc. An electrician therefore, must have, not only the necessary theoretical knowledge, but also be sufficiently trained and skilful to perform various working activities, some of which you can see illustrated below.

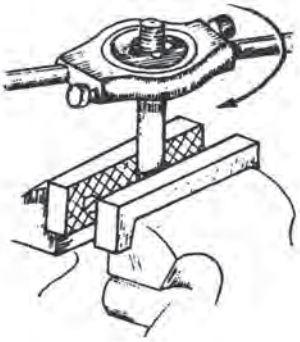


1. Screwing slot and cross-head screws

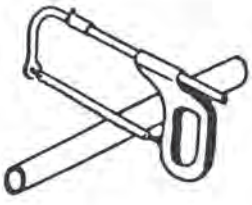
2. Digging holes in walls and ceilings



3. Bending metal conduits

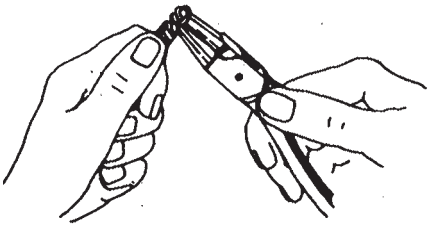


4. Threading metal conduits

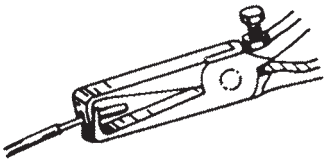


5. Cutting conduits

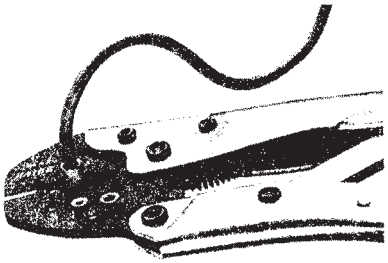
6. Tightening and loosening bolts, nuts and bushes



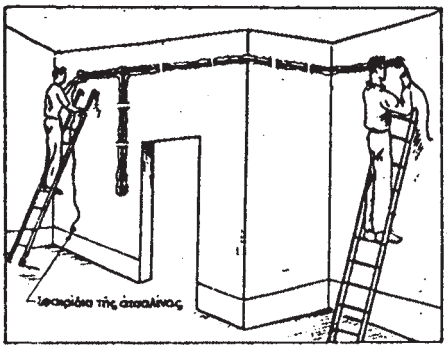
7. Making loops at the ends of wires



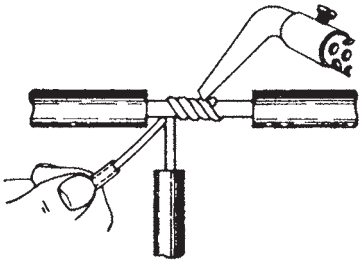
8. Stripping wires



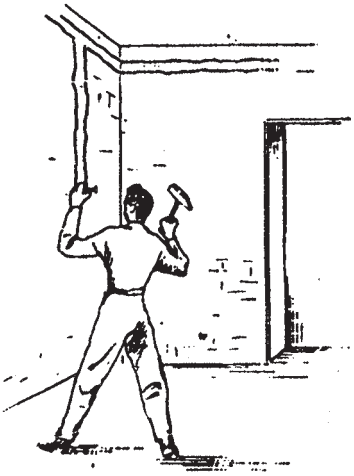
10. Crimping terminals to cables and wires



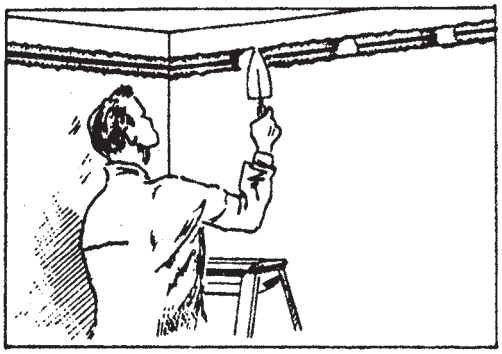
9. Drawing cables and wires along conduits



11. Soldering wires



12. Digging channels to install conduits in plaster



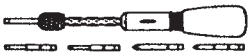
13. Preparing and applying plaster on wall and ceiling

To be efficient in his work, an electrician must be able to use a wide variety of tools skilfully. Below you can see the most common tools and accessories used by electricians taken from a company's catalogue.

1. Flat-tip screwdriver

2. Cross-point screwdrivers (Phillips)

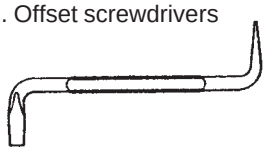
3. Automatic/retaining screwdrivers



4. Screwholding screwdrivers

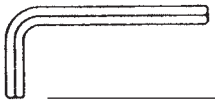
5. Precision screwdrivers

6. Offset screwdrivers



7. Voltage testers

8. Allen-hex sockets



9. Socket spanners

10. Wrenches

11. Adjustable wrenches

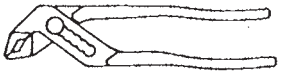
12. Combination/universal pliers

13. Flat nose pliers

14. Round nose pliers

15. Pointed/snip-nose pliers

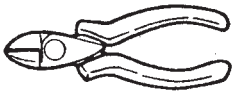
16. Water-pump pliers



17. Crimping pliers

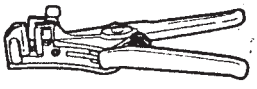
18. End cutters

19. Side cutters



20. Cable cutters

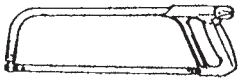
21. Wire strippers



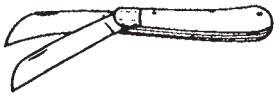
22. Cable strippers

23. Scissors

24. Hacksaws/metalsaws



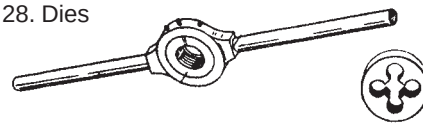
25. Electrician's knives



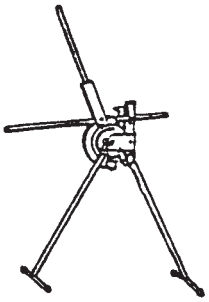
26. Tweezers

27. Soldering irons

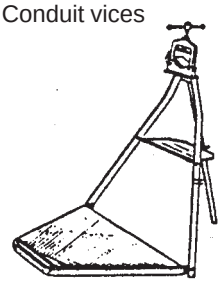
28. Dies



29. Conduit benders

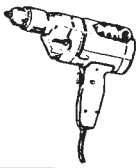


30. Conduit vices

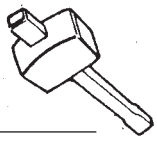


31. Files

32. Drills

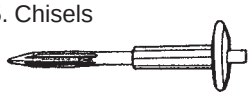


33. Hammers



34. Punches

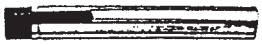
35. Chisels



36. Trowels

37. Spring hooks

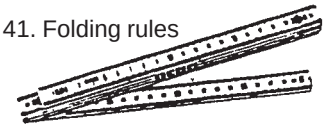
38. Pocket flash light



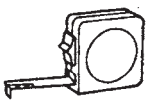
39. Dust brushes

40. Spirit levels

41. Folding rules



42. Flexible tapes



43. Oilers

48. Clips

44. Mirrors

49. Saddles

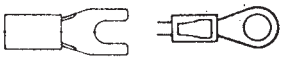
45. Rolls of insulating tapes

50. Bushes

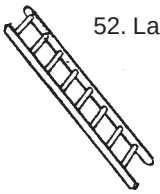
46. Rolls of soldering tin

51. Terminal blocks

47. Terminals



52. Ladders



EXERCISES

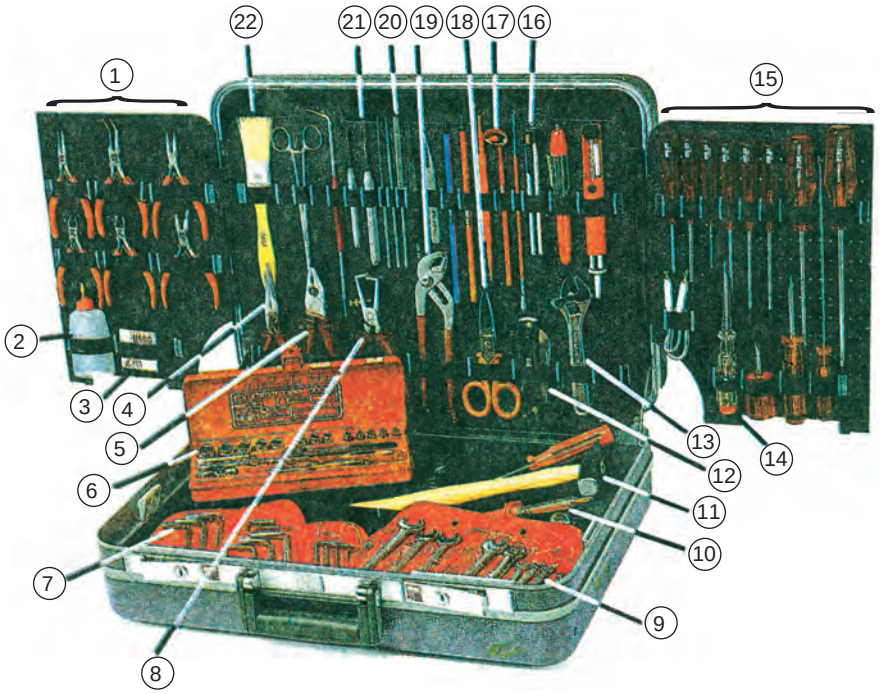
1. Go through the catalogue and name the tools in your mother tongue.

2. Go back to the pictures illustrating some of the jobs electricians usually carry out, and write (in English) the tool used for each job.

e.g. *1. Screwing slot and cross-head screws with flat-tip and cross-point screwdrivers.*

3. In the spaces provided label in English the tools and equipment illustrated.

A. In the case below.



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____
21. _____
22. _____

B. In the following pictures.

1. _____

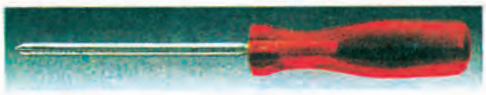
2. _____

3. _____

5. _____

4. _____

6. _____



7. _____

8. _____

10. _____

9. _____

11. _____

12. _____

15. _____

13. _____

14. _____

16. _____

4. A. Tick the use of each tool as in the example.

TOOLS	USE									
	cutting	*stripping*	*holding*	*screwing tightening loosening*	*soldering*	*filing*	*bending*	*drilling*	*measuring*	*gripping*
screwdrivers				✔						
drills										
flexible tapes										
cable cutters										
socket spanners										
wire strippers										
conduit vices										
universal pliers										
folding rules										
hacksaws										
screwholders										
wrenches										
files										
conduit benders										
soldering irons										
tweezers										
scissors										
water-pump pliers										
Allen-hex sockets										

B. Taking your information from the grid, make sentences as in the examples:

We can cut wires (by) using scissors.
To cut wires we (can) use scissors.
Scissors are used to cut/for cutting wires.

5. Use the table to make meaningful sentences.

Electricians use (a/an)…		*a. making loops at the end of wires.* *b. remove insulation from cables.* *c. removing dust from surfaces or components.*
1. chisel *2. spring hook* *3. punch* *4. round-nose pliers* *5. cross-point screwdriver* *6. dust brush* *7. tweezers* *8. trowel* *9. combination pliers* *10. flat-tip screwdriver* *11. conduit bender* *12. die* *13. insulating tape* *14. folding rule/flexible tape* *15. cable stripper* *16. crimping pliers*	*for* *to*	*d. draw wires and cables along conduits.* *e. prepare and apply plaster to fill in holes and fix devices on walls and ceilings.* *f. screw slot-head screws.* *g. measuring the length of conduits.* *h. gripping, inserting and removing small-sized objects.* *i. dig paths in walls for installing conduits and cables.* *j. insulating stripped wires.* *k. holding, tightening or loosening nuts and bushes and also for cutting wires.* *l. making threads to conduits.* *m. crimp terminals to cables and wires.* *n. marking the point where a hole is to be drilled.* *o. bend metal conduits.* *p. screwing cross-head screws.*

e.g. *1-i: Electricians use a chisel to dig paths in walls for installing conduits and cables.*

6. Installing a lighting circuit

You have been employed to make a new lighting circuit installation in the workshop illustrated in figure 1 below. The electrical lines of the installation will be installed in metal conduits on plaster (surface wiring), but the distribution board will be flush-mounted (hidden).

Diagrammatic representation of the lighting circuit

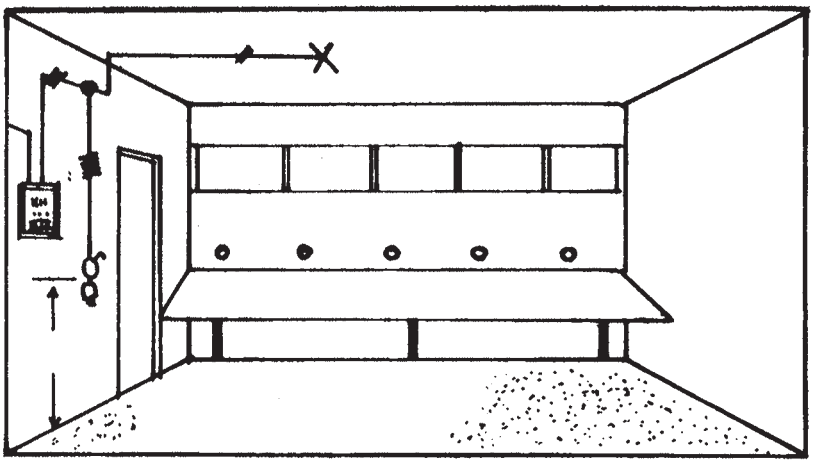


Figure 1. Wiring diagram presenting the exact location of the wiring and components of the circuit in the workshop

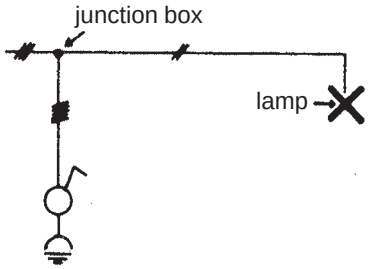


Figure 2. Single-pole representation of the lighting circuit

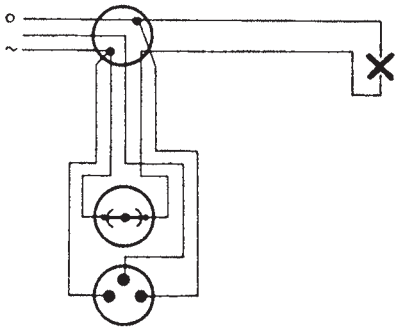


Figure 3. Multi-pole representation of the lighting circuit

In the spaces provided below write the appropriate tool for every step you will follow to carry the installation out.

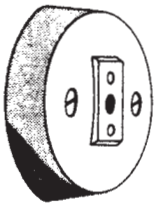
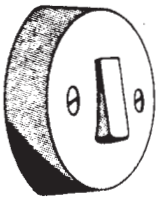
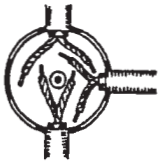
Necessary tools

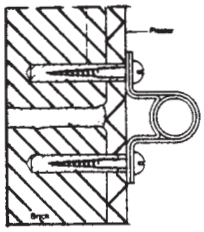
A. To install the flush-mounted distribution board.

1. _____ *to draw the outline of the distribution board on the wall.*
2. _____ *and* _____ *to dig the wall.*
3. _____ *to prepare and apply plaster to install the distribution board at its appropriate place on the wall.*

B. To install the rest of the circuit.

1. _____ *to reach the ceiling and the upper parts of the wall.*
2. _____ *a) to measure the length of the various conduit pieces needed for the work,*
   b) to find the exact position on the wall where the various components of the circuit should be placed.
3. _____ *to hold the conduits in order to cut them.*
4. _____ *to cut the metal conduits.*
5. _____ *to make threads at the ends of the conduit pieces.*
6. _____ *and* _____ *to mark the appropriate points for the holes to be drilled.*
7. _____ *to dig the holes for the screws which will fix the various components of the circuit (socket outlet, switch, junction box, saddles) on the wall and ceiling.*

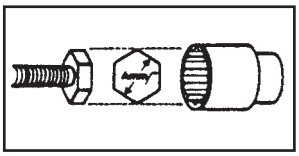


8. _____ *to tighten the screws of: a) the junction, switch and socket outlet boxes, and b) the saddles which clip the conduits through their run on the wall and ceiling.*
9. _____ *to join the necessary accessories to the conduits.*
10. _____ *to tighten the bushes which join the conduits to the junction boxes.*
11. _____ *to draw the wires along the conduits.*
12. _____ *to cut the wires.*
13. _____ *or* _____ *to strip the insulation off the ends of the wires.*
14. _____ *to twist the ends of wires to be joined in the junction box.*
15. _____ *a) to join the wires of the circuit to the switch and outlet boxes, as well as to the wires of the lamp.*
    b) to install the switch and socket of the circuit on the wall.
16. _____ *to test:*
    a) the wires continuity,
    b) a possible earth leakage,
    c) the grounding/earthing of the circuit.

Using hand tools correctly

The quality of a job and the safety of the user greatly depend on the correct use and maintenance of the tools he uses.
The following instructions may prove useful.
Read them and in the spaces provided write if they refer to: a) the safety of the user (S), b) the maintenance (M) or c) the correct use (U) of tools.
Bear in mind that some of them may refer to more than one categories of instructions.

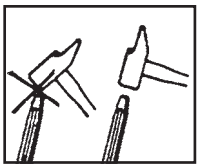
Instructions

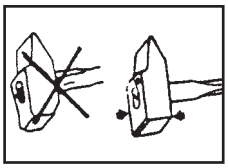


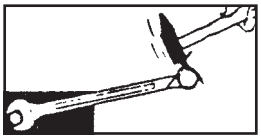
Spanners

When using a spanner:

_____ 1. Select the correct size for the job.
_____ 2. Don't push it away from your body.
_____ 3. Keep its handle free from oil or grease.
_____ 4. Don't use it as a lever.



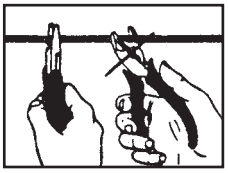




Hammers

When using a hammer:

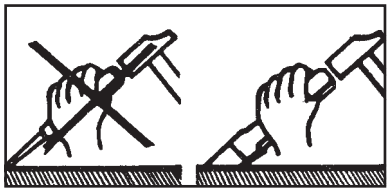
_____ 1. Don't use the shaft as a lever or striker.
_____ 2. Ensure that the head is securely attached to its shaft.
_____ 3. Select the correct one for each job.
_____ 4. Use eye protection if necessary.

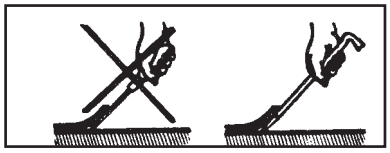


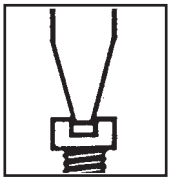
Pliers

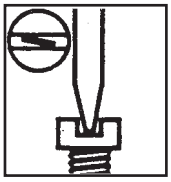
When using pliers:

_____ 1. Select the correct size and type for the job.
_____ 2. Avoid finger traps when a sudden release occurs.
_____ 3. Ensure that the cutting edges remain sharp.
_____ 4. Check insulated pliers regularly.









Screwdrivers

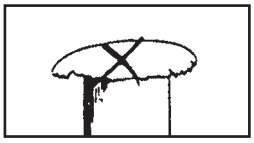
When using screwdrivers:

_____ 1. Select the correct size for the job. (The tip should fit the slot and not be wider than the screwhead.)

_____ 2. Keep the handle free from oil or grease.

_____ 3. Don't strike the screwdriver with a hammer.

_____ 4. Don't use it as a lever.



Files and chisels

When using files or chisels:

_____ 1. Select the correct ones for the job.

_____ 2. Don't use a file without its handle.

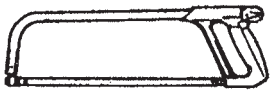
_____ 3. Don't use a file as a lever or to stir paint.

_____ 4. Avoid the formation of a mushroom head on a chisel.

_____ 5. Chisel away from your body.

_____ 6. Keep chisels sharp.

_____ 7. Examine the handles of files and chisels frequently.



Saws

When using saws and other tools with blades:

_____ 1. Make regular checks of their sharpness and teeth.

_____ 2. Fasten blades securely to their attachments.

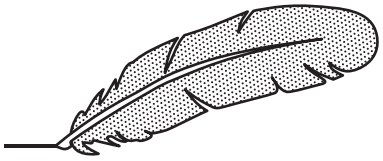
_____ 3. Don't use blades outside their frames.

_____ 4. Keep them free of rust.

_____ 5. Return saws to their special boxes after use.

Check your answers. If there are any different opinions, discuss them in class. Then read the instructions again and say which of them apply to more than one tools.

Writing Activity



Choose the instructions concerning two categories of tools and write a paragraph for each. *Don't forget to use linking words to join your sentences.*

The expressions in the table below, which are often used when giving instructions, will help you.

You must/mustn't…	*Be careful to/not to…*
You should/shouldn't…	*Avoid the + noun/+ gerund…*
Take care to/not to…	*Never/Always + imperative…*
Try to/not to…	*Make sure you…/that…*

Examples

You must/should
Take care to
Try to
Be careful to
Always
Make sure you
} *select the correct size of spanner for each job.*

Never select
Avoid selecting
} *the wrong size of spanner for each job.*

Transferring Information

When your teacher gave the instructions, your partner was absent, so he asked you to inform him about what the teacher had said. ***Work in pairs. Choose three groups of tools each, and inform your partner about the teacher's instructions. Begin your sentences as follows:***

He told us
He advised us
He warned us
He recommended
{ *to/not to…*
to avoid the…/gerund…
never to/not to forget to…
that we must/should/mustn't/shouldn't…
etc.

e.g. *He told us to select the correct size of spanners for the job.*

Listening Activity

STEP 1

Your teacher will read some statements referring to the use of various tools. Some of them are correct. Some others are not. ***Listen to the statements and tick the appropriate column.***

No	*Statements*		*Correct tool to be used*
	Correct	*Wrong*	
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			

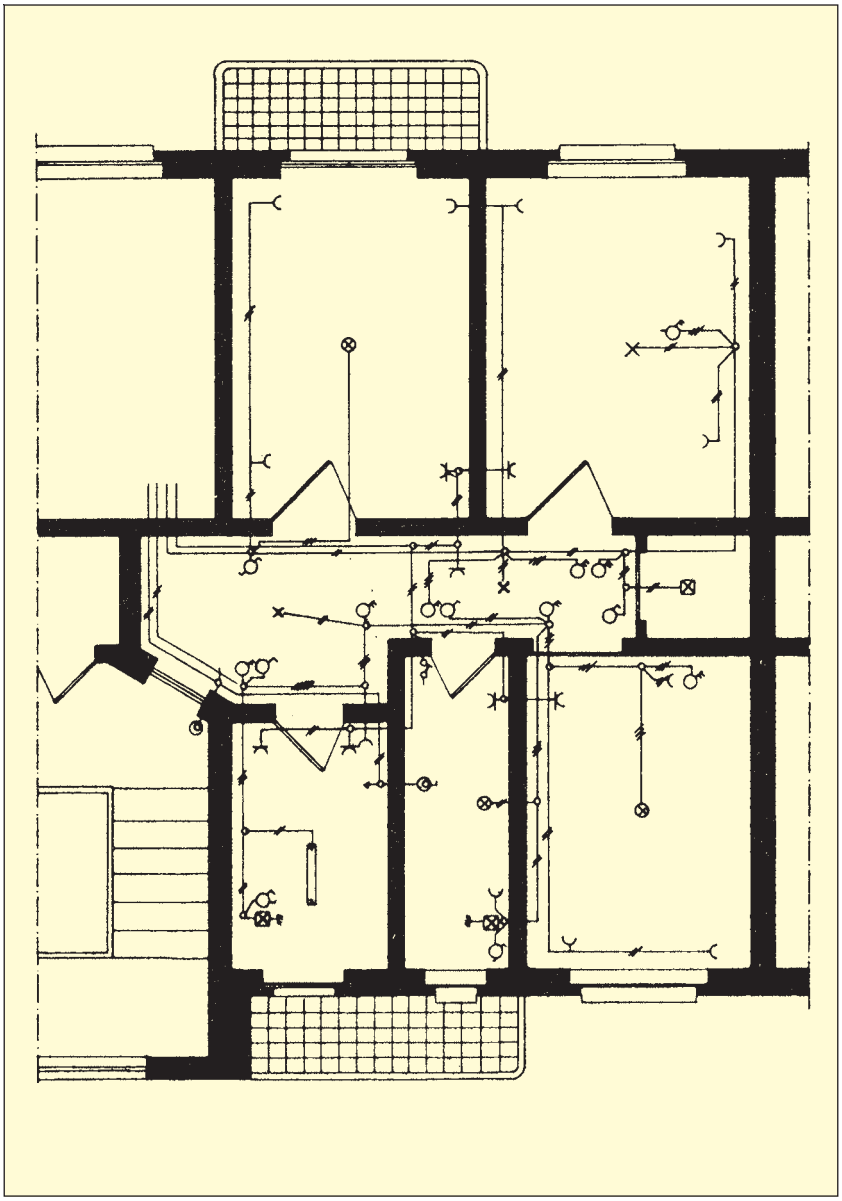
How many statements were correct and how many wrong? Which ones?

STEP 2

Listen to the statements again and correct the wrong ones by writing the correct tool to be used in each case in the 3rd column of the above table.

UNIT 8

ELECTRICAL DRAWING



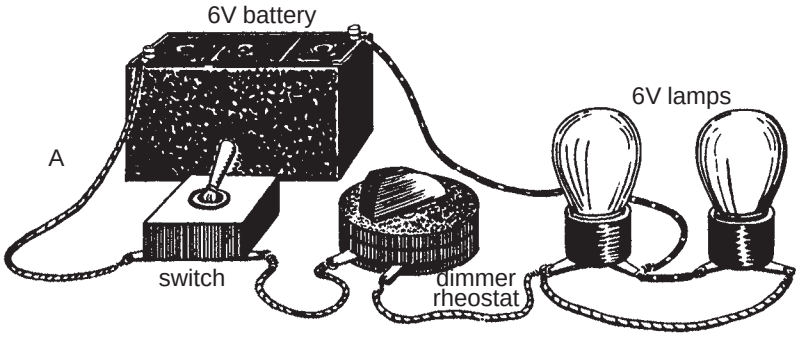
Read the text and say if the following statements are true or false. Correct the false ones.

1. *Drawings represent graphically electrical installations or circuits.*
2. *The first electrical drawings were figurative.*
3. *Schematic diagrams use pictures to show the various parts of a circuit.*
4. *Pictorial diagrams can be drawn up easily and quickly.*
5. *A symbol contains more information than the picture of a component.*
6. *Diagrams make the location and removal of a fault in installations, machines or appliances more complicated.*
7. *Circuit, block, wiring and network diagrams are types of figurative drawings.*

ELECTRICAL DIAGRAMS

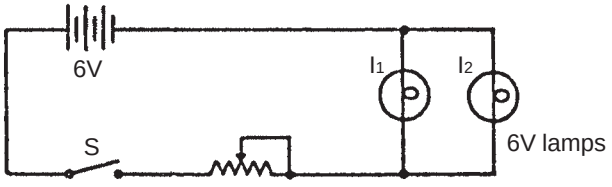
In electrical trade, information is usually given by means of drawings. They serve to give a diagrammatic representation of electrical installation or circuits and all their parts: lines, switches, lighting fixtures, distribution boards, resistors, capacitors, electrical machines, etc.

The first drawings of electrical assemblies were pictorial; that is, they used pictures to show the various parts and how they were arranged and connected together. These drawings, however, demanded a lot of skill on the part of the designer, and were time consuming.



A pictorial / figurative diagram of a dimmer control circuit

So, they were soon replaced by schematic diagrams in which easily drawn symbols are used instead of pictures to represent the various parts of a circuit.



Schematic diagram of the above circuit

In many cases the symbol actually contains more information than does the picture of a component. The picture of the switch in the pictorial diagram of the dimmer control circuit, for example, does not give its purpose in the circuit, while the symbol shows clearly that it either breaks or completes it.

Diagrams facilitate the location and removal of faults in electrical installations or machines since they give a clear survey of the component parts, their arrangement and function in the circuit. An electrician, therefore, must know how to read, plot or supplement diagrams, as well as the symbols used in them.

There are various types of schematic diagrams, e.g. block, circuit, wiring, network diagrams, etc.

EXERCISES

1. Answer the questions.

1. *Why were pictorial diagrams replaced by schematic? Mention as many reasons as you can.*
2. *Why is it easier to locate and repair a fault by referring to a diagrammatical sketch?*
3. *An electrician must know how to read, plot or supplement an electrical drawing. Say which of these three skills is necessary in order to perform each of the following activities:*
   a) to give a diagrammatic representation of the additional electric lines and equipment required, to the wiring diagram of an existing installation.
   b) to carry out an installation by studying a diagram.
   c) to present graphically the circuit of an existing apparatus or installation.
   d) to judge the function of an apparatus or installation from a drawing.

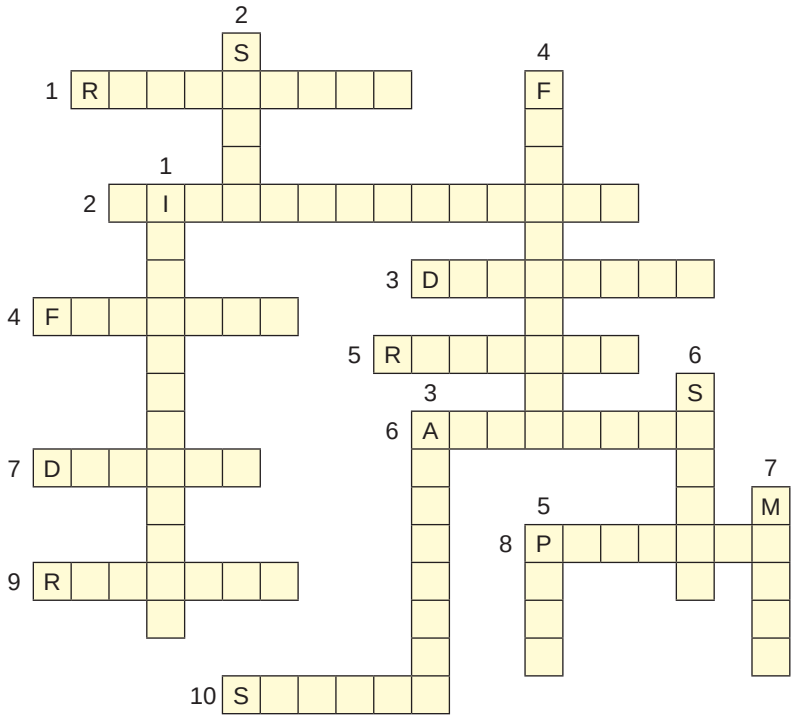
2. Crossword puzzle
Complete with the words from the text defined below.

Across

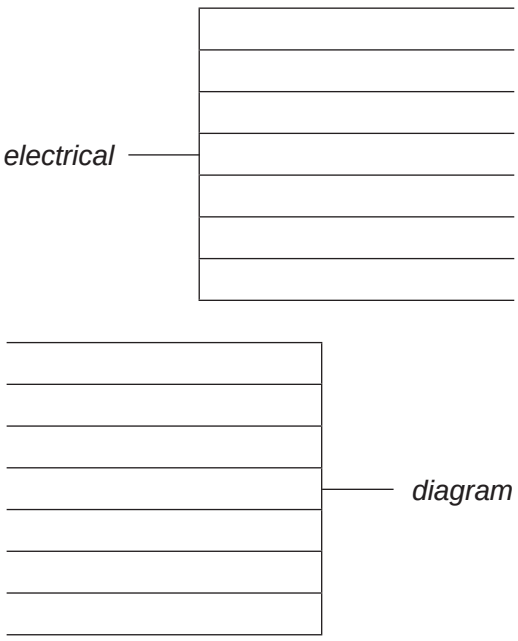
1. *Stand for*
2. *It takes a lot of time to be done*
3. *Person who makes drawings*
4. *Something fixed in place*
5. *Take the place of somebody or something*
6. *Parts/things put together*
7. *Ask for, require*
8. *Aim, reason for existing/being used*
9. *Act of taking something away, getting rid of it*
10. *General view*

Down

1. *Placing something (e.g. an apparatus) in its position*
2. *Be satisfactory for a need or a purpose*
3. *In fact, really*
4. *Make something easy, less difficult*
5. *Make a plan or diagram*
6. *Graphical representation of an item*
7. *Method, process, way by which a result may be obtained*



3. Find words in the text which: a) are qualified by the word "electrical" and qualify the word "diagram".



Types of schematic diagrams

The paragraphs below describe the various types of schematic diagrams and their uses. ***Read the paragraphs and identify the type of each one of the diagrams on the right of the page.***

1. Circuit diagrams

They are the schematic representation of an electrical installation or apparatus with all its component parts and lines or wires. They also show the functional relationship of the various components to each other and to the entire circuit, but without presenting their exact location in it.

Circuit diagrams are usually detailed multi-pole representations.

2. Block diagrams

They show the function and relationship of the various circuits within an installation or device. They are, therefore, used as simplified drawings of complex electrical parts, whenever their internal wiring details would unnecessarily complicate the diagram. As a result, the more complex the circuit of an installation or apparatus, the more useful the block diagram, especially in troubleshooting.

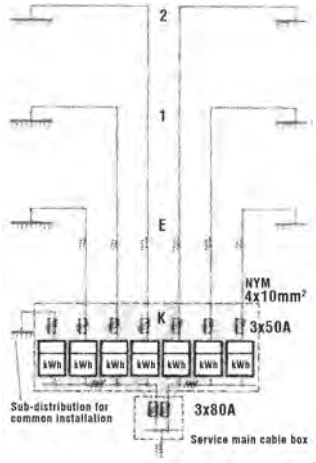


Fig. 1 _____ diagram of the arrangement of meters and consumer unit boards

3. Wiring diagrams (layout)

They are usually single-pole representations of an electrical installation plotted on the construction plan of a house. They indicate the actual location of the electric lines and the required component parts: switches, socket outlets, lighting fixtures etc.

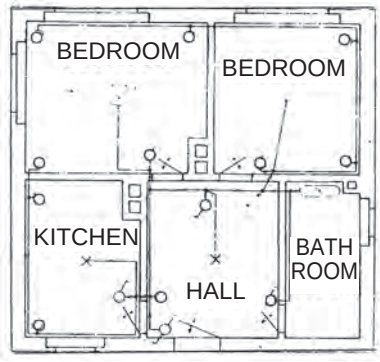


Fig. 2 _____ diagram of a house

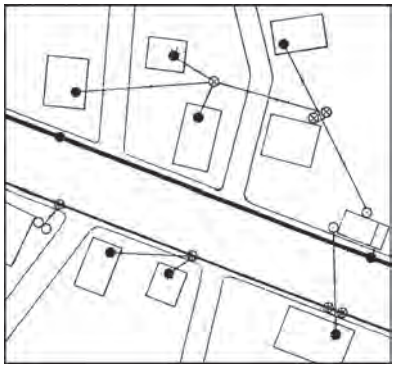


Fig. 3 _____ diagram of a small village

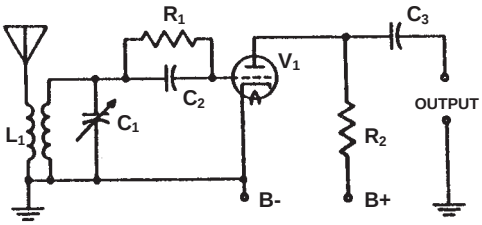


Fig. 4 _____ diagram of a one-tube radio

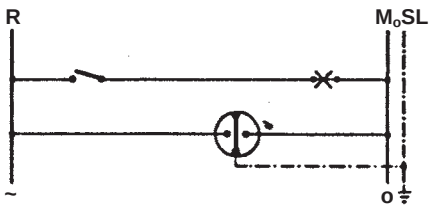


Fig. 5 _____ diagram showing a lamp, a switch and a socket outlet

4. Network diagrams

They are single-pole representations usually drawn up on a map to show the starting point of the electric lines (belonging to the network system) and their route. They also give information about the type (size) of lines, as well as about the material and accessories to be used.

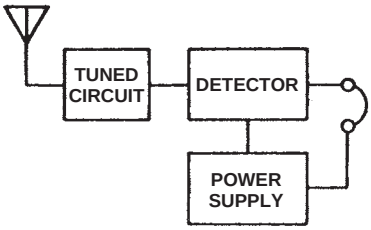
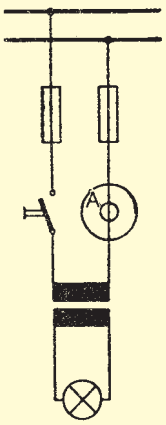


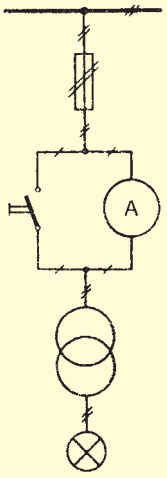
Fig. 6 _____ diagram of a one-tube radio

NOTE



A diagram is characterized as a **multi-pole representation** if it is very detailed; that is, when all the electric lines and component parts of an installation or a circuit are drawn up in it one by one.

A diagram is characterized as a **single-pole representation** when, instead of all, only one line or component is drawn. This line or component is marked with several short oblique lines ( ) which indicate the actual number of electrical lines or components in the circuit. Single-pole representations give the same information as multi-pole ones but without complicating the drawings, and therefore, they are more commonly used.



EXERCISES

1. Say if the diagrams on p. 153 and 154 are single-, or multi-pole representations.

2. Write the equivalent Greek term to the following types of diagrams and representations.

1. Schematic diagram
2. Block diagram
3. Wiring diagram
4. Network diagram
5. Circuit diagram
6. Single-pole representation
7. Multi-pole representation

3. Tick appropriately.

	Characteristics	Types of diagrams			
		Circuit	Block	Wiring	Network
1.	*It is drawn on a map.*				
2.	*It shows the functional relationship of the various components to each other and to the entire circuit.*				
3.	*It is usually a multi-pole representation.*				
4.	*It is plotted on the construction plan of a house.*				
5.	*It shows the function and relationship of the various circuits of an electrical installation or device.*				
6.	*It gives information about the size of lines and also the materials and accessories to be used.*				
7.	*It shows all the lines and parts, but not their actual location in the circuit.*				
8.	*It is usually a single-pole representation.*				
9.	*It indicates the actual position of lines and components to be installed in a house.*				
10.	*It is used whenever the internal wiring details of complex electrical parts would make a diagram very complicated.*				
11.	*It is a schematic representation of the circuit of an electrical installation or apparatus.*				
12.	*It is especially useful in locating and removing faults in an electrical installation, apparatus, or machine.*				

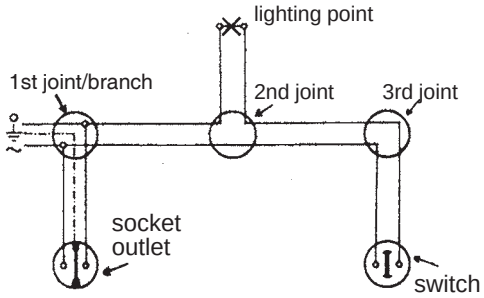
4. Answer the questions.

1. What is the difference between:
a) a circuit and a block diagram?
b) a circuit and a wiring diagram?
c) a wiring and a network diagram?
d) a single-pole and a multi-pole representation?

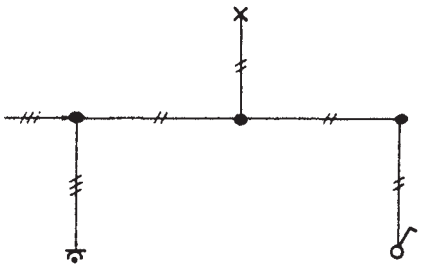
2. What sort of diagram would you use:
a) to show the main circuits to be included in the electrical installation of a small hotel so as to help your assistant buy the appropriate type of distribution board?
b) to indicate the starting point, route and type of the electric lines to be used to supply light and power to a small village, which is going to be rebuilt after a destructive earthquake?
c) to check the wiring connections and parts of the secondary circuit of a motor in which a fault has been located?
d) to indicate the exact position of the electric lines and the various components to be installed in a newly built house?

5. Compare the single-pole and multi-pole representation of the same circuit. Use the patterns:

From the ..... to the ..... the multi-pole representation has ..... lines, while the single-pole one has only ..... with ..... oblique lines across it.
From the ..... to the ..... the single-pole representation has ..... line with ..... oblique lines across it, instead of the ..... lines in the multi-pole representation.



Multi-pole representation



Single-pole representation

6. Match words with definitions

1. Set of instruments or other appliances	*a. detailed*
2. Place, position	*b. indicate*
3. Fully described, presented/including all items	*c. oblique*
4. Make complex, confusing, difficult to understand	*d. apparatus*
5. State briefly, point out	*e. material*
6. That of which something is or can be made	*f. complicate*
7. Slopping, at an angle of less than 90° (<)	*g. location*

7. Odd-man out

1.	*entire* *perfect* *whole* *complete*	*2.*	*sure* *actual* *real* *true*	*3.*	*internal* *inside* *interface* *inner*	*4.*	*simplified* *brief* *easy* *simple*
5.	*required* *demanded* *necessary* *appropriate*	*6.*	*route* *trip* *way* *road*	*7.*	*means* *kind* *sort* *type*	*8.*	*relationship* *association* *participation* *connection*

8. WORD FORMATION

Suffixes **-ship** and **-ness**

The above two suffixes can be used to form nouns.

relation + **-ship** → relationship

careless + **-ness** → carelessness

Use either -ship or -ness to form nouns out of the following words.

peaceful _____
friend _____
polite _____
foolish _____
leader _____
member _____
ready _____

skilful _____
scholar _____
partner _____
willing _____
fellow _____
useful _____
inventive _____

9. EXPRESSING CAUSE / REASON → REASON / CONSEQUENCE

Apart from expressions such as: **because (of) / due to →**
so (that) / as a result / because of that, which you have already come across, the above relationship is also expressed as follows:

Cause / reason	Result / consequence
since as	therefore consequently for that reason thus

Examples

- *As / since pictorial diagrams were time consuming, they were soon replaced by schematic.*
- *Pictorial diagrams were time consuming, (and) thus / for that reason / consequently / therefore, they were soon replaced by schematic.*

Use expressions from the table to join the sentences below.

1. He didn't have much experience in repairing electrical machines.
A more experienced electrician got the job.
2. There was a long power-cut yesterday evening.
Students found a good excuse not to do their homework.
3. He spent a lot on new equipment and expensive measurement instruments.
He can't rent the workshop he wanted to.
4. Fossil fuels have run low.
We must develop new sources of energy.
5. The motor is overloaded.
It cannot operate properly.
6. Instruction manuals aren't always translated into Greek.
One should know a foreign language, especially English, to read them.
7. Nuclear power has proved quite dangerous.
All nuclear power plants should shut down.
8. He was working on a live circuit using uninsulated tools.
He was electrocuted.

GRAPHIC SYMBOLS

Resistors, batteries, lamps and all other circuit components, electrical appliances, devices, etc. are presented in circuit drawings by simple, easily drawn symbols, which an electrician must know in order to both understand and use them in his drawings.

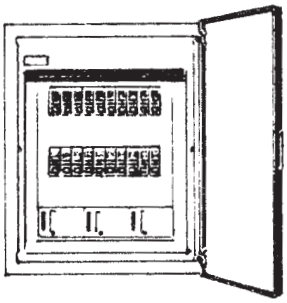
Brush up your knowledge, and at the same time learn the English terms for the most commonly used symbols, by carrying out the following exercises. The index at the end of your book will help you.

EXERCISES

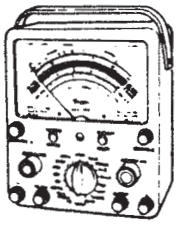
1. Use the list to label the items illustrated in the pictures. Then match each item with its corresponding symbol.

List:

measurement instrument lighting fixture	*transformer*	*fuse*
circuit breaker	*time switch*	*motor*
distribution board	*thermostat*	*heater*
electric light	*joint box*	*resistor*
discharge/fluorescent lamp	*energy meter*	*battery*

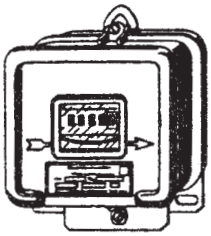


1. _____

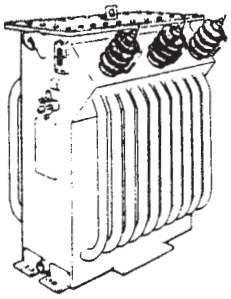


7. _____

8. _____

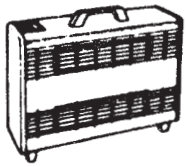


11. _____

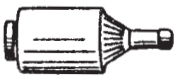


2. _____

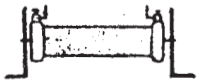
(a)	M	(i)	
(b)		(j)	t
(c)		(k)	kwh
(d)	t° ϑ	(l)	
(e)		(m)	
(f)		(n)	
(g)		(o)	
(h)	x	(p)	



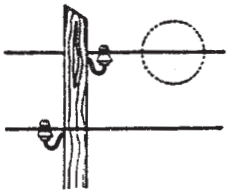
12. _____



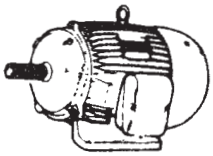
3. _____



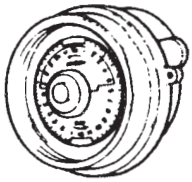
13. _____



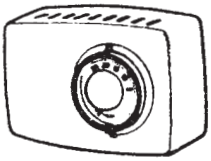
4. _____



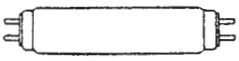
14. _____



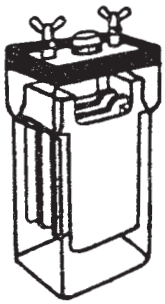
15. _____



5. _____

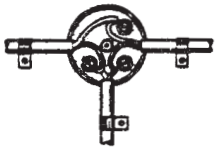


6. _____



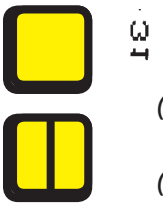
9. _____

10. _____



16. _____

2. Match the terms for the various types of switches given below with their corresponding symbols.



Symbols

Types of switches

1. Single-pole, one-way switch

2. Cord operated, single-pole, one-way switch

3. Two-pole, one-way switch

4. Three-pole, one-way switch

5. Single-pole, two-way switch

6. Single-pole, two-circuit, single interruption switch

7. Single-pole, two circuit, double interruption switch

8. Single-pole, intermediate switch

9. Regulating dimmer switch

10. Pushbutton

11. Time switch / relay

(a)

(b)

(c)

(d)

(e)

(f)

(g)

(h)

(i)

(j)

(k)

3. Use the list to label the various types of power socket outlets represented by their symbols below.

List

1. Two-pole single socket outlet

2. Two-pole twin socket outlet

3. Two-pole multiple socket outlet (4 outlets)

4. Switched socket outlet

(a) _____

(b) _____

(c) _____

(d) _____

T.V.

5. *Single socket outlet with earthing contact (three-pole)* (e)  _____

6. *Twin socket outlet with earthing contact* (f)  _____

7. *Telephone socket outlet* (g)  _____

8. *Television socket outlet* (h)  _____

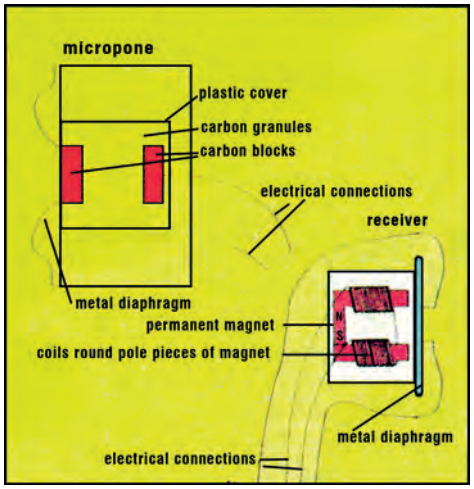
4. Below, some other very commonly used symbols are presented. Write what each one stands for. The index will help you.

	*1.*		*12.*
	*2.*		*13.*
	*3.*		*14.*
	*4.*		*15.*
	*5.*		*16.*
	*6.*		*17.*
	*7.*		*18.*
	*8.*		*19.*
	*9.*		*20.*
	*10.*		*21.*
	*11.*		*22.*

5. Identify the items defined in the paragraphs below choosing the appropriate term from the list.

List:

doorphone system	*battery*	*coil*
consumer unit board	*receiver*	*switch*
energy meter	*thermostat*	*plug*
power socket outlet	*microphone*	*relay*
phase alternating current		

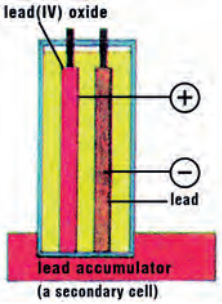


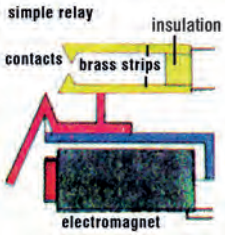
1. _____

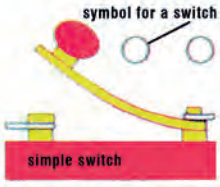
Device used for keeping an object at a constant temperature. When cold, it makes an electric contact start a heating coil. When sufficiently hot, the contact is broken.

2. _____

Device producing electric current by chemical reaction.







3. _____

Current generated in three separate coils (which are part of the AC generator's stator) and transmitted to consumers by three separate cables.

4. _____

Electrical device using a small electric current to control a greater current in another circuit by switching it on or off. It usually uses electromagnets to control a switch.

5. _____

Board where the electric energy coming from the power supply system is distributed to the various circuits of a house. It is also called "distribution board".

6. _____

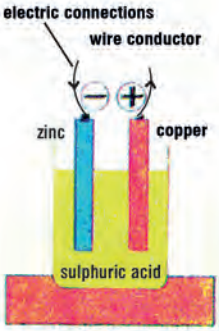
Device used to join or break parts of a circuit.

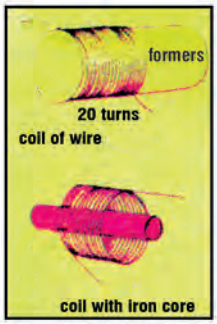
7. _____

Device, usually fixed to the wall of a building, used to supply energy to the various electrical appliances.

8. _____

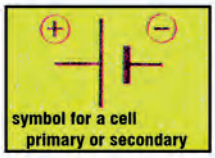
Device used to transform sound waves into electric current.



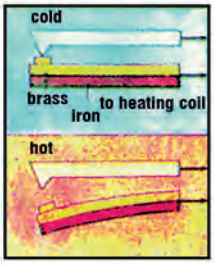


9. _____

Device used to connect electrical appliances to power socket outlets and, through them, to the power supply system.



simple thermostat



10. _____

Device used to transform electric current into sound waves.

11. _____

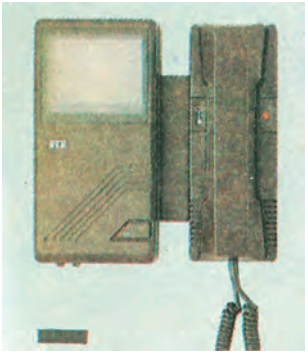
It consists of a door telephone station, several telephone stations in the flats or offices of a building, the bell transformer, an amplifier for door intercommunication telephone installations, and an electrical door opener.

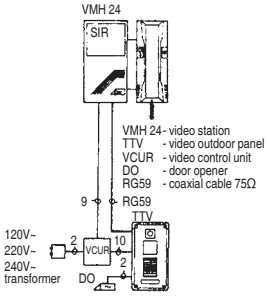
12. _____

Wire wound around a solid object in rings (turns).

13. _____

Device connected to the circuit in order to measure the amount of electric energy flowing through it, that is the energy used by a consumer.



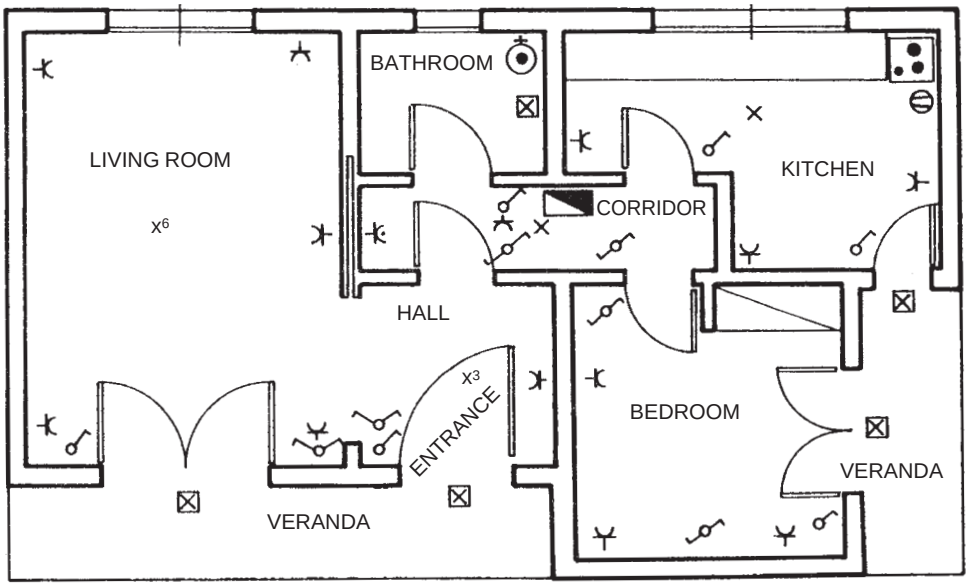


6. Describing an electrical installation

Below is the construction plan of a house with the necessary symbols for the electrical installation.

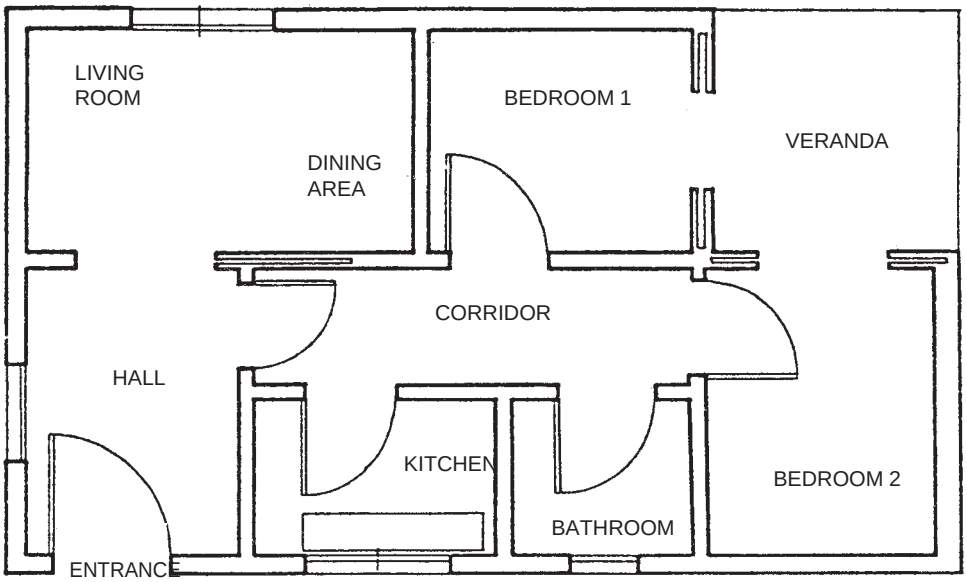
Describe the component parts and the appliances it includes.

e.g. *The installation in the hall comprises/includes: / In the hall there are: three switches: two single-pole, two-circuit, single interruption ones, and one single-pole, one-way switch. There are also two single socket outlets with earthing contact and a luminaire with three lamps. Finally, there is a water-proof luminaire outside the entrance door.*



7. Designing your own installation

Work in pairs. You have 10 minutes to draw the symbols you think necessary for the electrical installation of the house presented in the construction plan that follows. Then report to the class the exact position of the various electrical components and appliances you have drawn. Compare your installation to those of your classmates, and comment on one another's drawings.



Expressions to help you

- Entrance / veranda door
- Kitchen bench
- On the left / right (wall of the…)
- On the wall opposite (to) the…
- Near the… / In the… / Over the…
- We drew (up) / put / installed / plotted a…
- We thought convenient / right / useful / necessary / appropriate to…
- It would be better to…
- You should have + p.p.…
- The best place to install / put etc. a… is…

} because

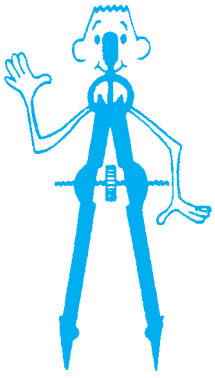
8. Choose any two spaces of the house and write a report of the installation you have drawn.

TIME FOR FUN

Let's play "Bingo"

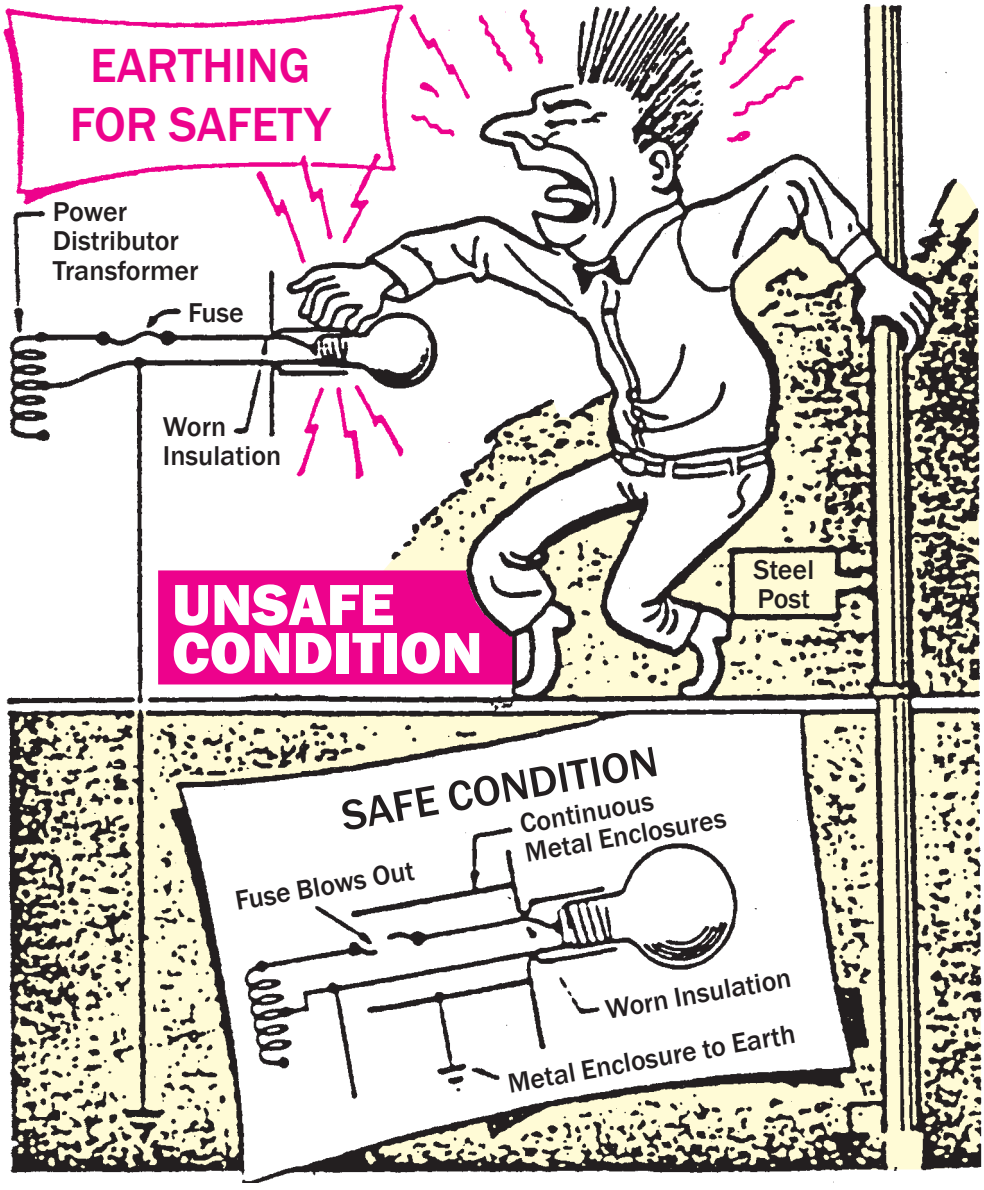
In the boxes below write words or phrases you remember from the text. Then listen to your teacher. Each time you hear a word or phrase you've written, cross it out. The first who crosses all the words out is the winner.

Drafty says:



- Always try to produce neat and accurate drawings.
- Be sure to sketch drafting problems on a scrap paper, first.
- In layout work, use light construction lines.
- Always keep your pencil sharp. You can't do good work with a dull pencil.
- Keep your hands clean to produce clean and neat drawings.
- Don't forget to clean your T-square, triangle and templates occasionally with a soft eraser and cloth.
- Do not slide instruments over drawings. Lift to move them.
- When erasing, use a shield to protect nearby lines.

SAFETY AT WORK



Among the fatal accidents to employees reported every year, almost 45% happen to people involved in electrical installations and repairs. The main cause of these accidents (over 60%) is the failure to isolate the electrical system. Many others happen due to carelessness. In this trade you should always bear in mind that electricity has no respect to ignorance and that many painful accidents have happened by carelessness. Thus, never forget that to secure the health, safety and welfare of all persons at work, regulations and safety precautions should always be respected.

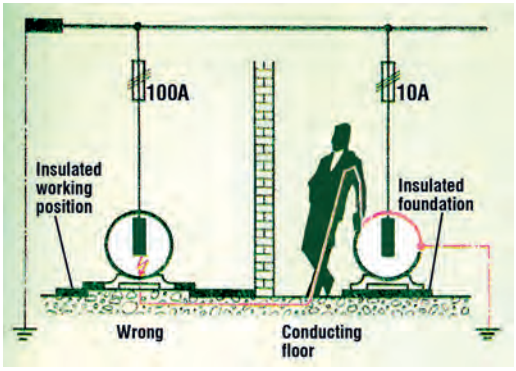
Below you can see some important precautions you should always take against the risk of death or personal injury in work activities.

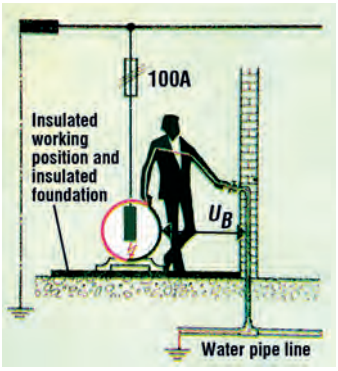
Work with your partner. Read the precautions and classify them in the appropriate column according to what their omission may result in.

	Fatal accident	***Injury***	***Damage***
e.g.	1	1	1

SAFETY PRECAUTIONS

1. Don't be engaged in any work activity unless you have the technical knowledge and experience to carry it out.
2. Be extremely careful when handling a metal ladder near overhead cables. Try to select a ladder of the correct length for the job.
3. Do not work around electrical equipment if floors are damp or wet.
4. Do not work on an electrical circuit with the power turned on. Isolate all its parts from the supply and earth where appropriate. Test the circuit to secure it is dead and remember to test the tester first.
5. When necessary, use eye protection, ear protectors, dust masks, gloves and safety footwear. Tie or cover long hair and take off rings, bracelets and other jewellery.
6. You should always know where the fire extinguishers are placed. In case an electrical fire does occur, switch off the power supply immediately. Don't





try to extinguish the fire if it becomes dangerous or if your escape route is threatened.

7. Be careful when handling or lifting objects. Get someone to help you lift heavy objects, especially if you have problems with your back.
8. Use tools correctly and do not use them if they are not in proper condition, especially if the insulation has been worn.
9. Never remove a plug from an outlet by pulling on the cord. Always pull it by the plug.
10. Before using a power tool, read the manufacturer's instruction and check the insulation of the cord.
11. When terminating flexible cables, make sure that the polarity of connections is correct.
12. Where live work is unavoidable, wear rubber soled shoes or stand on a rubber mat.
13. Be particularly careful not to contact any live wire or terminal.

EXERCISES

1. Work with your partner again. Look through the precautions once more and decide which three you consider the most important. Justify your answer.

2. Join halves of sentences to reproduce some of the instructions.

A	***B***
1. You get the risk to be electrocuted	
2. Never remove a plug by the socket	*a. don't use the tool and fix or replace the cord.*
3. If live work is unavoidable,	*b. is to turn off the power supply.*
4. When floor is damp or wet,	*c. ensure that the polarity connections are correct.*
5. The first thing to do in case an electrical fire occurs	*d. don't work on a live circuit or electrical equipment.*
6. Don't be engaged in a work activity	*e. if you don't have the necessary knowledge or experience.*
7. Be extremely careful when carrying or handling a long metal ladder	*f. by pulling on the cord.*
8. If the insulation of a tool or of a cable has been worn or ragged,	*g. test it to secure it is dead.*
9. Before working on an electrical circuit	*h. stand on a rubber mat or wear rubber soled shoes.*
10. When terminating flexible cables,	*i. under overhead cables.*
***e.g.:** 1-j*	*j. if you touch a live wire or terminal with bare hands.*

3. Match the following with words or phrases:

A. In the introductory paragraph

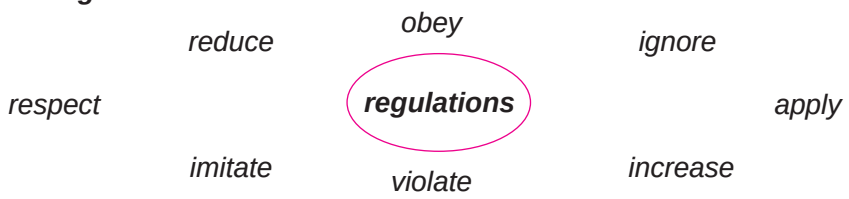
1. someone or something that causes death or disaster: _____
2. dealing with: _____
3. lack of success, unsuccessful attempt: _____
4. lack of knowledge: _____
5. make reliable / certain / safe, ensure: _____
6. condition of having good health, comfortable living and working conditions: _____

B. In the "Safety precautions"

1. take part, undertake, get involved in (to): _____
2. not completely dry, having some moisture: _____
3. disconnect, stop the flow of electric current, put or keep apart from others: _____
4. no electric current flows through this circuit (open circuit): _____

5. take place, happen: _____
6. put out (a light, a fire, a cigarette): _____
7. be in danger: _____
8. electrical work carried out while electric current flows through the circuit: _____
9. inevitable, that cannot be avoided: _____

4. Draw arrows to show which of the following verbs may collocate with the word "regulations".



5. Write sentences using the following expressions:

1. take precautions against…

2. take / run / face / avoid the risk < *to + infinitive* / *of + gerund*

3. be involved in (to) < *noun* / *gerund*

4. deal with…

5. be engaged in (to) < *noun* / *gerund*

6. WORD FORMATION

Some of the most commonly used prefixes and suffixes are the following:

Prefixes	Suffixes
un-	-less
in-	-ful
dis-	-able

Their meanings are given in the box below in jumbled order.

full of - not - that can be done
the opposite of - without, not having

A. Look at the following groups of words and: a) say what each word means, after the prefix or suffix has been added, and b) choosing from the above box write the meaning of each prefix or suffix in the spaces provided.

Prefixes

un-

*avoidable → **un**avoidable*
*usual → **un**usual*
*qualified → **un**qualified*

un-=

in-

*equality → **in**equality*
*possible → **im**possible**
*direct → **in**direct*

in-=

** in, becomes il before an l (e.g. illegal), ir before r (e.g. irregular) and im before b, m or p (e.g. immeasurable, imbalanced).*

dis-

*connect → **dis**connect*
*like → **dis**like*
*obey → **dis**obey*

dis-=

Suffixes

-less

*care → care**less***
*speech → speech**less***
*home → home**less***

-less=

-ful

*care → care**ful***
*beauty → beauti**ful***
*peace → peace**ful***

-ful=

-able

*drink → drink**able***
*repair → repair**able***
*measure → measur**able***

-able=

B. Form new words out of the following by adding the above prefixes or suffixes.

respect: _____
comfort: _____
use: _____

happy: _____
rest: _____
formal: _____
*help:*_____
*proper:*_____
*success:*_____
engage: _____
believe: _____

Grammar Review

I. 3rd Conditional

USE - STRUCTURE

1. Study the following examples.

If I had had more money then, I could have bought a better DMM.
If you had noticed the malfunction earlier, the motor would not have been so seriously damaged.
He is lucky. The train he intended to catch, crashed and many were killed or injured. If he had caught that train, he might have been killed.

2. Tick the correct answer

1. Did the action in the if-clause happen?
- *a. Yes*
- *b. No*

2. Is there any possibility for the action in the main clause to be fulfilled?
- *a. Yes*
- *b. No*

3. What does the 3rd conditional also express?
- *a. happiness*
- *b. regret*
- *c. relief*
- *d. sadness*

3. Fill in the missing information in the table below.

Use

We use the third conditional to talk about **unreal past situations**, that is, when the action in the main clause _____ because the action in the if-clause _____.

Structure

If + _____ could + _____

PRACTICE

Put the verbs in parentheses in the correct form.

1. *If he (be) _____ more careful, he (not be) _____ electrocuted.*
2. *If I (realize) _____ how difficult this job was, I (never be engaged) _____ in it.*
3. *If they (apply) _____ the regulations, the damage (not happen) _____.*
4. *If you (read) _____ the specifications, you (buy) _____ a motor of greater capacity.*
5. *If he (not be) _____ so careless, he (made) _____ the correct connections.*
6. *If they (have) _____ better equipment, they (do) _____ a better job.*
7. *If you (tie or cover) _____ your hair you (not be injured) _____.*
8. *If he (stop) _____ fighting the fire earlier, he (not be burnt) _____ so seriously.*
9. *If the operators (not make) _____ so many mistakes, the Chernobyl accident (not occur) _____.*
10. *If we (lubricate) _____ the motor more often, the bearings (not be worn out) _____ so soon.*

II. Reviewing all types of conditional sentences

Read the sentences carefully, identify which type each one belongs to, and put the verbs in parentheses in the correct form.

1. *If governments (spend) _____ more money on research, the use of renewable sources of energy (cost) _____ less.*
2. *If you (study) _____ more, you (not fail) _____ in the exams yesterday.*
3. *If you (want) _____ the best transformer on the market, (buy) _____ an Anderson dry-type one.*
4. *If we (not stop) _____ overusing fossil fuels for energy production, they (soon be) _____ completely exhausted.*
5. *Unfortunately, John didn't get the job he had applied for. If he (have) _____ more qualifications, he (get) _____ it.*
6. *If you (work) _____ on the night shift, you (earn) _____ more money.*

Listening Activity

You are going to listen to three fatal accidents as they were announced on the TV news. ***Familiarize yourself with the first three columns of the table below, listen to the announcement and write the number of the corresponding accident in the space provided on the left of each piece of information. Then, listen again and do the same with the other two columns.***

Person's who had the accident		
Name	**Occupation**	**Cause of death**
___ *David Costner* ___ *John Newman* ___ *Pat Silverson*	___ *Trainee electrician* ___ *Retired teacher* ___ *Electrician*	___ *was electrocuted* ___ *received electric shock* ___ *sustained fatal burns*

Person's activity at the time of the accident	**Factors resulting in the accident**
___ *was trying to change an over-heated contact in the switch board of a factory.* ___ *was running cables through a false ceiling in a showroom from a metal step ladder.* ___ *was filling an old water heater with water.*	___ *The water heater was plugged in and turned on.* ___ *The switchboard had not been isolated.* ___ *Near his work a three-pin plug was lying unprotected on the ceiling.*

FOLLOW UP

1. *In the boxes below you will find the causes of the three accidents.* ***Match causes with accidents.***

1 *After investigation, it was found that the live pin in the plug connector had been wrongly wired.*
Accident: _____

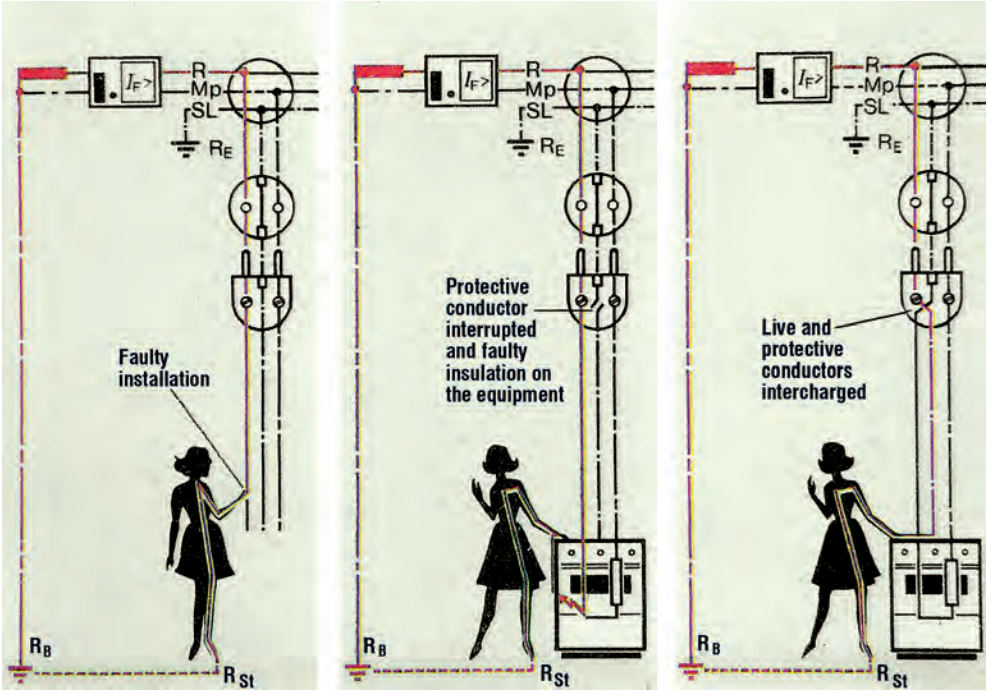
2 *He touched the live busbar connections with an uninsulated spanner causing a short circuit to earth.*
Accident: _____

3	*Examination after the accident showed that: a) the earth wire was not connected to the terminal of the plug, and b) the insulation had melted at the point where the live and earth wires crossed, resulting in voltage leakage.* ***Accident:*** _____

2. *All three accidents occurred due to ignorance or carelessness on the part of the person who died.* ***Say what the fatal error of the three persons was.***

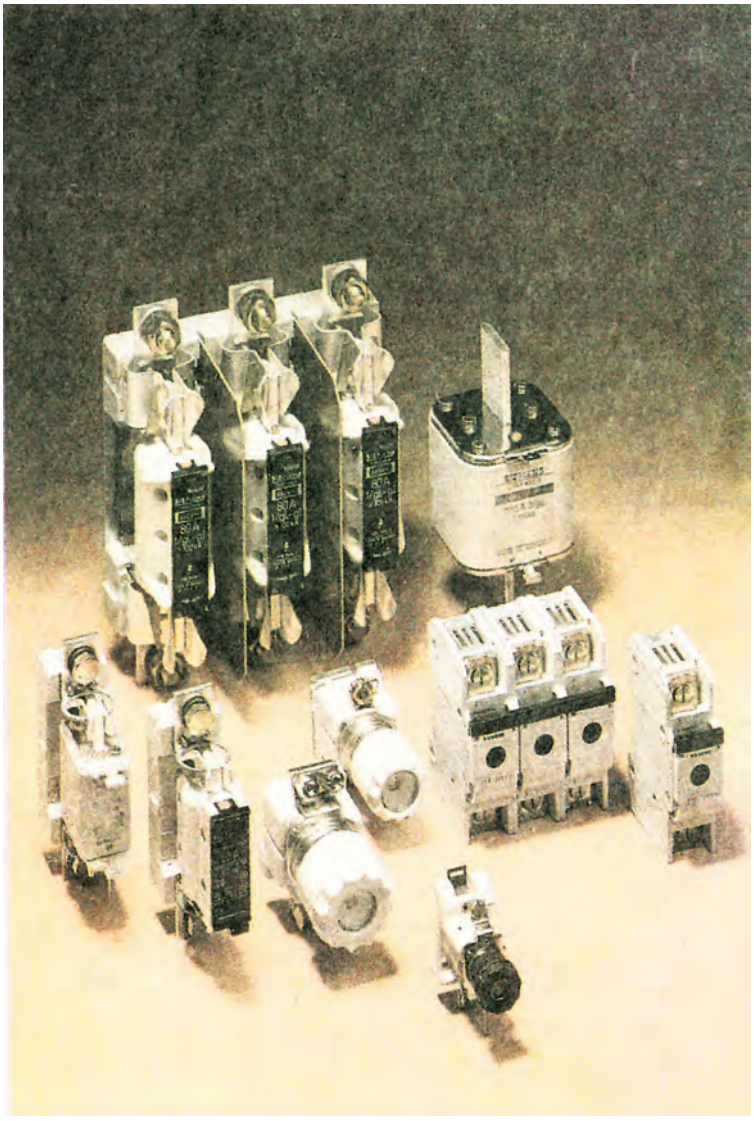
Expressions to help you

Mr / Mrs… had the accident because s/he…
Since Mr / Mrs… was…, s/he should / shouldn't have +p.p.…
The fatal error of Mr / Mrs… was that s/he…
The accident wouldn't have happened if Mr / Mrs… had / hadn't +p.p.…



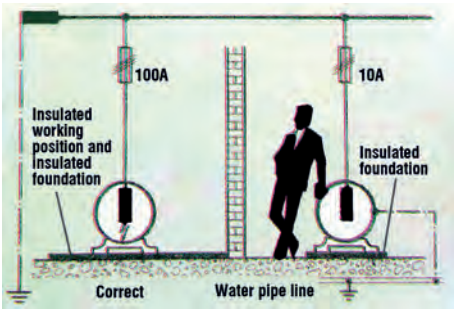
UNIT 10

SAFETY FOR THE USER



Read the text and answer the questions.

1.When do risks coming from the use of electricity occur?
2. When does overloading take place?
3. Name some of the damages that overloading may cause.
4. Name three types of mechanisms or devices which make electrical installations safe.



Electricity can usefully power many appliances but at the same time can be dangerous.

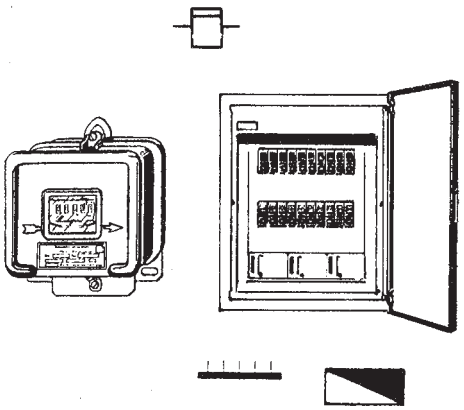
Risks coming from the use of electricity occur either when there is a voltage leakage or an overloading. Overloading or overcurrent takes place when excessive current is forced through the circuit rising the temperature and destroying the wires. This may cause short circuits, electric shocks, bums or fire.

Voltage leakage or overloading may happen at any circuit. Therefore, one should never tamper with electrical appliances or units.

To provide a safe way of tapping power lines of electrical installations, appliances, sockets and plugs are equipped with fuses, breakers and switches which provide protection to both installations and the users.

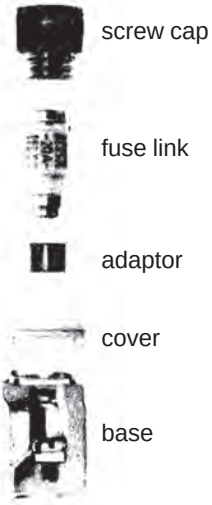
PROTECTIVE DEVICES

Electricity enters the home through the Electrical Corporation's main fuse and from there to the Watthour meter. The supply is then divided up to feed various lighting circuits and appliances in the home via the distribution board, which includes switches, fuses and breakers. These are protective or safety devices and are mainly intended to protect cables and wiring against overloading, voltage leakage and short circuit.

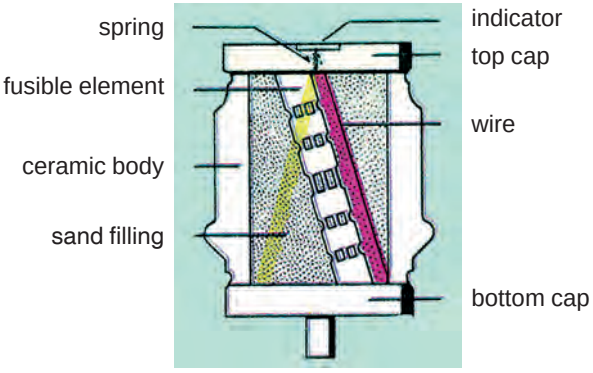


Fuse links are thin strips of metal with a low melting point. They are designed to cope with increasing fault levels on supply systems and are used in both domestic and industrial applications.

N.H. fuses are another type of fuse. Due to their high degree of protection against overload and short circuits, they have wide industrial applications. Their system is of the plug-type with no protection against touch. Although they are now



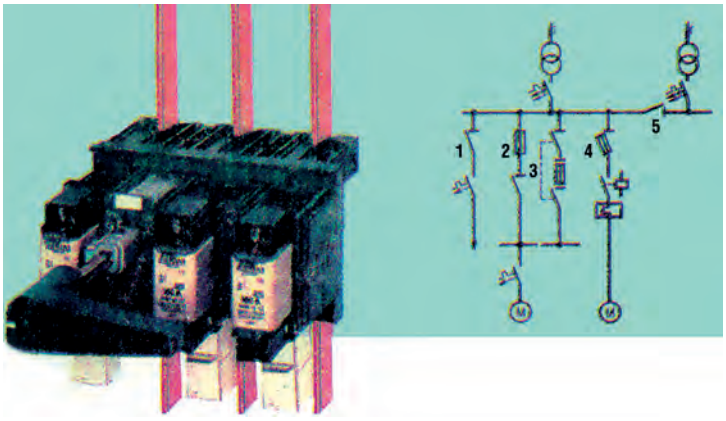
Parts of a fuse link



Cross-section of a fuse link

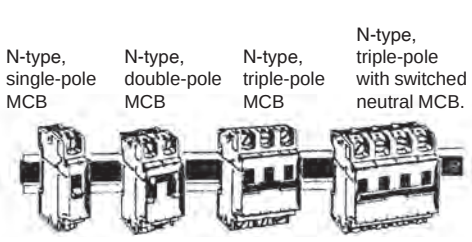
manufactured from plastic and modern insulating materials, for optimum safety, only trained personnel must replace them.

Miniature circuit breakers are primarily used in final circuits in domestic applications. They are classified into single-pole and multi-pole with breakers with



switched neutral and auxiliary contacts. The advantage of using miniature circuit breakers instead of fuse links, is their immediate operation after a trip.

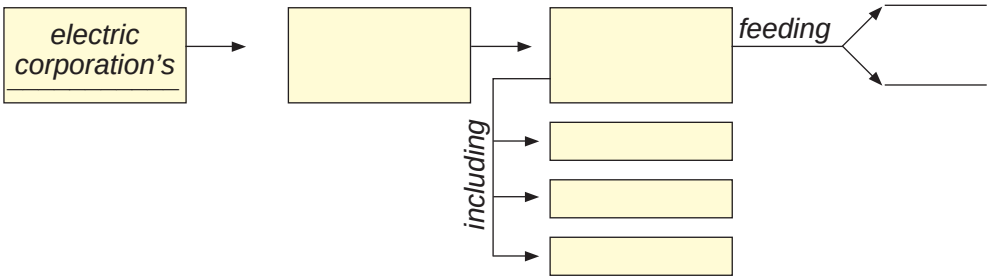
Types of miniature circuit breaker (MCB)



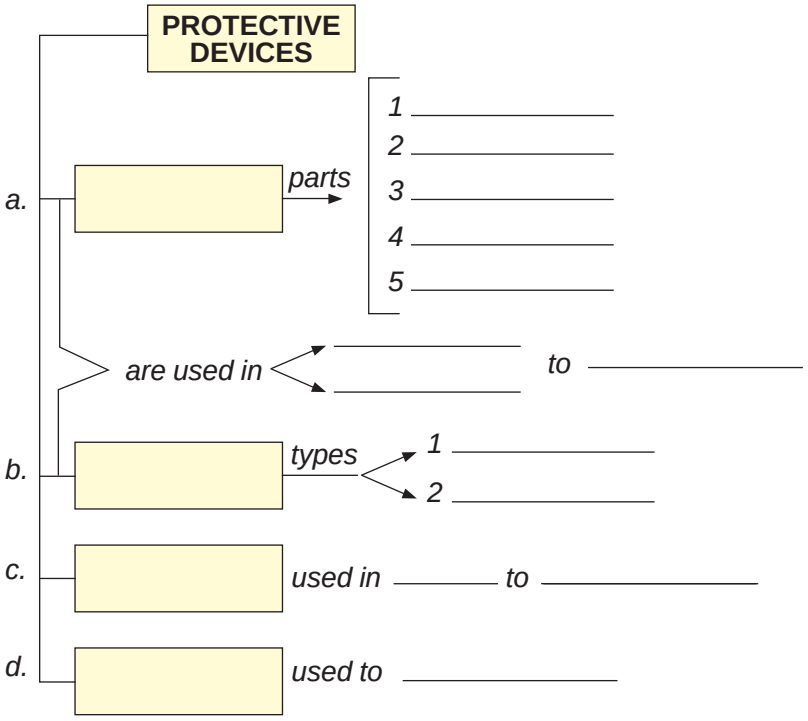
An earth-leakage breaker, which is a highly sensitive, magnetic or thermal protective circuit device, is sometimes installed in distribution boards. It accurately detects any voltage leakage in the electrical systems by opening the circuit when an excessive current flows.

EXERCISES

1. *Which is the route of electric current from the point it enters the home, until it is delivered to the various circuits?* ***Complete the flow-chart below.***



2. *Which are the most important protective devices, their parts, types and uses?* ***Complete the flow-chart below.***



3. Which of these terms can be used alternatively to the term "Watthour meter"?

Watthour meter
Multimeter
Consumption meter
Runhour meter
Voltmeter
Electrical meter

4. What do the underlined expressions or terms mean? Match the two columns.

1. voltage leakage	*a. a way of controlling the flow of current in power lines*
2. they are designed to cope with increasing fault levels	*b. immediate operation after a voltage fall due to a fault*
3. fuses have a low melting point	*c. an amount of voltage coming out of the wiring through an insulation fault*
4. one should never tamper with electrical appliances	*d. they have to deal with fault levels successfully*
5. overcurrent takes place…	*e. one should never interfere with electrical appliances*
6. immediate operation after a trip	*f. excessive current is flowing through wires*
7. a way of tapping power lines…	*g.they melt at a low temperature*

5. Search the text to find qualifiers to the following nouns.

1. _____ circuits
2. _____ leakage
3. _____ device
4. _____ strips
5. _____ _____ point
6. _____ degree

7. _____ *system*

8. _____ } *applications*
9. _____ *materials*
10. _____ *safety*

11. _____ } *miniature circuit breakers*

12. _____ } *contacts*

6. WORD FORMATION

The suffix -ive

The suffix **-ive**, when added to verbs, forms an adjective and has the following meaning: **"having the nature, character or quality"** expressed by the verb.

e.g. *protective: having the quality to protect.*

Form adjectives out of the following verbs by adding the suffix -ive. Make any necessary changes.

1. *detect* _____
2. *conduct* _____
3. *exceed* _____
4. *express* _____
5. *intend* _____
6. *produce* _____
7. *inform* _____
8. *create* _____
9. *alternate* _____
10. *receive* _____

7. EXPRESSING FUNCTION AND USE

There are various ways of expressing the **function** and the **use** of items.

e.g. *The earth wire **is made to** connect an appliance to the ground.*
*The earth wire **connects** the appliance to the ground.*

A. Search the text to find similar expressions about the following.

1. *Protective or safety devices* _____
2. *Fuse links* _____
3. *The miniature circuit breakers* _____

B. Use the above five structures to fill in the gaps in the following sentences.

1. *Insulated tools* _____ *protect electricians.*
2. *Motors* _____ *convert electrical into mechanical energy.*
3. *Power transmission systems* _____ *distribute power to thousands of consumers over long distances.*
4. *Nuclear power stations* _____ *generate electric energy using nuclear fuel.*

5. Fuse links _____ melt at a low temperature.
6. The Watthour meter is a motor _____ measure electrical consumption.
7. Cable insulation _____ protect cables against moisture and air pollution.

How the Earth-Leakage Breaker Operates

The earth-leakage breaker mainly consists of a summation current transformer, a tripping mechanism and a switching mechanism. The current-carrying conductors, including the neutral, pass through the current transformer.

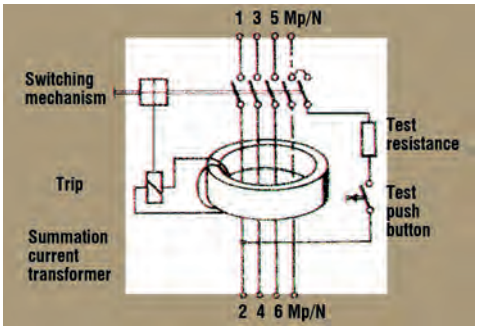
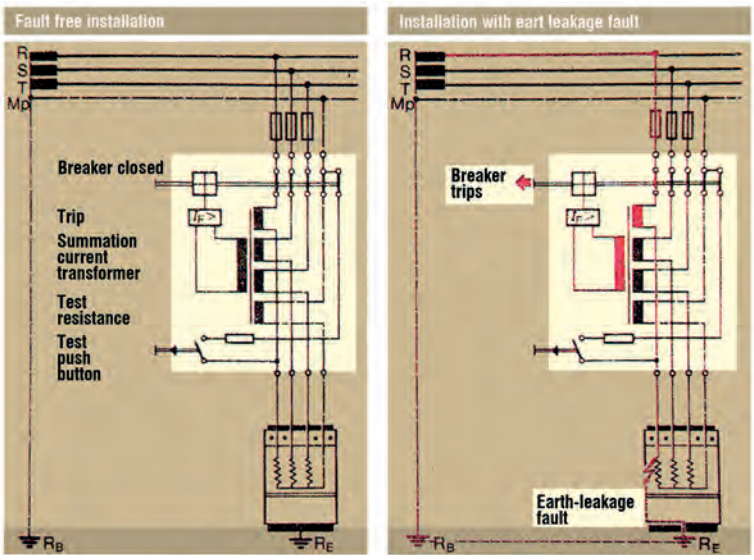


Fig. Construction of a current operated earth-leakage circuit breaker.

If there is an insulation fault on the load side of the earth-leakage breaker, a fault current will flow to earth disturbing the “equilibrium” of the magnetic forces in the summation transformer. The resulting magnetic field in the transformer core will induce a voltage in the secondary winding which, via the tripping mechanism, will switch off the faulty circuit.

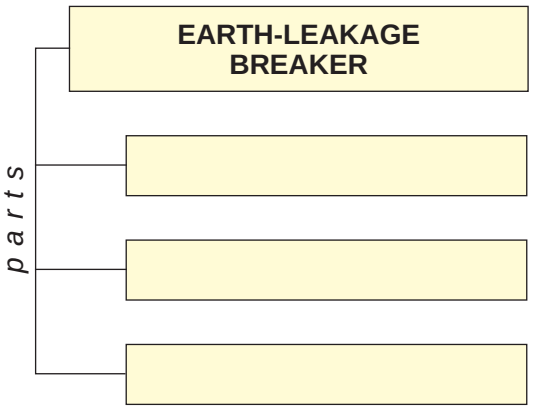
So, there is no dangerous contact voltage.

For a functional test, the test pushbutton should be pressed, producing a fault, so as to see if the breaker trips.



EXERCISES

1. Complete the following diagram.



2. Choose words from the list to complete the following sentences.

List: *disturb, tripping, via, summation, equilibrium.*

1. He travelled to Washington _____ Rome.
2. The _____ mechanism automatically breaks the circuit in case of voltage leakage.
3. The production manager is in a meeting. You shouldn't _____ him.
4. I hope this state of _____ will be maintained.
5. The adding up of numbers or quantities is called _____.

3. Tick appropriately according to the text.

		trans-former	*core*	*mecha-nism*	*breaker*	*field*	*test*	*winding*	*fault*
e.g.	*tripping*			✓					
	summation								
	switching								
	insulation								
	earth-leakage								
	magnetic								
	secondary								
	functional								
	transformer								

4. Finish the following sentences using structures of the 1st Conditional.

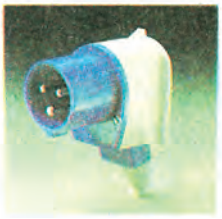
1. If there is an insulation fault, _____ .
2. If there is a magnetic field in the transformer core, it _____ _____
3. If you want to do a functional test, _____ .
4. If you press the test pushbutton, _____ .
5. If excessive current is forced through the circuit, _____ .
6. In case of an overloading, _____ .

Sockets and Plugs

Sockets have three holes, which accept the three pins of plugs.

Earthing rod

Plugs contain a) three pins, connected each to a live, a neutral and an earth wire, and b) a cartridge fuse.



When you plug in an electrical appliance, the pins touch the live and neutral contact behind the socket holes.

The live and neutral wires form a complete circuit linking the power supply and the appliance. So, current flows throughout the circuit.

The earth wire is a safety wire. It connects the body of the appliance you are using to earth.

Current in the live wire flows via the cartridge-fuse, which protects the circuit from excessive current flow (overload). If, for example, the live wire inside a metal kettle works loose and touches the metal, a large current flows in the live and earth wires and blows the fuse.

The fuse is a thin piece of wire that acts as a weak point in an electric circuit. If more current flows in the circuit than the wires are designed to carry, the fuse inside the cartridge overheats and melts or blows, thus breaking the circuit.

An additional device used in modern sockets is the on/off switch, which provides extra safety to the user by breaking the circuit before the socket, when / the socket is not in use.

EXERCISES

1. Read the text and:

A. Name the three wires corresponding to the three pins of a plug.

B. Write the colour of each of these three wires.

wires	colour

2. Tick the correct answer.

1. Sockets have
a. three holes which accept the three pins of plugs.
b. three pins which are connected to the three holes of plugs.
c. four wires which accept the four pins of plugs.

2. When a plug is connected to a socket outlet, the live and neutral wires form a complete circuit linking
a. the fuse to the appliance.
b. the socket to the fuse box.
c. the appliance to the power supply.

3. Current in the live wire flows via
   a. the earth wire which protects the circuit from overload.
   b. the neutral pin of the plug which protects the circuit from overload.
   c. the cartridge-fuse which protects the circuit from overload.

4. The fuse link
   a. is a thick piece of wire that acts as a strong point to an electric circuit.
   b. is a thin piece of wire that acts as a weak point to an electric circuit.
   c. supplies current to the appliance.

5. When the fuse link inside the cartridge overheats and melts or blows,
   a. it completes the circuit.
   b. it supplies the circuit with electric current.
   c. it breaks the circuit.

6. The fuse inside the cartridge overheats and melts or blows
   a. when the current that flows is less than the wires are designed to carry.
   b. when the current that flows is more than the wires are designed to carry.
   c. at an extremely low melting point.

7. The additional safety device used in modem sockets is
   a. the on/off switch.
   b. the earth-leakage breaker.
   c. the N.H. fuse.

3. Classify the words you hear from your teacher under the following headlines.

Sockets	*Plugs*	*Earth-leakage breakers*

4. Identify the terms described in the following definitions.

1. _____

Circuit broken at a point, so that electric current cannot flow.

2. _____

Continuous path of conductors and other devices along which an electric current can flow.

3. _____

The electricity supply socket opening and the cable which is at a voltage of 240 V above the value of the neutral voltage. It is connected to one of the cables of the three-phase supply system.

4. _____

The power socket opening and the cable which is at a voltage of 0 Volts. It is connected to the corresponding cable from the local substation.

5. _____

The cable which runs from the top socket opening of a socket outlet to a rod pushed into the ground thus helping make electrical devices safe.

6. _____

It occurs in a circuit resulting from a fault between live conductors.

7. _____

A mechanical device designed to open or close a circuit under normal or abnormal conditions (e.g. overloading or voltage leakage).

8. _____

A current exceeding the rated value (e.g. due to short circuit).

9. _____

A device for opening a circuit by means of a fusible element, that is a thin strip of wire.

5. Choose the right preposition from the list to fill in the gaps in the following sentences.

List: *behind, in, up, before, of, via, through, inside, to*

1. *To prevent excessive current flow, the thin fuse wire _____ the cartridge, overheats and melts.*
2. *Electricity is supplied _____ your home _____ a mains electricity supply cable.*
3. *_____ the distribution board electrical energy is divided _____ to the various circuits _____ the fuses or miniature circuit breakers.*
4. *The fuse breaks the circuit and stops the flow _____ current _____ anything else can overheat and catch fire.*
5. *_____ case that an appliance becomes faulty, electric current flows _____ the earth pin rather than the person using the appliance.*
6. *The pins _____ the plug are connected _____ the contacts _____ the socket holes.*

Oral practice

Imagine the following situation:

Mr. Black has just bought an old house in the country. He wants to make some improvements in the electrical installation as well as take some measures to ensure it is safe. So, he contacted an electrician, Mr. Simpson, to discuss the matter. Here is the conversation between them.

Work with your partner to complete the missing parts of the dialogue choosing from the table below. Then perform it.

CLIENT. *Good morning, Mr. Simpson. Thank you for coming.*

ELECTR. *Good morning, Mr. Black. Welcome to our neighbourhood. What can I do for you?*

CL. *Well, as you can see, the house is pretty old and I'm afraid the electrical installation isn't safe enough. I'd like you to check it, replace some cracked sockets and faulty switches, and install some new ones where necessary.* _____

_____

_____

_____

EL. *First of all, can I have a look at the distribution board?*

CL. _____

EL. *Well, it's old. I would suggest it should be replaced by a new one including miniature circuit breakers instead of fuse links.*

CL. *Why do you consider it necessary?*

EL. _____

_____

_____

_____

_____

CL. *O.K. then. Anything else?*

EL. *Yes, since there are little children in the house,* _____

_____

_____

CL. _____

EL. *It's a device which will protect you against voltage leakage. If for example, there is a fault in the wiring connection or the insulation of any of your appliances, or* _____

_____

_____

_____

CL. *Oh, I see. Indeed, it is necessary to install one.*

EL. *Also I think you should consider the possibility of replacing all the sockets with new ones* _____

_____

_____

CL. *Yes, maybe you're right.* _____

_____

EL. *First, I have to cost* _____

_____

CL. *Thank you very much.* _____

_____

EL. *Thank you, too. Goodbye.*

CL. *Goodbye.*

ELECTRICIAN'S PART

- *I think you should also install an earth-leakage breaker.*
- *…the materials and equipment to be used as well as my labour and I'll let you know as soon as possible.*
- *Because miniature circuit breakers are not only safer, but also more convenient. You don't have to replace them, as you do with the fuse links when they blow, and they operate immediately after a trip.*
- *…including an on/off switch as an additional protective measure.*
- *…if any of your kids, inserts a metal pin in a socket, the earth-leakage breaker will immediately trip preventing a fatal accident.*

CLIENT'S PART

- *Sorry, what is that?*
- *And what do you think the overall cost will be?*
- *Finally, I'd like you to suggest any protective measures you think necessary to make the whole installation safe. We have two little kids, you know, and we'd like to prevent an accident.*
- *… you've been very helpful. I'll be expecting your call.*
- *Of course, here it is.*

Grammar Review

Can - May

I. Read the sentences and say what "can" expresses. Choose from the alternatives below.

a. Ability (A)
b. Suggestion (S)
c. Permission (Pe)
d. Order (O)
e. Possibility (Po)
f. Request (R)
g. Effect (E)

1. Can you tell me the way to the factory?
2. Lightning can be dangerous.
3. He can solve the problem.
4. Can I go out?
5. Can you repair the damage for me?
6. You can split the text into four paragraphs.
7. He can speak three languages.
8. The current can be raised by increasing the speed at which the magnet rotates.

Now fill in the table.

Can/could is used to express:	
a. _____	*d. _____*
b. _____	*e. _____*
c. _____	

II. Read the sentences and say what "may" expresses. Choose from the alternatives below.

a. Condition (C)	*c. Possibility (Po)*
b. Permission (formal) (Pe)	*d. Ability (A)*

1. The text may start by giving definitions.
2. May I have the information I asked for?
3. What might be the cause if the motor doesn't start?
4. The damage might be at the motor.
5. May I ask you something?

Now fill in the table.

May/might is used to express:
a. _____
b. _____

EXERCISES

1. Fill in the gaps with one of the above verbs (can-may).

1. World energy sources _____ be categorized into renewable and non-renewable.
2. Free electrons _____ move from atom to atom.
3. What _____ a cyclist do to increase the brightness of the lamp?
4. In the table below, you _____ see some patterns.
5. You _____ look up the words in the dictionary.
6. Insulating materials _____ be improved.
7. An earth-leakage breaker _____ be installed in distribution boards.
8. Fuse links _____ cope with increasing fault levels.
9. Overloading _____ cause short circuit, electric shocks, burns or fire.
10. Electricity _____ be dangerous.

2. Rephrase the following sentences using either "can" or "may".

1. What is possibly the cause that the reactor does not operate?
2. I don't think the text ends like this.
3. Perhaps it will be sunny tomorrow.
4. Am I allowed to use your screwdriver?
5. Would it be possible to borrow some money from you?
6. It's possible that he will solve the problem.
7. There is a chance to get the job.
8. It is impossible to find my glasses anywhere. Perhaps I've left them in the shop.
9. When he first started his training, it was impossible to use all the tools.
10. I suggest you arrange the paragraphs of your composition like this.

Listening Activity

STEP 1

Listen to the text and decide which of the following titles is the most appropriate for it.

a. "Repairing Electrical Appliances by Yourself".
b. "A General Safety Guide".
c. "Faults in Home Electrical Appliances".

STEP 2

Listen to the text again and:

A. Write the three common causes of accidents coming from electrical appliances

1. _____
2. _____
3. _____

B. While listening to the guidelines again, tick the appropriate column below, with things one should or should not do (avoid doing).

	What
you should do	***you should not do***

How many dos and dont's have you ticked?

FOLLOW-UP

Feeling your responsibility as an electrician to help people overcome ignorance so as to avoid electrical accidents, you decided to pin up a sign with useful guidelines in your workshop. You found the instructions below in a magazine. The instructions were in Passive Voice though, and therefore they weren't so emphatic as you thought they should. So, you decided to turn them into Active Voice using the Imperative form.

- All appliances should always be isolated before repair or inspection.
- Repairing appliances that are still plugged in, even if the socket switch is OFF, should be avoided.
- The mains plug should always be correctly fitted ensuring the connections are in the correct position.
- It should be checked that the sockets are in good condition and have sound earth paths.
- Power tools or electrical appliances should never be used outdoors in the rain or in damp conditions, e.g. in the bathroom.
- Cables with worn out insulation should never be touched.
- Damaged cables should not be repaired with insulation tape.
- Faults in electrical appliances should never be repaired if you are not sure you can remedy them yourself.

Prepare the sign with the guidelines.

For Your Safety

To prevent accidents:

- *Always isolate all appliances* _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

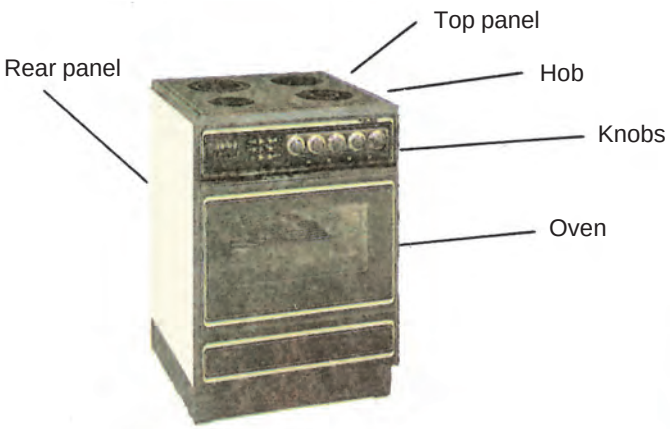
UNIT 11

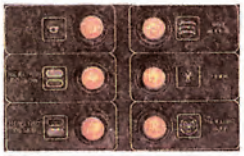
REPAIRING ELECTRIC COOKERS

In every modern household, there is an average of fifteen electrical appliances, which, due to their high degree of usage, need often repair. Repairing these appliances is therefore one of the most common work activities of electricians.

OVENS AND HOBS

Electric cookers are among the most commonly used electrical appliances in a home. Over the years ovens and hobs have become more and more complex with the addition of digital timers, touch controls, etc. However, many modern ovens and hobs still function with parts that are almost the same as those of conventional ones.

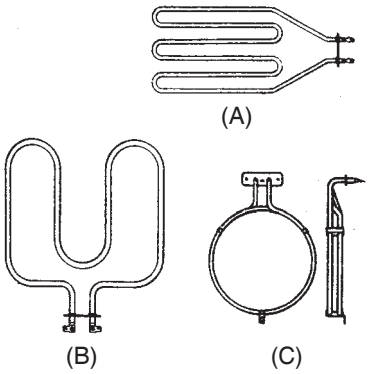




Panel with touch controls and indicator lamps

Read the information about electric cookers below and answer the questions.

1. How are ovens and hobs heated?
2. Which is the usual type of hob elements?
3. How is the temperature regulated in a hob and how in an oven?
4. Where are the oven elements situated?
5. Is the replacement of an oven element easy?



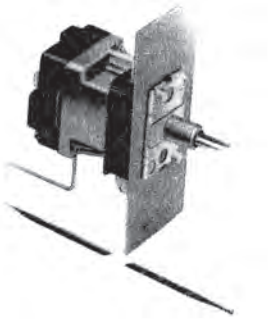
Heating elements

Hobs and ovens of the electric cooker are heated by means of radiant heating elements, the size, wattage, shape, etc. of which vary enormously between makes and individual models. If, therefore, a replacement is required, it is essential that the new part meets all the specifications of the old one.

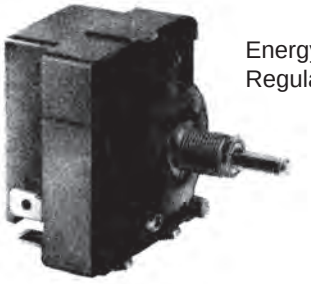
The temperature of a hob is controlled by means of an energy regulator, while the temperature in an oven is regulated by a variable or pod-type thermostat. The most popular hobs use spiral heating elements

in either double or single form usually covered with a solid plate.

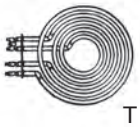
Conventional ovens have two or more elements which are situated either at the sides or at the top and bottom of the oven (normally behind its inner lining). Fan ovens, on the other hand, usually consist of an element which surrounds or is positioned in front of a fan, driven by a shaded-pole motor. In general, repairs to ovens are not difficult, since many ovens now have plug-in elements. Others, however, will require removal of panels to gain access to the fixing screws, nuts and connections.



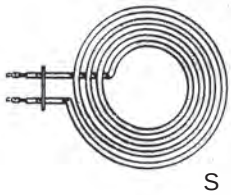
Variable or pod-type Thermostat



Energy Regulator



Double element



Single element

EXERCISES

1. Choose the correct word to fill in the gaps in the following sentences.

1. His father's model influenced him _____ in his career.
a. differently b. enormously c. perfectly

2. What _____ is his car? I don't know.
a. make b. product c. style

3. Oxygen and water are _____ to living.
a. correct b. difficult c. essential

4. He doesn't _____ me to use his tools without permission.
a. allow b. give c. prepare

5. The inner _____ of ovens can be easily removed.
a. regulator b. frame c. lining

6. It's difficult to _____ to the computer motherboard.
a. give permission b. gain access c. save memory

2. WORD FORMATION

Forming adverbs

Most adverbs are formed by adding the suffix **-ly** to the corresponding adjective.

e.g. *slow + -ly → slow**ly***
*careful + -ly → careful**ly***

A. Search the text to find four adverbs ending in -ly and underline them.

B. Find three adjectives in the text and form their corresponding adverbs.

IDENTIFYING AN OVEN FAULT

Electric cookers are the mostly used household electrical appliances and, therefore, they often need repairing.

Locating a fault in a hob is quite easy, and replacing its heating element or the regulator is simple enough. In ovens, on the other hand, both location and removal of a fault are more complicated, especially if the cooker is old.

Below you can see the most often faults occurring in conventional ovens and their possible causes.

Read them and answer the question:

If the symptom of an oven does not give clear evidence of the faulty item (thermostat or heating element), what should you do to locate it?

CONVENTIONAL OVEN FAULTS

1. The most likely cause of overheating will be a failure of the thermostat contact point, in which case, a new compatible replacement unit will be needed.

2. Slow initial heating-up times or uneven heating distribution within the oven is usually caused by the failure of one element. Simple testing of the elements will highlight the faulty item.

3. Failure to heat up at all may be either the thermostat or elements. If the cooker has plug-in elements, they are relatively easy to check for continuity, so eliminate them first.

4. Poor cooking results or under-cooking of food can also be caused either by a faulty thermostat, which turns off elements at too low a temperature, or by the failure of one element.

EXERCISES

1. Taking your information from the text, complete the table.

	Symptom	Possible cause	Cure
1.			
2.	*a)* *b) Uneven heating distribution*		
3.			*Identification and replacement of the faulty item.*
4.			

2. *Clients have their own way to describe the symptoms of the faulty operation of an electrical appliance. Here are some of their usual complaints about oven faults.* ***Match complaints with oven faults as described in the text.***

Complaints

1. "I have to cook the food much longer than before, and it is still not well cooked".
2 "It burns the food even at the lowest dial setting".
3. "It takes too long to heat up and start cooking the food".
4 "I turn the knob at the highest dial setting, but the oven doesn't get warm. It remains cool".
5. "It doesn't cook the food well, even when I turn the knob to the highest dial setting".
6. "The food remains uncooked underneath".

e.g. *The first complaint corresponds to: "Poor cooking results".*

3. Find words in the text which mean:

1. possible: _____
2. fault, defect: _____
3. appropriate, similar, suitable, identical, the same as the original: _____
4. starting, beginning: _____
5. not uniform, equal, regular: _____

6. show, indicate, clarify, give evidence:
7. rather, more or less:
8. set aside and pay no consideration, exclude, get rid of:

4. OF and OFF

Both OF and OFF are used to express various meanings, the most important of which are:

OF

It indicates:

1. Cause

e.g. His mother died **of** grief, soon after her husband's death.
She is afraid **of** earthquakes.

2. material, substance, measure

e.g. They live in an old house **of** stone.
I need a roll **of** insulating tape.

3. genitive, possession

e.g. Buy products **of** our own manufacture.
The wiring **of** a house requires skill.
He is a friend **of** mine.
It's no business **of** yours.

OFF

It indicates:

1. departure, removal, separation

e.g. I must be **off**.
Take **off** your coat. It's hot in here.
The door handle has come **off**.

2. that something is disconnected, or no longer available

e.g. Turn the instrument **off** when you finish.
The water is **off**.

Fill in the blanks below with either OF or OFF.

1. It is late. Please turn the radio _____.
2. The function pushbuttons are on the left _____ the on/off switch.
3. The lights are _____. Check the main fuse in the distribution board.
4. Insulators are usually made _____ porcelain.
5. She has read almost all the works _____ Shakespeare.
6. Before starting repairing the cooker, switch _____ the main supply.
7. The result _____ the meeting satisfied both parts.
8. He died _____ his burns soon after the accident.

9. *Don't forget to take your hat _____ before entering the church.*
10. *The plotting _____ a circuit diagram is time consuming.*
11. *This Wind-power unit provides the same annual amount _____ energy equivalent to more than 10 million barrels _____ low sulphur oil.*

OVEN ELEMENT TESTING AND RENEWAL

When the faulty operation of an oven is located to the thermostat, replacing it is rather easy. On the contrary, testing and replacing an oven heating element is more difficult as the electrician has to disassemble and reassemble almost the whole appliance. Here is the procedure to be followed.

Read it, and:

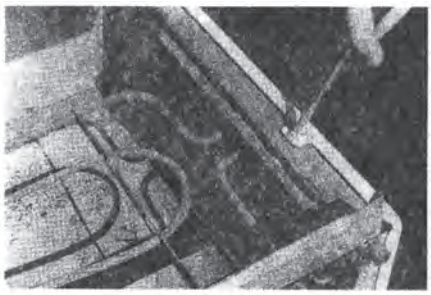
1. Split the instructions into two parts according to these thematic areas:
a) "Stripdown procedure",
b) "Refitting procedure".

2. Say which of the instructions referring to the stripdown procedure concern the testing, and which the renewal of an element.

3. Say which of the instructions deal with your safety in carrying out the job.

Procedure

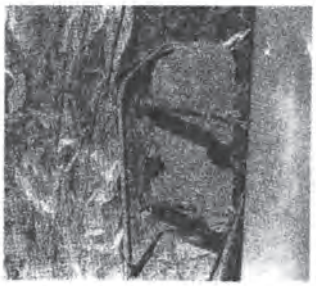
1. Isolate appliance by either removing fuse of switching off MCB* of cooker circuit at consumer unit board.



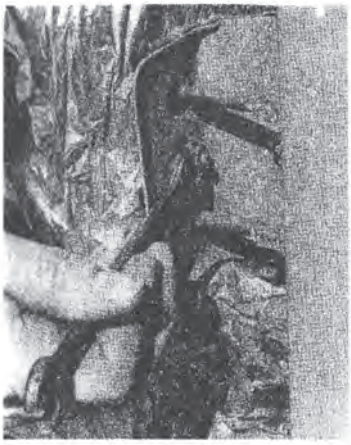
2. Lift top panel to gain access to rear panel screws.

3. Remove real panel to gain access to oven elements.

4. Carefully remove terminal connectors with pliers; do not pull on wires. Note wiring and positions.

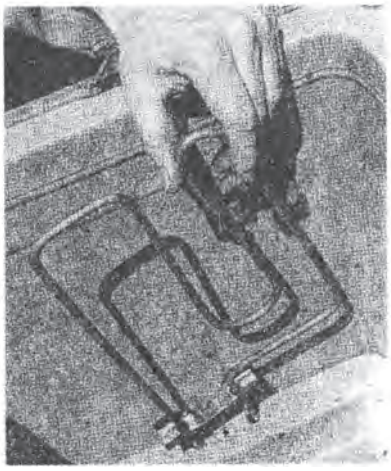


5. With wires removed, test element for continuity with Ohmmeter. In case of OC*, oven circuit requires renewal.



6. Remove centre fixing nut.

7. Remove oven inner liner to gain access to element.



8. Ease element from support clip/slides carefully.

9. Replace faulty element with new one.

10. Refitting is a careful reversal of stripdown procedure. Make sure all connections are tight and in their original positions so as to prevent contact with sharp or hot surfaces, or with the covering panel when refitted.

11. Double check all work carried out.

12. Prior to functional testing, test cooker for earth continuity.

13. Turn on MCB or replace fuse at distribution board.

14. Carry out functional test.

---

*MCB=Miniature Circuit Breaker
**O.C.=Open Circuit

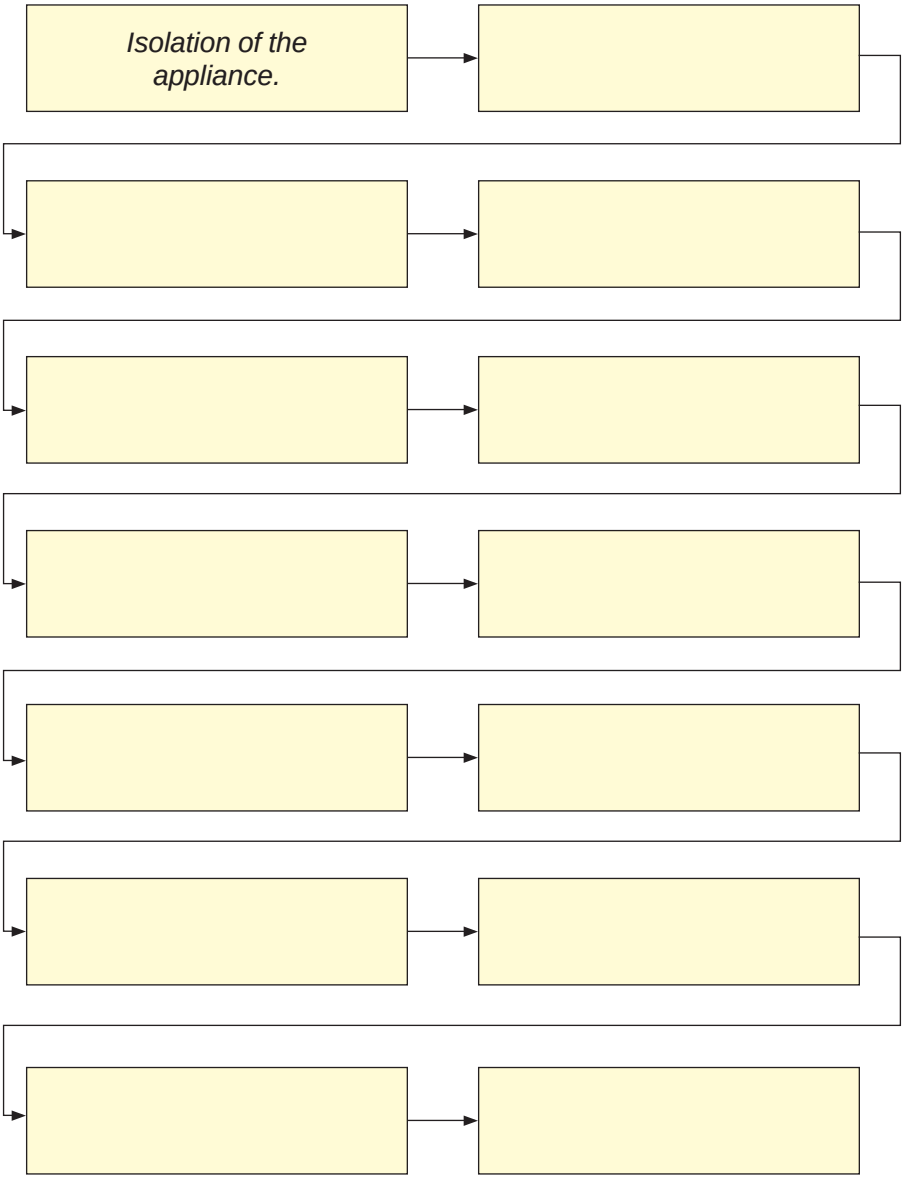
EXERCISES

1. Say which instruction each picture corresponds to, and what it illustrates.

e.g. *The second picture on the right corresponds to the fourth instruction and illustrates the terminal connectors to be removed.*

2. Write in brief all the steps to be followed for the replacement of an oven element.

e.g.



3. Say which words in the text can be replaced by the following.

1. reach: _____
2. back: _____
3. take off, detach: _____
4. needs: _____

5. replacement: _____
6. loosen, disconnect: _____
7. reassembling: _____
8. disassembling: _____
9. secure, ensure: _____
10. previous, old: _____
11. check twice: _____
12. performed, done: _____
13. before: _____
14. put back in place: _____

4. Arranging the steps of a procedure

The steps of the refitting procedure are given below in jumbled order. Arrange them correctly by adding numbers in front of the instructions.

_____ *Place top panel back in position.*
_____ *Connect wire terminals to element appropriately.*
_____ *Tighten element to support clips/slides carefully.*
_____ *Place fuse back at consumer unit board, or switch on MCB.*
_____ *Put oven inner liner back in place.*
_____ *Check for earth continuity.*
_____ *Tighten element centre fixing nut.*
_____ *Fix rear panel into place.*

5. DESCRIBING SEQUENCE OF ACTIONS

Look at the examples

*The lifting of the top panel is done **before / prior** to removing the rear panel.*
*The removing of the rear panel is done **after** lifting the top panel.*

Now make similar sentences taking your information either from the stripdown or from the refitting procedure. Don't forget to develop elliptical speech.

6. Make pairs of opposites by matching the two columns.

A	*B*
correctly	*connect, unite*
remove	*lower*
conventional	*loose*
failure	*include*
initial	*replace*
uneven	*after*
eliminate	*wrongly*

isolate	*fasten, fix*
lift	*modern*
ease	*uniform, regular*
tight	*final*
prior to	*success*

7. Classify the following words in groups according to their meaning.

essential — ease — conventional — individual — fixed — unfasten — faulty — necessary — defective — usual — set — ordinary — personal — situated — located — fundamental — single — basic — release — damaged — placed — free — important — disconnect — common — loosen

essential	*ease*	*conventional*
individual	*defective*	*fixed*

8. Choose the correct preposition from the list to fill in the gaps in the following sentences.

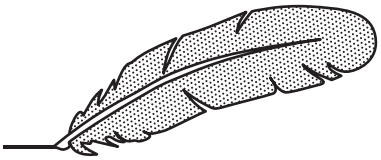
List: *behind — within — from — in — on down — at — out — to — of*

1. *Prior _____ buying a new multimeter, have a look _____ all the products _____ the market.*
2. *He is a good technician. He repaired the faulty water heater _____ ten minutes.*
3. *Run-hour meters are usually situated _____ the basement of a building.*
4. *Overloading must be the cause _____ the motor faulty operation.*
5. *I've told you so many times not to pull _____ the cord. Look what you've done now.*
6. *_____ case _____ an earth-leakage, the earth-leakage breaker will trip.*
7. *Give me that wrench to ease this rusty nut _____ the screw.*

8. *Oven thermostats are situated _____ the cooker's front panel.*
9. *Are you sure you can carry it _____?*
10. *He didn't note _____ the position of the various components, so he can't put them back _____ place.*
11. *He highlighted the subject _____ every possible way.*
12. *It's not so easy to gain access _____ an oven heating element.*

Writing Activity

Describing a procedure

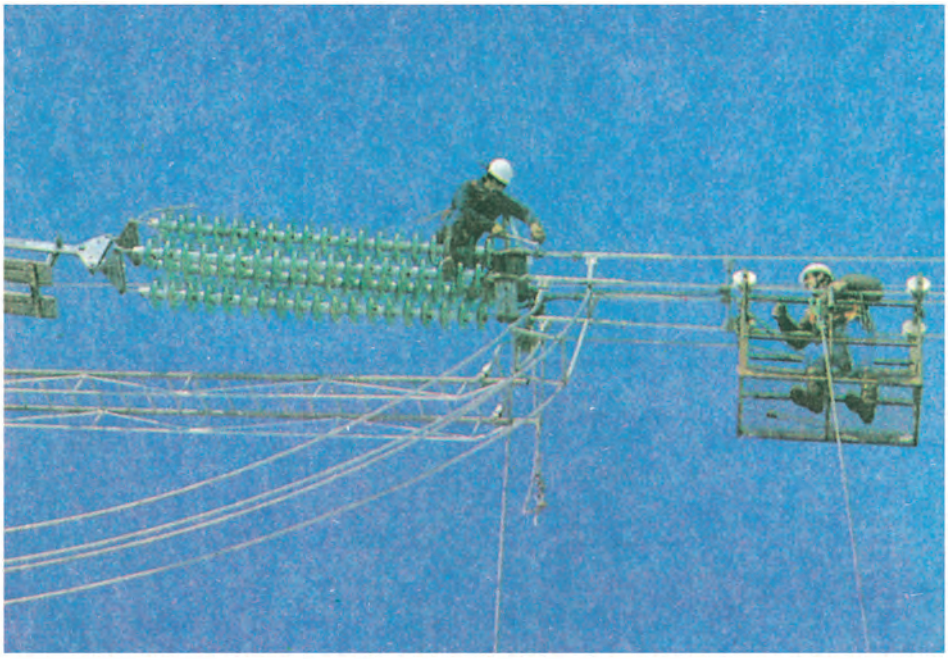


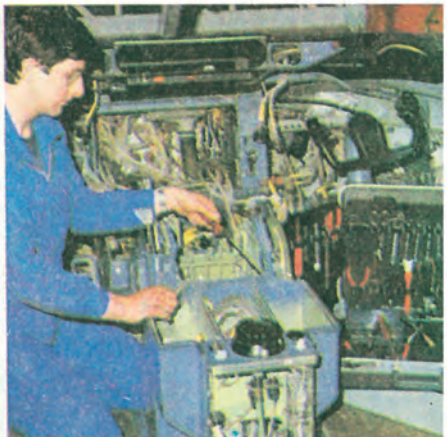
The topic of the examination paper on the subject "Electrical Appliances Maintenance and Service" was: "What should you do to replace a conventional oven faulty element? Describe all the steps you will follow". ***Imagine that you are one of the students taking this exam and carry out the task.***

EXPRESSIONS TO HELP YOU	**LINKING WORDS**
To	First .....
I will	Then .....
I would	Next .....
I should ..... in order to	The next step is to .....
I have to	After (the) + gerund/that .....
I must	Before (the) + gerund/that .....
The ..... should be + p.p.	Finally .....

UNIT 12

THE ELECTRICAL TRADE





THE ELECTRICAL TRADE

You have decided to become an electrician. In this unit you will become familiar with the nature of the trade, its values and requirements since it probably concerns a long-life occupation.
The Electrical Trade is one of the basic trades in the construction industry. It is a trade in which individual ability and skill is recognized and rewarded. The trade offers opportunities for indoor and outdoor work. Working hours and conditions of the trade permit the electrical worker to find pleasure in doing a first-class job.

Look at the statements in the table below. Discuss with your partner and decide which of these statements are requirements of / opportunities offered by the Electrical Trade. Tick the "Before" column.

BEFORE		**AFTER**
	a) Individual skills are necessary for the trade. *b) You will be asked to install and maintain electronic equipment.* *c) You will be expected to train new electricians.* *d) You have to cooperate with people in other trades.* *e) You will have opportunities for outdoor work.* *f) As an electrician, among other activities, you will get involved in cable installation and appliance servicing.* *g) You should be prepared to work in an office.* *h) You are expected to have good knowledge of Mathematics.* *i) You ought to get informed about new developments in the trade.* *j) You must be strong enough and in good physical condition.* *k) You will be expected to design buildings.* *l) You should never ignore the National Electrical Codes and Regulations.* *m) The trade offers wide career opportunities.* *n) You must always practise safe working procedures.*	

Now read the text, tick the "After" column, and see if your opinion agrees with the writer's.

1. _____

The constant increase in new types of construction and the new electrical equipment offer increasing employment opportunities in the fields of cable installation, light and power systems, motor maintenance and repair, appliance servicing and installation,

as well as in the maintenance of electronic equipment. As a result, the modern home, office and factory demand a great deal of electrical work which can be carried out only by qualified electricians.

2. _____

Educational

To succeed in the Electrical Trade, the electrician should be eager to acquire the skills and technical information required by the trade. He is also expected to have good knowledge of Mathematics, since this helps in understanding the important and necessary electrical formulas, as well as the theoretical concepts of electricity.

Physical

A person must be strong enough to perform certain duties since the trade demands a great deal of moving about, climbing and working under conditions which require muscular action.

3. _____

The electrician must like working with electrical material, be willing to do a fair share of manual labour, take an interest in his work, and plan and organize it efficiently. He is further expected to develop initiative and leadership, as well as keep informed about the developments of the trade in order to advance in his profession.
Finally, he should be sociable, polite and cooperative since he has to deal with customers and workers in other trades.

4. _____

The Electrical Trade requires a high degree of responsibility on the part of the trained technician. He must be aware of and obey the National Electrical Codes, which controls the interconnection and construction of the complex electrical systems he deals with.
Another serious responsibility is to care for the safety of himself and that of other persons who may be affected by his acts or omissions at work.

EXERCISES

1. The text is divided into big thematic areas. Add headings to them choosing from the following:

1. QUALIFICATIONS FOR EMPLOYMENT
2. OPPORTUNITIES IN THE TRADE
3. RESPONSIBILITIES
4. QUALITIES NECESSARY FOR THE TRADE

2. Use the words below, in the order they are given, to replace words in:

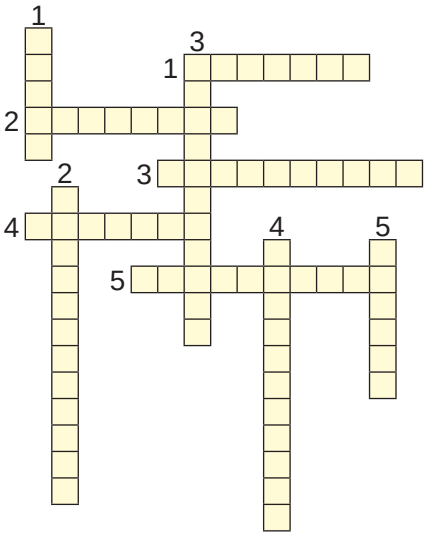
A. The introductory paragraph

1. *demands*
2. *profession / job*
3. *personal*
4. *chances*
5. *allow*

B. The text

1. *continuous*
2. *career*
3. *areas*
4. *a large amount*
5. *trained*
6. *willing*
7. *helps*
8. *work activities*
9. *design*
10. *progress*
11. *have knowledge*
12. *influenced*

3. Crossword puzzle



Across

1. *An idea or principle.*
2. *Something that has not been done though it ought to.*
3. *The ability to be a good leader.*
4. *Letters, numbers, symbols representing a scientific or mathematical rule.*
5. *Ability to decide by yourself on what is to be done.*

Down

1. *Very hard manual work that does not need much skill.*
2. *The building or creating of something.*
3. *Someone who likes working with others.*
4. *The process of keeping something in good condition by regularly checking it and doing the necessary repairs.*
5. *To give someone something in return for something useful he has done.*

4. EXPRESSING OBLIGATION / NECESSITY

Obligation has not always the same emphasis. It ranges from strong obligation (duty) up to useful advice or suggestion. The distinction is expressed with the use of different verbs.

Look at the table below

must **have to**	Both express strong obligation or necessity usually coming from a sense of duty or social responsibility **(must)** or imposed by external circumstances **(have to)**. They are also used to express emphatic advice.
e.g.	• *If you come late again, you'll be fired. You **must/have to** get up earlier in the morning.* • *He's a very interesting person. You **must** meet him.* • *When you finish school, you **have to** earn your living.*
should to **ought to**	Both express obligation, but more gentle or not so strong. It's rather a matter of conscience or good sense. They are also used to give advice or remind someone of his duty.
e.g.	*You **should/ought to** finish your work before going out.*
had better (…d' better)	Expresses even less strong obligation. It's used to give a useful advice, to make a suggestion or to warn somebody.
e.g.	*You'**d better** wear gloves when hammering on metal objects, to protect your hands from flying chips.*

Complete the following sentences choosing the appropriate verb from the table to express the kind of obligation required by the sentence.

1. *An electrician _____ install and maintain electronic equipment.*
2. *Electrical work _____ be carried out only by qualified electricians.*
3. *An electrician _____ develop initiative and leadership.*
4. *An electrician _____ be informed about the new products on the market and their specifications.*
5. *The electrician_____ practise safe working procedures.*
6. *The electrician_____ like to work with electrical material.*
7. *An electrician _____ be sociable and cooperative.*
8. *Electricians _____ be willing to do a fair share of manual labour.*

9. *An electrician _____ be strong enough to move about, climb and work under conditions which require muscular action.*
10. *The electrician _____ be eager to get the skills required by the Electrical Trade.*

5. Fill in the gaps in the following paragraphs using the words given below.

1. *The electrician should be able to _____ and repair _____ in electrical _____ and installations.*
   • damages • equipment • detect
2. *Increasing _____ opportunities are offered to _____ electricians due to the new types of _____ and new electrical equipment used nowadays.*
   • construction • career • trained
3. *An electrician should have basic knowledge of _____ in order to understand the _____ and necessary electrical _____.*
   • important • formulas • Mathematics
4. *In order to _____ in his job an electrician _____ keep informed about the _____ in the _____.*
   • ought to • trade • progress • developments
5. *An electrician _____ prepared to do _____ labour and also to _____ muscular _____.*
   • action • should be • manual • exercise

Oral practice

Imagine the following situation:

A student, who is thinking of becoming an electrician, has visited the Career Advisor of his school to discuss his choice. ***Work in pairs to prepare and perform a dialogue on the above situation.***

(One of you will take the part of the Career Advisor, and the other that of the Student). ***The information below will help you.***

STUDENT (S)	CAREER ADVISOR (C.A.)
Ask the Career Advisor about: ***career opportunities*** *and* ***fields*** *of the trade,* ***payment, working conditions, qualifications*** *and* ***responsibilities*** *required. (Draw your information from the text and your general knowledge).*	*Inform the student about the most important* ***requirements of the trade*** *and* ***the qualities of a good electrician.*** *Also ask him* ***if he is prepared to satisfy them****. (Draw your information from the text and your general knowledge).*

Expressions to help you:

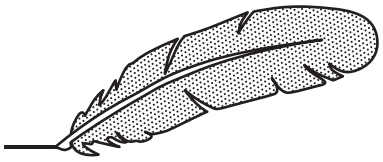
Should / must I…? *Do I have to…?* *Am I expected to…?* *Which are the…?* *Shall I…?*	*I like / don't like…* *I'm prepared to…* *Are there…?*	Are you prepared / willing / eager to…? Do you like…? Do you think you…? I hope that…? You should know that… I'd like you to keep in mind that…

Begin your dialogue like this:

S. *Good morning, sir.*
C.A. *Hello. Good morning.*
S. *I've come here to ask you for information about the speciality I'm thinking of attending.*
C.A. *Which is it, dear?*
S. *Well, I'm thinking of becoming an electrician. It's a nice job, isn't it, sir?*

Continue in the same way

Writing Activity

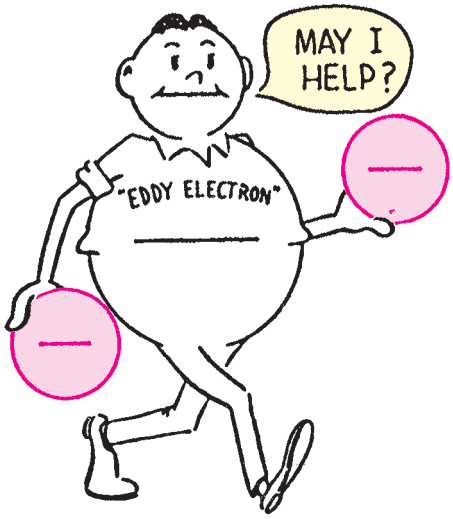


You have chosen to become an electrician. ***Write one or two paragraphs of about 100 words to justify your choice.***

(Write what you like and what you don't like in the trade, and also which of its requirements you think you will be able to satisfy).

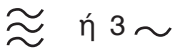
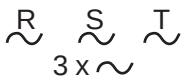
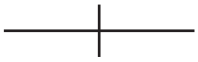
Expressions to help you:

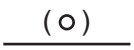
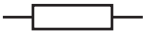
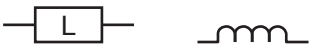
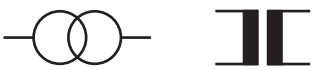
I like… Though I don't like… I think I (will be able)… I'll try… I am eager to…

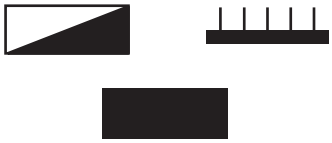
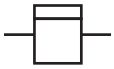


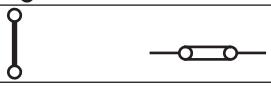
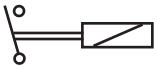
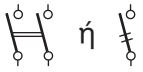
APPENDIX

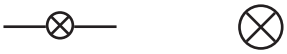
COMMON SYMBOLS USED IN ELECTRICAL DIAGRAMS

Direct current (DC)	
Alternating Current (AC)	
Three-phase AC	
DC source	
AC source	
Power supply (direction of current/energy flow)	
Battery element	
Battery	
Power line / Conductor	
Protective line/wire	
Flexible conductor	
Live line	
Three-phase AC line	
Neutral line	
Line with indication of number of wires, cables (e.g. four)	
Lines crossed over	
Lines connected (line branch)	

Line installed in conduit	
Line installed under plaster / Buried line	
Line installed on plaster / Surface line	
Line installed in plaster	
Junction / Joint box	
Earth	
Connection for protective earth wire	
Voltage leakage	
Resistor	
Inductor (air-core)	
Iron core coil / Inductor	
Capacitor	
Converter	
Contactor	
Generator	
Motor	
Transformer	
Rectifier	

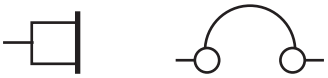
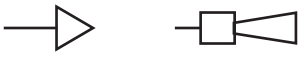
Measurement instrument	
Distribution boards	
Distribution sub-board	
Surface-mounted distribution board	
Flush-mounted distribution board	
Energy/KWh meter/Run-hour meter	
Fuse	
Circuit breaker (general symbol)	
Overcurrent protective breaker (e.g. for line protection)	
Undervoltage circuit breaker	
Earth-leakage circuit breaker a) voltage operated b) current operated	
Single-pole, one-way switch	
Cord-operated, single-pole, one-way switch	
Two-pole, one-way switch	
Three-pole, one-way switch	
Single-pole, two-circuit, single interruption switch	

Single-pole, two-circuit, double interruption switch	
Single-pole, two-way switch (aller-retour)	
Single-pole, intermediate switch	
Regulating dimmer switch	
Pushbutton	
Luminus pushbutton	
Contact normally open (N.O.)	
Contact normally closed (N.C.)	
Contact controlled by a relay	
Single-pole, one-way contact (switch)	
Two-pole, two-way contact (switch)	
Three-pole, three-way contact (switch)	
Time switch/Time relay/Timer	
Two-pole, single socket outlet	
Two-pole, twin socket outlet	
Two-pole, multiple socket outlets (e.g. with three socket outlets)	
Two-pole switched socket outlet	
Single socket outlet with earthing contact (three-pole)	
Twin socket outlet with earthing contact (three- pole)	

Multiple socket outlet with earthing contact (three-pole)	
Switched socket outlet with earthing contact (three-pole)	
Telephone socket outlet	
Television socket outlet	
Plug	
Plug with earthing contact	
Lighting point*/lamp	
Multi-lamp luminaire with indication of lamp number (e.g. four)	
Luminus indicator (signal/pilot/indicating lamp)	
Weather- / Moisture- / Waperproof luminaire or lamp	
Spotlight / Floodlight	
Luminaire for discharge (fluorescent) lamp / Discharge lamp	
Luminaire for discharge lamp with indication of lamp number (e.g. three)	
Illuminated sign	
Emergency / Safety lighting point	

* Also: light(ing) fixture or luminaire

Indicator panel	
Electrical appliance (general symbol)	
Electric cooker	
Refrigerator	
Washing machine	
Clothes drier	
Dish washer	
Water heater	
Heater with / Without fan	
Air conditioner	
Fan / Ventilator	
Freezer	
Thermostat	
Clock	
Telephone equipment/set	
Radio set	
Television set	
Amplifier	
Antenna	

Electric bell	
Buzzer	
Microphone	
Receiver / Ear/head phones	
Loudspeaker	
Main call station/doorphone	
Call panel with name plates	
Door opener	
Siren / horn	
Automatic fire detector	

UNITS OF MEASUREMENT

nV	nanoVolt	MΩ	MegaOhm
µV	microVolt	GO	GigaOhm
mV	milliVolt		
V	Volt	pF	piccoFarad
KV	KiloVolt	µF	microFarad
MV	MegaVolt	mF	milliFarad
GV	GigaVolt	F	Farad
nA	nanoAmpere	mH	milliHenry
µA	microAmpere	H	Henry
mA	milliAmpere		
A	Ampere	Hz	Hertz
KA	KiloAmpere	KHz	KiloHertz
MA	MegaAmpere	MHz	MegaHertz
GA	GigaAmpere	GHz	GigaHertz
nW	nanoWatt	VA	VoltAmpere
µW	microwatt	KVA	KiloVoltAmpere
mW	milliWatt	MVA	MegaVoltAmpere
W	Watt	GVA	GigaVoltAmpere
KW	KiloWatt		
MW	MegaWatt	Wh	Watthour
GW	GigaWatt	KWh	KiloWatthour
		MWh	MegaWatthour
Ω	Ohm	GWh	GigaWatthour
KΩ	KiloOhm		
		HP	HorsePower

MATHEMATICAL SYMBOLS AND NUMERICAL OPERATIONS

HOW TO READ FIGURES

You read them the same way as in Greek, that is from the highest to the lowest number.

Don't forget to add "and" after hundred

e.g. 8.003.002.678: 8 billion, 3 million, 2 thousand, 6 hundred and seventy eight

573.450.876: 5 hundred and seventy three million,
4 hundred and fifty thousand,
8 hundred and seventy six

HOW TO WRITE WHOLE NUMBERS (INTEGERS) AND DECIMALS

Greek people put a point (.)
to show thousands
e.g. 3.260

English people put a comma (,)
instead
e.g. 3,260

Greek people put a comma (,)
to show decimals
e.g. 7,75 (επτά κόμμα εβδομήντα πέντε)

English people put a decimal point (.)
instead
e.g. 7.75 (seven point seventy five)

HOW TO EXPRESS NUMERICAL OPERATIONS

SYMBOL	VERB	NOUN
+ (plus)	add	addition
- (minus)	subtract	subtraction
x (multiplied by…/times)	multiply	multiplication
: (divided by…/to…)	divide	division
= (equals/makes)		

e.g. 6 + 8 = 14 six plus eight equals/makes fourteen
16 - 3 = 13 sixteen minus three equals/makes thirteen
7 x 4 = 28 seven multiplied by four equals twenty eight, or seven times four makes twenty eight
48 : 8 = 6 forty eight divided by eight equals six, or forty eight to eight equals six

NOTE

The result of an addition is called sum.
The result of a subtraction is called difference.
The result of a multiplication is called product.
The result of a division is called quotient.

HOW TO READ FRACTIONS

You can read fractions in four ways.

1. Use **cardinal numbers** for the **numerator** (the number above the line) and **ordinal numbers** for the **denominator** (the number below the line).

NOTE

Cardinal Numbers	Ordinal Numbers
1	1^{st} (first)
2	2^{nd} (second)
3	3^{rd} (third)
4	4^{th} (fourth)
5	5^{th} (fifth)
6	6^{th} (sixth)
7	7^{th} (seventh)
etc.	etc.
18	18^{th} (eighteenth)
90	90^{th} (ninetieth)
100	100^{th} (hundredth)
1000	1000^{th} (thousandth)
1000000	1000000^{th} (millionth)

$\frac{1}{6}$ one sixth

e.g.

$\frac{9}{19}$ nine nineteenths

2. Use: “over” after the numerator.
3. Use: “divided by” after the numerator, which is not very common.
4. Say: “the ratio of (numerator) to (denominator)”.

$\frac{5}{7}$ five over seven
five divided by seven
the ratio of five to seven

e.g.

$\frac{1.2}{6.5}$ one point two over six point five
one point two divided by six point five
the ratio of one point two to six point five

HOW TO READ POWERS

Use the patterns:
(number) to the power (cardinal number)
(number) to the (ordinal number)

6^8 six to the (power) eight
six to the eighth

e.g.

2^5 two to the (power) five
two to the fifth

Especially for the powers of $\begin{cases} 2 \\ 3 \end{cases}$ we usually say $\begin{cases} \text{squared} \\ \text{cubed} \end{cases}$

e.g.* 4^2 four squared
8^3 eight cubed

In case of a negative power, use the pattern:
(number) to the (power) minus (ordinal number)

e.g.* 6^{-7} six to the (power) minus seven (not seventh)
10^{-4} ten to the (power) minus four (not fourth)

HOW TO READ ROOTS

Use the pattern:
(ordinal number) root of (cardinal number)

e.g. $\sqrt[6]{8}$ sixth root of eight **
$\sqrt[4]{25}$ fourth root of twenty five

Especially for the $\begin{cases} \sqrt{\ } \\ \sqrt[3]{\ } \end{cases}$ we usually say $\begin{cases} \text{square root} \\ \text{cube root} \end{cases}$

e.g. $\sqrt{6}$ square root six
$\sqrt[3]{9}$ cube root nine

** The number to be raised to a power (e.g. 4 or 8) is called "the base" while the power it is raised to (e.g. 2 or 3) is called "the exponent".*

*** The number 6 in the above symbol is called the index of the radical.*

HOW TO READ MATHEMATICAL SYMBOLS

SYMBOLS	HOW TO READ THEM
±	plus or minus
≈ or ≃	is approximately equal to
∝	is proportional to
>	greater than
<	less than
≥	greater than or equal to
≤	less than or equal to
≷	greater or less than
| a |	absolute value
%	per cent
f (x)	function of x
[( )]	in brackets/square bracket
{ }	in braces

LIST OF IRREGULAR VERBS

INFINITIVE	PAST TENSE	PAST PARTICIPLE
be	was	been
become	became	become
begin	began	begun
bend	bent	bent
bite	bit	bitten
blow	blew	blown
break	broke	broken
bring	brought	brought
build	built	built
burn	burnt	burnt
buy	bought	bought
catch	caught	caught
choose	chose	chosen
come	came	come
cost	cost	cost
cut	cut	cut
deal	dealt	dealt
do	did	done
draw	drew	drawn
drink	drank	drunk
drive	drove	driven

INFINITIVE	PAST TENSE	PAST PARTICIPLE
eat	ate	eaten
fall	fell	fallen
feel	felt	felt
find	found	found
fly	flew	flown
forget	forgot	forgotten
forgive	forgave	forgiven
freeze	froze	frozen
get	got	got
give	gave	given
go	went	gone
grow	grew	grown
hang	hung	hung
have	had	had
hear	heard	heard
hide	hid	hidden
hit	hit	hit
hold	held	held
hurt	hurt	hurt
keep	kept	kept
know	knew	known
lead	led	led
learn	learnt	learnt
leave	left	left
lend	lent	lent
let	let	let
light	lit	lit
lose	lost	lost
make	made	made
mean	meant	meant
meet	met	met
pay	paid	paid
put	put	put
read	read	read
rend	rent	rent
ride	rode	ridden
ring	rang	rung
rise	rose	risen
run	ran	run
say	said	said
see	saw	seen
sell	sold	sold
send	sent	sent

INFINITIVE	PAST TENSE	PAST PARTICIPLE
shake	shook	shaken
shine	shone	shone
shoot	shot	shot
show	showed	shown
shut	shut	shut
sing	sang	sung
sink	sank	sunk
sit	sat	sat
sleep	slept	slept
smell	smelt	smelt
speak	spoke	spoken
spend	spent	spent
spread	spread	spread
spring	sprang	sprung
stand	stood	stood
steal	stole	stolen
strike	struck	struck
sweep	swept	swept
swim	swam	swum
take	took	taken
teach	taught	taught
tear	tore	torn
tell	told	told
think	thought	thought
throw	threw	thrown
understand	understood	understood
wake	woke	woke/woken
wear	wore	worn
win	won	won
wind	wound	wound
write	wrote	written

MODEL LETTERS

BUSINESS INQUIRY LETTER

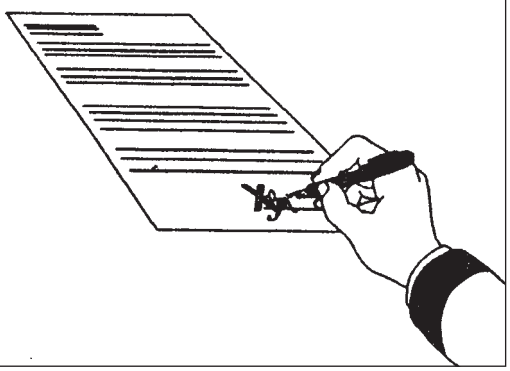
PLACING AN ORDER

LETTER OF COMPLAINT

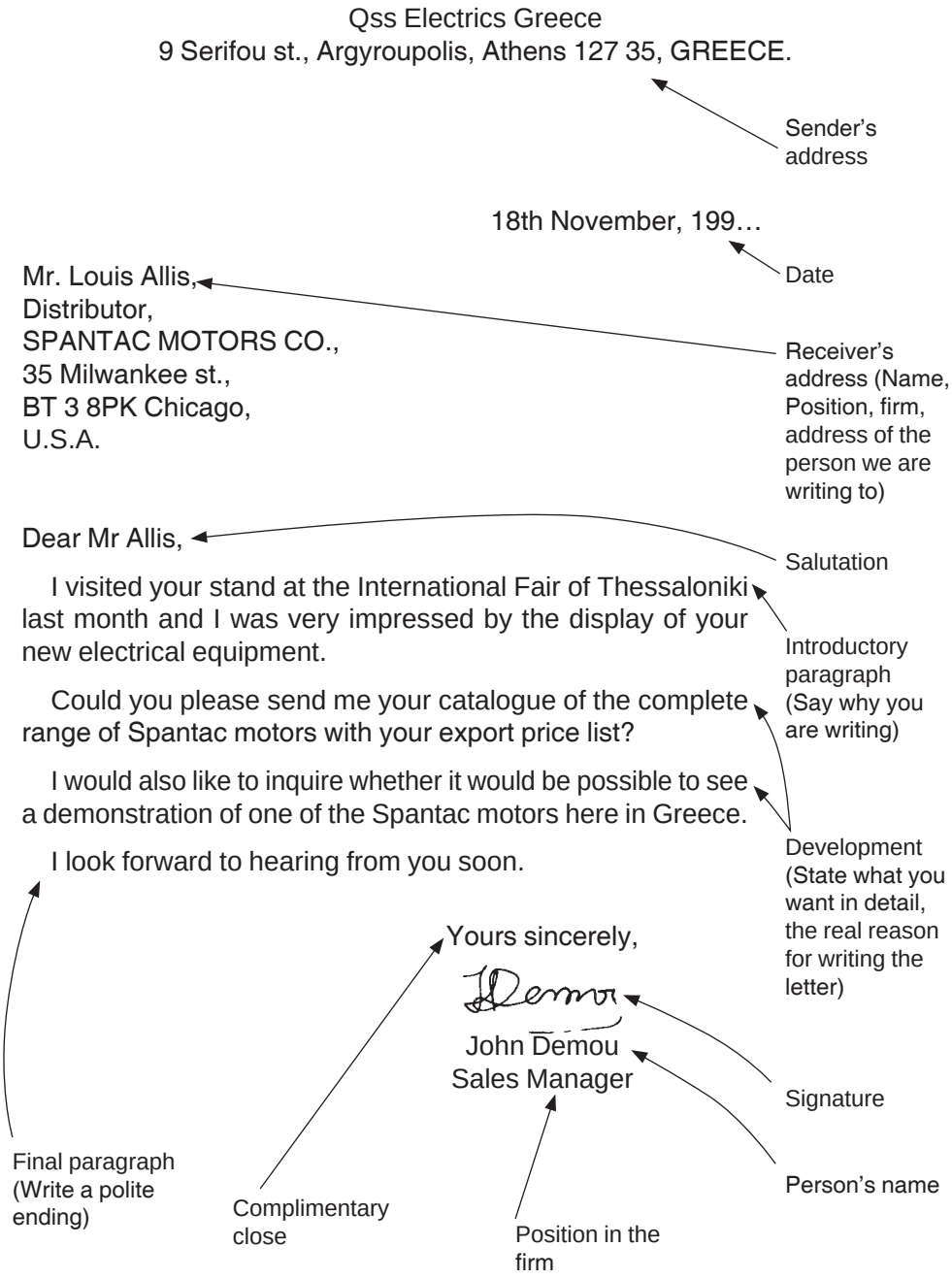
INQUIRY LETTER FOR STUDIES

LETTER OF APPLICATION (I, II)

CURICCULUM VITAE



BUSINESS INQUIRY LETTER



PLACING AN ORDER

D. THOMPSON AND CO. LTD,
75 Academias st.,
Athens 105 22.

20th February, 199…

Mr. George Thomas,
Export Manager,
MICOM LTD,
Grays Road,
Havant,
England.

Dear Mr Thomas,

Thank you very much for your letter of 15th January and your latest catalogue.

We were very satisfied with the last consignment* of goods we received from you, and should be glad if you would let us place the following order and have the items as soon as possible:
50 PAXMAN DMM 580/337
30 MILIX Oscilloscopes 2700-38
Please inform us when these have been dispatched*.

I am looking forward to hearing from you.

Yours sincerely,

Peter Michelis
Sales Manager

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* consign = send goods
* dispatch = send off (to a destination, on a journey for a special purpose).

Useful expressions

- We can accept your offer on these terms and are pleased to place/make an order for…
- With reference to your quotation, we enclose our order for immediate delivery.
- Please supply/send us the undermentioned goods.
- As the goods are urgently required, we should be grateful for delivery by… (date).
- Please confirm that you can supply this quantity by the required date.

LETTER OF COMPLAINT

D. THOMPSON AND CO. LTD,
73 Panepistimiou st.,
Athens 250 37.

28th February, 199…

The Sales Manager,
Electrical Equipment Co. Ltd.,
8 Victoria street,
Oxford Circus,
LONDON SE 4 567.

Dear Sir,

I am writing to complain about the shipment of the wrong model of the instrument transformers we ordered and the considerable delay in delivery.

In January, we ordered four L.T. 1200 instrument transformers but we received the L.T. 1500 instead. Therefore, we have arranged to return these items to you and expect that you will send us the correct model.

As this delay is causing us great inconvenience we shall be compelled to cancel our order if we do not receive the transformers, the latest, by the end of March.

We are looking forward to receiving the order the soonest possible.

Yours faithfully,

Paul Panagopoulos
Manager

Useful expressions

- We are disappointed to find that the quality of the goods you supplied does not correspond with that of the samples submitted.
- Further delay would result in the cancellation of our order.
- This order was placed on condition that we received the machines by May 1st.

INQUIRY LETTER FOR STUDIES

28 Korytsas st.,
Aghia Sophia,
185 31 Piraeus,
GREECE.

1st June, 199…

DURHAM POLYTECHNIC,
ELECTROLOGY DEPARTMENT,
PARSONS FIELD HOUSE,
THE GRADUATE SOCIETY,
DURHAM, DH 13JP,
ENGLAND.

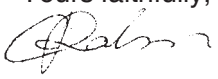
Dear Sir,

I graduated from the State Technical Lyceum, Electricians Department, in Athens last year and I am very interested in attending an advanced Electrical Engineering course at your university.

Could you please send me the studies curriculum, an application form and any other information you think necessary?

Thanking you in advance I am looking forward to hearing from you soon.

Yours faithfully,



Costas Palaskas

LETTER OF APPLICATION I

32 Eptanisou str.
Kypseli,
Athens 128 36,
GREECE.

29th May, 199…

The Personnel Manager,
D. Thompson Ltd.,
17 North st.,
Birmingham BK 17,
England.

Dear Sir,

With reference to your advertisement in the "Electrical Machines" magazine of March, I would like to apply for the position of motor repairman.

As you will see from my enclosed curriculum vitae, I have been working at "MBC Motors and Generators Co. LTD" for the last two years. I feel, therefore, that I would be a suitable candidate for the above post.

I look forward to hearing from you soon.

Yours faithfully,

G. Kambas

Useful expressions

- I recently heard from… that there is a vacancy in your Electronics department.
- Please refer to the enclosed curriculum vitae for further details.
- I would prefer to discuss the question of salary at a personal meeting.
- I would welcome the opportunity to have a personal interview.
- I would be grateful if you could send me further information and application forms.
- References concerning my character and ability can be obtained from my former employer.
- I have been told by Mr…, whom you are acquainted with, that you are expecting to make some additions to your staff and I would like to apply for one of these positions.

LETTER OF APPLICATION II

86 Solomou st.,
Cholargos,
Athens 126 32,
GREECE.

27th April, 199…

The Personnel Manager,
D. Thompson Ltd.,
17 North st.,
Birmingham BK 17,
England.

Dear Sir,

I saw your advertisement for an electrician and I would like to apply for the job.

I am 24 years old, recently discharged from the Army. I have graduated from a state Technical Lyceum, Electricians Department, in Athens and I am a fully trained electrician. Before joining the Army, I worked for an Electrical Engineering firm for 9 months.

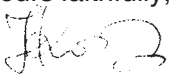
I studied English for 6 years at school and I passed the Cambridge First Certificate exams last year. I have also spent two months in England as a visitor and I can speak English fluently.

I would be grateful if you could give me further information about the nature of the job and the salary you are offering.

I would also be grateful if you could send me an application form.

I am looking forward to hearing from you soon.

Yours faithfully,



John Kostides

CURICCULUM VITAE

Surname: Kambas
First Name: George
Sex: male
Address: 32 Eptanisou st., Kypseli Athens 12835
Tel.: 82 26 698
Date of birth: 12-7-1970
Marital status: Single
Children: None

Education and qualifications

Sept. 1985 - June 1988	Technical and Vocational Lyceum Certificate (Electricians Department)
Dec. 1986	Cambridge First Certificate
Sept. 1991 - June 1992	Training course on repairing motors and generators

Experience

Jan. 1991 - Oct. 1994	M.B.C. Motors and Generators Co LTD", Service Department, 175 Aharnon Ave., Athens 112 36 Greece

Military Service

Sept. 1988 - Oct. 1990	Air Force

GLOSSARY

A

ability = ικανότητα
abnormal = ανώμαλος, αντικανονικός
absolute = απόλυτος
absolute value = απόλυτη τιμή
abroad = στο εξωτερικό, έξω, μακρυά
absorb = απορροφώ
accept = δέχομαι
access = προσπέλαση, πρόσβαση
accessories = εξαρτήματα
accommodation = κατάλυμα, διαμονή
account = λογαριασμός, υπολογισμός, έκθεση
accumulate = συσσωρεύω
accurate = ακριβής
achievement = επίτευγμα, κατόρθωμα
acid = οξύ, όξινος
acquaint = γνωρίζω, κάνω γνωστό
across = σταυρωτά, δια μέσου, εγκαρσίως, καθέτως
action = πράξη, ενέργεια, δράση
activity = δραστηριότητα, ενεργητικότητα
add = προσθέτω
addition = πρόσθεση
additional = πρόσθετος, συμπληρωματικός
address = διεύθυνση, απευθύνω
adjective = επίθετο
adjust = ρυθμίζω, προσαρμόζω, τακτοποιώ
adjustable = ρυθμιζόμενος
adjustment = ρύθμιση, προσαρμογή
admit = δέχομαι, επιτρέπω την είσοδο, παραδέχομαι
advance = προχωρώ, προβιβάζω, προωθώ, προκαταβάλλω, προοδεύω
advanced = προχωρημένος, ανώτερος, προηγμένος, εξελιγμένος
advantage = πλεονέκτημα
adverb = επίρρημα
advertise = διαφημίζω, γνωστοποιώ
advertisement = διαφήμιση
advertising campaign = διαφημιστική καμπάνια (εκστρατεία)
advice = συμβουλή
advisable = φρόνιμος, σωστός, αξιοσύστατος, συμβουλεύσιμος, συνιστώμενος
advise = συμβουλεύω
advisor = σύμβουλος
Aegean = Αιγαίο
affect = επηρεάζω, επιδρώ, συγκινώ
agent = πράκτορας, φορέας
agree = συμφωνώ

agreement = συμφωνία
aggressive = επιθετικός, εχθρικός
aid = βοηθώ, υποστηρίζω, συμβάλλω, βοήθεια
aim = σκοπός
air-forces = αεροπορικές ένοπλες δυνάμεις
allen-hex sockets = κλειδιά άλλεν
allow = επιτρέπω, δέχομαι, συγχωρώ
alloy = κράμα
along = κατά μήκος
alternative = εναλλακτικός
alternator = εναλλακτήρας, γεννήτρια συνεχούς ρεύματος
amber = κεχριμπάρι
ammeter = αμπερόμετρο
amount = ποσό
amplifier = ενισχυτής
analog = αναλογικός
ancient = αρχαίος
announce = αναγγέλλω, ανακοινώνω
announcement = αγγελία, ανακοίνωση
annual = ετήσιος
antenna = κεραία
apparatus = συσκευή
apart (from) = εκτός (από)
application = εφαρμογή, αίτηση
apply = εφαρμόζω, κάνω αίτηση, υλοποιώ
appointment = διορισμός, ραντεβού
appropriate = κατάλληλος
approximately = κατά προσέγγιση, περίπου
area = περιοχή, έκταση, ζώνη
argue = συζητώ, υποστηρίζω, φιλονικώ, αιτιολογώ, επιχειρηματολογώ
argument = επιχείρημα, συζήτηση, λογομαχία
arise = προκύπτω, σηκώνομαι, απορρέω
armature-winding = τύλιγμα/περιέλιξη στάτη/τυμπάνου
arrange = τακτοποιώ, διευθετώ, διαρθρώνω, (δια)κανονίζω
arrangement = διακανονισμός, διευθέτηση
assist = βοηθώ, συνεργάζομαι, ενίσχυση
assistance = βοήθεια, συνδρομή
assistant = βοηθός
associate = συνδέω, συνεταιρίζομαι, συσχετίζω
association = εταιρεία, σύλλογος, συνεταιρισμός, συσχετισμός
attach = συνδέω, προσαρμόζω, προσαρτώ, προσκολλώ
attachment = προσάρτημα, εξάρτημα
attack = επιτίθεμαι, έφοδος, επίθεση
attempt = επιχειρώ, προσπαθώ, προσπάθεια
attend = παρακολουθώ, φοιτώ

attention = προσοχή, φροντίδα
attitude = στάση, συμπεριφορά
attract = προσελκύω, τραβάω
attraction = έλξη, γοητεία, θέαμα
audible = ακουστός, ευδιάκριτος
authority = εξουσία, αρμοδιότης
auxiliary = βοηθητικός
available = διαθέσιμος
avoid = αποφεύγω
avoidable = αποφευκτός, που μπορεί να αποφευχθεί
aware = ενήμερος
axle = άξονας, τροχός

B

bare = γυμνός
base = βάση (χημεία)
barrel = βαρέλι
bear in mind = έχω στο νου μου, θυμάμαι
bearing/ball bearing = τριβέας, ρουλεμάν
behind = πίσω από
bell = κουδούνι
bench = πάγκος
bend = κάμπτω, λυγίζω
benefit = πλεονέκτημα, ωφέλεια
bill = λογαριασμός
blade = λεπίδα, λάμα
blank = κενός, άγραφτος
blast = φύσημα αέρα, έκρηξη, εκτόνωση αερίων
block diagram = συνοπτικό διάγραμμα
blow = καίγομαι (για ασφάλεια π.χ.), πνέω, φυσώ, φύσημα ανέμου, χτύπημα
blow off = εκτινάσσω με την ισχύ αέρα
board = σανίδα, συμβούλιο, επιτροπή, πινακίδα, πίνακας
boiler = καζάνι, βιομηχανικός λέβητας, βραστήρας
bold-typed letters = μαυρισμένα γράμματα
bolt = μπουλόνι
bonus = δώρο, φιλοδώρημα, επίδομα
bound = δεμένος, δεσμευμένος, συνδεδεμένος, υποχρεωμένος, όριο, σύνορο, περιορίζω
bracelet = βραχιόλι
brace = μύστακας (μαθηματικό σύμβολο)
bracket = παρένθεση, αγκύλη
in brackets = σε παρένθεση, σε αγκύλες

branch = κλάδος, παρακλάδι, υποκατάστημα
brass = μπρούντζος, ορείχαλκος
bridge = γέφυρα, γεφυρώνω
brightness = φωτεινότητα
broadcast = μεταδίδω (από το ραδιόφωνο π.χ.), εκπέμπω, εκπομπή
brochure = διαφημιστικό φυλλάδιο
bronze = μπρούντζος, ορείχαλκος
broom = σκούπα
brush = ψήκτρα, καρβουνάκι
brush holder = υποδοχέας ψηκτρών
brush up = φρεσκάρω (γνώσεις, θέμα κ.λπ.)
burn = έγκαυμα, κάψιμο, καίω, φωτίζω, φλέγομαι
burned line = χωνευτή γραμμή (ηλεκτ.)
burst = σπάσιμο, έκρηξη, ξέσπασμα, εκρήγνυμαι, προκαλώ έκρηξη βόμβας
busbar connections = μπάρα ηλεκτρικής σύνδεσης
bush = δακτύλιος (στεγανωτικός), παρέμβυσμα
button = κουμπί

C

cable = καλώδιο
calibration = μέτρηση, ρύθμιση
campaign = εκστρατεία, καμπάνια
cancel = ακυρώνω
candidate = υποψήφιος
candle = κερί
capacitance = χωρητικότητα, ικανότητα αποθήκευσης ηλ. φορτίου
capacitor = πυκνωτής
capacity = ικανότητα, χωρητικότητα
capital = πρωτεύουσα, κεφάλαιο, κεφαλαίο (γράμμα), πρωτεύων
carbon = άνθρακας
cardinal (number) = απόλυτο αριθμητικό, απόλυτος αριθμός
care = ενδιαφέρομαι, φροντίζω, ενδιαφέρον, φροντίδα
careful = προσεκτικός
careless = απερίσκεπτος, ξέγνοιαστος, απρόσεχτος
carelessness = απερισκεψία, αδιαφορία, αμέλεια
carpet = χαλί, τάπητας
carry out = εκτελώ, πραγματοποιώ, φέρνω σε πέρας
cartridge = φυσίγγιο
casing = περίβλημα, θήκη
cassette recorder = κασσετόφωνο
catch = αρπάζω, πιάνω, σύλληψη
cause = προκαλώ, προξενώ, αιτία
ceiling = ταβάνι, οροφή

cell = στοιχείο, κύτταρο, στοιχείο συσσωρευτού
central heating = κεντρική θέρμανση
centrifugal = φυγοκεντρικός
certificate = πιστοποιητικό
chamber of engineers = Τεχνικό Επιμελητήριο
chance = ευκαιρία, τύχη, σύμπτωση, τυχαίος, συμπτωματικός
channel = κανάλι, πορθμός
charge = φορτίζω, γεμίζω, φορτίο
chart = χάρτης, διάγραμμα, γραφική παράσταση
chisel = κοπίδι, κόβω με κοπίδι, σκαρπέλο
circuit = κύκλωμα
circuit breaker = διακόπτης κυκλώματος
circuit diagram = διάγραμμα κυκλώματος (αναλυτικό)
circumstances = περιστάσεις, συνθήκες, περιστατικά
civil engineer = πολιτικός μηχανικός
cladding = επένδυση, κάλυμμα
classification = ταξινόμηση
classify = ταξινομώ, κατατάσσω
clause = πρόταση
  main clause = κύρια πρόταση
climb = αναρριχώμαι, ανεβαίνω, αναρρίχηση, ανάβαση
clip = συνδετήρας
clockwise = δεξιόστροφος, δεξιόστροφα
closed circuit = κλειστό κύκλωμα
clothes drier = στεγνωτήριο ρούχων
coal = κάρβουνο
coat = ντύνω, σκεπάζω, καλύπτω, κάλυμμα, σακκάκι
coating = επένδυση
code = κώδικας
coherence = συνοχή
coherent = αυτός που έχει συνοχή, συνεκτικός
coil = πηνίο, περιέλιξη, σπείρα
collect = συλλέγω, μαζεύω, συγκεντρώνω
column = στήλη
combination = συνδυασμός
combination pliers = πένσα γενικής χρήσεως
combine = συνδέω, συνδυάζω
combustion = ανάφλεξη, καύση
come to a conclusion = οδηγούμαι/φθάνω σε συμπέρασμα
comfort = ανακούφιση, παρηγοριά, άνεση, ανακουφίζω
comment = (κόμεντ) = σχόλιο παρατήρηση
comment = (κομέντ) = σχολιάζω
communication = επικοινωνία
community = κοινότητα, κοινωνία
commutator = συλλέκτης

comparative = συγκριτικός
compare = συγκρίνω
comparison = σύγκριση
compatible = συμβατός, συμβιβάσιμος, ταιριαστός, συνδυαζόμενος
compel = εξαναγκάζω, υποχρεώνω, επιβάλλω
compete = συναγωνίζομαι
complain = παραπονούμαι
complaint = παράπονο
complex = περίπλοκος, (πολυ)σύνθετος, σύμπλεγμα
complicate = περιπλέκω, μπερδεύω
complicated = περιπεπλεγμένος, μπερδεμένος, σύνθετος
component (part) = εξάρτημα, συστατικό μέρος
compose = συνθέτω
composition = σύνθεση, έκθεση, χημική σύνθεση, ουσία
compound = σύνθετος, χημική ένωση
compound excitation motor = ηλεκτροκινητήρας σύνθετης διέγερσης
comprehensible = κατανοητός
comprise = περιλαμβάνω
concern = αφορώ, υπόθεση, συμφέρον, ενδιαφέρον
concerning = όσον αφορά, σχετικά με
conclude = συμπεραίνω, τελειώνω, καταλήγω
conclusion = συμπέρασμα, απόφαση, κατάληξη
condenser = συμπυκνωτής
condition = όρος, προϋπόθεση, συνθήκη
conditional = γενόμενος υπό όρους, υποθετικός
conditional sentense = υποθετική πρόταση
conductance = αγωγιμότητα
conductor = αγωγός ηλ. ρεύματος, αγωγός, διευθυντής
conduit = σωλήνας ηλεκτρικών εγκαταστάσεων (διέλευσης καλωδίων)
conduit bender = εργαλείο κάμψης σωλήνων ηλ. εγκαταστάσεων, κουρμπαδόρος
conduit vice = σωληνομέγγενη
confirm = επιβεβαιώνω, επικυρώνω
confirmation = επιβεβαίωση, σταθεροποίηση, επικύρωση
confusion = σύγχυση, μπέρδεμα
connect = συνδέω
connection = σύνδεση, συνδεσμολογία
connector = συνδετήρας
consensus = ομοφωνία, συναίνεση
consent = συγκατάθεση, συμφωνία, συγκατατίθεμαι
consequently = συνεπώς, κατά συνέπεια
consider = νομίζω, θεωρώ, εξετάζω, λαμβάνω υπ' όψη
considerable = σημαντικός, υπολογίσιμος
considerably = αξιόλογα, υπολογίσιμα
consideration = θεώρηση, μελέτη, εξέταση

consist (of) = συνίσταμαι, αποτελούμαι
constant = σταθερός, συνεχής, ακλόνητος
construct = κατασκευάζω, οικοδομώ
construction = κατασκευή, οικοδόμηση, σύνταξη, οικοδόμημα
construction plan = κάτοψη (σχέδιο)
consultant = σύμβουλος
consumption = κατανάλωση, σπατάλη
contact = επαφή, σχέση, έρχομαι σε επαφή
contactor = επαφέας
contain = περιέχω, περιλαμβάνω
contaminate = μολύνω
contamination = μόλυνση
content = περιεχόμενο, περιεκτικότητα
continuity = αγώγιμη συνέχεια
continuity test = έλεγχος, αγώγιμης συνέχειας
continuous = συνεχής, αδιάκοπος
contradict = αντιλέγω
contrast = αντίθεση, αντιπαραβολή, αντιτίθεμαι
contribute = συνεισφέρω, συντελώ, συμβάλλω, συνεργάζομαι
contribution = εισφορά, συνεισφορά, συμβολή, συνεργασία
controversy = αμφισβήτηση, λογομαχία, αντιπαράθεση
convenient = κατάλληλος, βολικός
conventional = συμβατικός, συνήθης, χωρίς πρωτοτυπία
conversion = μετατροπή, μεταστροφή
convert = μετατρέπω, αντιστρέφω
converter = μετατροπέας
cook = μαγειρεύω
cooker (electric) = ηλεκτρική κουζίνα
cool = δροσερός, ψυχρός, δροσιά, ψύχραιμος, ήρεμος, δροσίζω, κρυώνω, ψύχω
cool down = δροσίζω, ηρεμώ
coolant = ψυκτικό, ψυκτική ουσία
cooperate = συνεργάζομαι
cooperative = συνεργάσιμος
coordinate = συντονίζω, εναρμονίζω
coordinator = συντονιστής
copper = χαλκός
cord = χοντρό καλώδιο, κορδόνι
core = πυρήνας
corporation = σύλλογος, σωματείο, εταιρεία
correspond = αντιστοιχώ, ανταποκρίνομαι, αλληλογραφώ
corresponding = αντίστοιχος
corridor = διάδρομος
corrosion = οξείδωση, σκωρίαση, διάβρωση
couple = ζεύγος, ταιριάζω, συνδέω (εξαρτήματα, μηχανήματα)
cover = σκέπασμα, κάλυμμα, περίβλημα, καλύπτω, σκεπάζω

crack = ρωγμή, ράγισμα, χαραμάδα, σπάω, ραγίζω
create = δημιουργώ, παράγω
crimp = συμπιέζω, πρεσσάρω (ακροδέκτες)
crimping pliers = πρέσσα ακροδεκτών
cross-head screw = βίδα με σταυρωτή κεφαλή
cross out = διαγράφω
cross over = διασχίζω δρόμο, διασταυρώνω, διασταυρώνομαι
cross section = τομή
cross-point screwdriver = σταυροκατσάβιδο
crucial = κρίσιμος, αποφασιστικός
cube root = κυβική ρίζα
cubed = εις τον κύβο, στην 3η δύναμη
cue = σύνθημα, νύξη
current = ρεύμα, ροή, τρέχων
current openings = ανοικτές/κενές θέσεις εργασίας
curriculum vitae = βιογραφικό σημείωμα
customer = πελάτης
cutter = κόφτης
cutting = κόψιμο, απόκομμα (εφημερίδας, περιοδικού κ.λπ.)

D

dam = φράγμα
damage = ζημιά, βλάβη, βλάπτω, ζημιώνω, κάνω ζημιά
damaged = κατεστραμμένος, ο έχων βλάβη
damp = υγρασία, μουσκεύω, υγρός
data = δεδομένα, στοιχεία
date = ημερομηνία, ραντεβού
dead circuit = νεκρό κύκλωμα (χωρίς ρεύμα)
deal (with) = ασχολούμαι, διαπραγματεύομαι
debit = χρεώνω, χρέωση, χρέος
decade = δεκαετία
decide = αποφασίζω
decimal = δεκαδικός
decimal point = τελεία που χωρίζει ακέραιους από δεκαδικούς αριθμούς, αντίστοιχο της υποδιαστολής
decision = απόφαση, επιλογή
decline = αποκλίνω, παρακμάζω, αρνούμαι, παρακμή, πτώση
decrease = μειώνω, ελαττώνω
defective = ελαττωματικός
deficiency = ανεπάρκεια, ελάττωμα, έλλειψη
define = ορίζω, προσδιορίζω, καθορίζω
definite = οριστικός, ορισμένος, συγκεκριμένος, σαφής, καθορισμένος

definition = ορισμός, προσδιορισμός
deliver = παραδίδω, δίνω, απελευθερώνω
delivery = επίδοση, παράδοση, διανομή
delta connection = σύνδεση τριγώνου
demand = ζητώ, απαιτώ, απαίτηση, ζήτηση
demonstrate = επιδεικνύω, διαδηλώνω
demonstration = επίδειξη, διαδήλωση
denominator = παρονομαστής
dense = πυκνός
department = τμήμα, κλάδος, διαμέρισμα
depend (on/upon) = εξαρτώμαι
dependence = εξάρτηση
deposit = καταθέτω, κατάθεση, απόθεμα
derivative = παράγωγος, απορρέων, προερχόμενος
derive = αντλώ, απορρέω, προέρχομαι
describe = περιγράφω
description = περιγραφή
design = σχεδιάζω, σχεδιασμός, σχέδιο
designer = σχεδιαστής
despite = παρά το... σε πείσμα του...
destroy = καταστρέφω
destruction = καταστροφή
detail = λεπτομέρεια
detailed = λεπτομερής
detect = ανιχνεύω, ανακαλύπτω, βρίσκω
detection = ανίχνευση, ανακάλυψη
determine = καθορίζω, αποφασίζω
develop = αναπτύσσω, εξελίσσω
development = ανάπτυξη, εξέλιξη
device = συσκευή, επινόηση
dial = παίρνω αριθμό στη συσκευή του τηλεφώνου, ένδειξη, διαβάθμιση, πίνακας ενδείξεων, καντράν
die = βιδολόγος, κοχλιοτόμος
dielectric = διηλεκτρικό
diesel oil = πετρέλαιο μηχανής
diesel engine = μηχανή εσωτερικής καύσεως συστήματος Ντήζελ, πετρελαιομηχανή
dig = σκάβω
digital = ψηφιακός
dimmer (control) = ρυθμιστής έντασης
direct = κατευθύνω, ευθύς, ίσιος
direction = κατεύθυνση, διεύθυνση, προορισμός
dirt = ακαθαρσία, βρωμιά
dirty = βρώμικος, ακάθαρτος
disadvantage = μειονέκτημα

disagree = διαφωνώ
disappointed = απογοητευμένος
disaster = καταστροφή, συμφορά, θεομηνία
discharge = εκφόρτιση, αποφόρτιση, ξεφόρτωμα
discharge lamp = λάμπα φθορισμού (κενώσεων)
disconnect = αποσυνδέω
discuss = συζητώ
disobey = παρακούω, παραβαίνω διαταγή
dispatch = αποστολή, διεκπεραίωση, αποστέλλω, διεκπεραιώνω, επισπεύδω
displace = εκτοπίζω, μετατοπίζω
display = εκθέτω, επιδεικνύω, έκθεση, επίδειξη, πίνακας αναγραφής αποτελεσμάτων ηλεκτρικών οργάνων
distance = απόσταση, διάστημα, δρόμος
distinguish = διακρίνω, ξεχωρίζω
distort = διαστρέφω, στραβώνω, παραμορφώνω
distribute = διανέμω, κατανέμω
distribution = διανομή, κατανομή
distribution board = πίνακας διανομής ηλ. ρεύματος
disturb = διαταράσσω, ενοχλώ, αναστατώνω
divide = διαιρώ
dividers = διαστημόμετρο, διαβήτης
division = διαίρεση
domestic = οικιακός, οικογενειακός
doorphone = θυροτηλέφωνο
double = διπλός
dramatically = δραματικά, σημαντικά
draw = σύρω, τραβώ, σχεδιάζω
drawing = σχέδιο
drill = τρυπάνι, τρυπώ με τρυπάνι
drive = οδηγώ, πηγαίνω με αυτοκίνητο, κινώ
dry-type transformer = μετασχηματιστής ξηρού τύπου
due (to) = οφειλόμενος, λόγω του..., χάριν του..., οφείλεται σε...
dull = ανιαρός, σκοτεινός, θαμπός, πληκτικός, μη αιχμηρός/κοφτερός, στομωμένος
dust = σκόνη, ξεσκονίζω
duty = καθήκον
dynamo = γεννήτρια, δυναμό

E

earphones = ακουστικά
earn = κερδίζω, βγάζω χρήματα, αποκτώ
earth = γη, κόσμος, χώμα, έδαφος, γειώνω
earthing = γείωση

earth leakage = διαρροή ηλ. ρεύματος προς τη γη
earth-leakage breaker = ρελέ διαφυγής/προστασίας
earthquake = σεισμός
earth tester = ελεγκτής γείωσης
ease = χαλαρώνω, λασκάρω, ελευθερώνω, ηρεμία, ησυχία
edge = κόψη, άκρη, γωνία, χείλος, ακμή, χαράζω
effect = επίδραση, αποτέλεσμα, επιρροή
effective = αποτελεσματικός
efficient = ικανός, αποδοτικός, αποτελεσματικός
electrification = ηλεκτροδότηση, εξηλεκτρισμός
electrify = ηλεκτροδοτώ, τροφοδοτώ με ηλεκτρικό ρεύμα
electrocardiograph = ηλεκτροκαρδιογράφος
electrocuted = αυτός που έχει πάθει ηλεκτροπληξία
electromagnet = ηλεκτρομαγνήτης
electromagnetic = ηλεκτρομαγνητικός
electromagnetism = ηλεκτρομαγνητισμός
electromotive = ηλεκτρεγερτικός
electrostatic = ηλεκτροστατικός
element = στοιχείο (σύσταση ύλης), εξάρτημα
elevator = ανελκυστήρας, αναβατήρας, ανυψωτήρας
eliminate = απομακρύνω, αποβάλλω, εξαλείφω
elimination = απομάκρυνση, εξάλειψη, αποκλεισμός
emergency = επείγουσα ανάγκη
emit = εκπέμπω, εκτοξεύω
employ = απασχολώ, χρησιμοποιώ, εφαρμόζω, δίνω εργασία, προσλαμβάνω
employee = υπάλληλος
employment = απασχόληση, χρησιμοποίηση, επάγγελμα, πρόσληψη
employer = εργοδότης
enclose = εσωκλείω
end cutter = εμπροσθοκόπτης
ending = τελικός, τελευταίος, τερματισμός, αποπεράτωση, απόληξη, τελείωμα
energy meter = μετρητής ηλεκ. ενέργειας
engage = απασχολώ, δεσμεύω, αναλαμβάνω
engine = μηχανή
engineer = μηχανικός
engineering = η μηχανική επιστήμη
enjoy = απολαμβάνω, χαίρομαι
ensure = ασφαλίζω, εξασφαλίζω, βεβαιώνω-ομαι
enter = εισέρχομαι
entertain = διασκεδάζω
entertainment = διασκέδαση
entire = ολόκληρος, ακέραιος, πλήρης
entrance = είσοδος

environment = περιβάλλον
environmental = περιβαλλοντικός
equal = ίσιος, όμοιος
equality = ισότητα
equip = εξοπλίζω
equipment = εξοπλισμός
equivalent = ισοδύναμος, ισότιμος, αντίστοιχος
era = εποχή
eraser = ξέστης, γομολάστιχα
error = σφάλμα, λάθος
escape = δραπετεύω
essential = ουσιώδης, ουσιαστικός, βασικός, σημαντικός
establish = εγκαθιστώ, εγκαθιδρύω, επιβάλλω
estimate = εκτιμώ, υπολογίζω, λογαριάζω, εκτίμηση, λογαριασμός, (προ) ϋπολογισμός
event = γεγονός
exact = ακριβής, πιστός
exactly = ακριβώς
examination = εξέταση, επιθεώρηση, δοκιμασία
examine = εξετάζω, επιθεωρώ, μελετώ
excess = υπερβολή, πλεόνασμα
excessive = υπερβολικός, υπέρμετρος
exchange = ανταλλάσσω, ανταλλαγή, συνάλλαγμα
excitation = διέγερση
exciter = διεγέρτρια, δυναμομηχανή
exciting = συγκινητικός, ερεθιστικός, διεγερτικός
excuse = συγχωρώ, δικαιολογώ, δικαιολογία, πρόφαση
exhaust = εξάτμιση (μηχανής), εξαγωγή (αερίου), εξαντλώ
exist = υπάρχω
expand = διαστέλλω, διαστέλλομαι, απλώνω, απλώνομαι, επεκτείνω, επεκτείνομαι
expansion = διαστολή, επέκταση
expect = προσδοκώ, αναμένω, περιμένω
expenses = έξοδα, δαπάνες
experience = εμπειρία
experiment = πείραμα
experimentation = πειραματισμός
expert = έμπειρος, ειδικός
exploit = εκμεταλλεύομαι
exploitation = εκμετάλλευση
explosion = έκρηξη
explosive = εκρηκτικός
export = εξάγω, εξαγωγή
extend = εκτείνω, επεκτείνω, επεκτείνομαι, εξαπλώνω
extension = επέκταση, έκταση, εσωτερική τηλεφωνική γραμμή

extinguish = σβήνω, εξαλείφω, καταργώ
extreme = άκρος, υπερβολικός, ακραίος, άκρο
extremely = εξαιρετικά, υπερβολικά

F

face = αντιμετωπίζω, πρόσωπο, όψη, εμφάνιση
facilitate = διευκολύνω
facility = ευχέρεια, ευκολία, διευκόλυνση
factor = παράγοντας
factory = εργοστάσιο
fail = αποτυγχάνω, αστοχώ, παραλείπω
failure = αποτυχία, βλάβη
fair = εμπορική έκθεση, παζάρι, πανηγύρι, δίκαιος, σωστός
faithfully = πιστά, τίμια, με εκτίμηση
false = ψευδής, ψεύτικος, εσφαλμένος
familiarize = εξοικειώνω, εξοικειώνομαι
fan = ανεμιστήρας, εξαεριστήρας, ριπίζω, (εξ)αερίζω
farther = πιο μακρινός, απώτερος, πιο μακριά
fasten = στερεώνω, σφίγγω, δένω
fatal = μοιραίος, καταστρεπτικός, θανάσιμος
fault = σφάλμα, ελάττωμα
fault-finding chart = πίνακας εντοπισμού βλάβης
faulty = ελαττωματικός, ατελής
favour = χάρη, εύνοια, προτίμηση, συμπάθεια
favourably = ευνοϊκά
favourite = ευνοούμενος, προτιμώμενος, αγαπημένος
feature = χαρακτηριστικό, ιδιομορφία
female = θηλυκός, γυναικείος, γυναίκα
field = πεδίο, τομέας, χωράφι
fight = παλεύω, πολεμώ, αγώνας, μάχη, πάλη
figure = ψηφίο, αριθμός, σχήμα, μορφή, εικόνα
figurative diagram = εικονογραφημένο διάγραμμα
file = λίμα, λιμάρω
fill = γεμίζω
fill (in) = συμπληρώνω
fire extinguisher = πυροσβεστήρας
firm = εταιρεία, φίρμα, στερεός, σταθερός, αμετακίνητος
fission = διάσπαση
fit = συναρμολογώ, ταιριάζω, προσαρμογή, εφαρμογή
fix = στερεώνω, προσαρμόζω
fixed = σταθερός, μόνιμος, στερεωμένος, ακίνητος
fixture = εξάρτημα

flash = λάμψη, φλόγα, αστραπή
flash light = ηλεκτρικός φακός
flat = επίπεδος, οριζόντιος, διαμέρισμα, όροφος
flat-nose pliers = πλατυτσίμπιδο
flat-tip screwdriver = κατσαβίδι εγκοπής (κοινό)
flexible = εύκαμπτος, ευλύγιστος, ελαστικός
flexible tape = εύκαμπτη μετροταινία
flood = πλημμυρίζω, κατακλύζω, πλημμύρα
floodlight = προβολέας
flow = ρέω, ροή
flowchart = διάγραμμα ροής
fluently = με ευχέρεια, άνετα
fluorescent lamp = λάμπα φθορισμού
flush mounted = χωνευτός
flux = ροή, ρευστοποιώ
fold = διπλώνω
folding rule = πτυσσόμενο μέτρο
foodstaff = τρόφιμα, τροφή
foolishness = παραλογισμός, απερισκεψία, ηλιθιότης
footwear = υπόδημα, υπόδεση
force = δύναμη, βία, εξαναγκασμός, εξαναγκάζω
form = μορφή, σχήμα, διαμόρφωση, σχηματίζω, διαμορφώνω, έντυπο
formal = τυπικός, επίσημος
formula = τύπος (μαθηματικός π.χ.)
fossil = απολίθωμα
fossil fuels = ορυκτά καύσιμα
foundation = βάση, θεμέλιο, ίδρυμα
fraction = κλάσμα
frame = πλαίσιο, πλαισιώνω
frequency = συχνότητα
freezer = ψύκτης
friendship = φιλία
front = μπροστινός, μέτωπο, αντιμετωπίζω
fuel = καύσιμο
fulfill = εκπληρώνω, ικανοποιώ
function = λειτουργία, συνάρτηση (Μαθημ/κά)
functional test = έλεγχος λειτουργίας
fund = χρηματικό ποσό, απόθεμα, χρηματοδοτώ
fundamentally = θεμελιωδώς
furnish = εφοδιάζω, παρέχω, επιπλώνω
further = περαιτέρω, μακρύτερα, πρόσθετος, επί πλέον
fuse = ασφάλεια
fuse link = φυσίγγιο

G

gain access to = αποκτώ πρόσβαση σε...
galvanize = γαλβανίζω
gap = κενό, χάσμα
gas = αέριο
gaseous = αεριώδης
gather = συλλέγω, μαζεύω, συγκεντρώνω
generate = γεννώ, παράγω
generation = γενιά, παραγωγή
generator = γεννήτρια
gloves = γάντια
government = κυβέρνηση
gradually = βαθμηδόν
grateful = ευγνώμων
grease = λαδώνω, γρασσάρω, γράσσο, λιπαρή ουσία
greasing = λίπανση, γρασάρισμα
great deal = πολύ
greenhouse = θερμοκήπιο
greenhouse effect = φαινόμενο του θερμοκηπίου
grip = λαβή, σφίξιμο
gripping screwdriver = κατσαβίδι με συγκρατητή βίδας, αρπάγη
ground = έδαφος, γήπεδο, γειώνω
grounding = γείωση
guarantee = εγγυώμαι, εγγυητής, εγγύηση
guideline = κατευθυντήρια γραμμή

H

habitat = είδος κατοικίας, βιότοπος
hacksaw = σιδηροπρίονο
hair drier = στεγνωτήρας μαλλιών, «πιστολάκι»
hammer = σφυρί
hand over = παραδίνω, παραιτούμαι από, μεταβιβάζω
handle = χερούλι, λαβή, χειρίζομαι
hardware = το μηχανικό μέρος του ηλεκτρονικού υπολογιστή
harness = χαλιναγωγώ
headline = επικεφαλίδα
head-phones = ακουστικά
health = υγεία
health services = υγειονομικές υπηρεσίες
healthy = υγιής, υγιεινός

heater = θερμαντήρας
hidden = κρυμμένος (p.p. του hide)
highlight = διαφωτίζω
highway = αυτοκινητόδρομος, εθνική οδός
hint = υπαινιγμός, νύξη, υπαινίσσομαι
hob (plate) = μάτι κουζίνας
hold = κρατώ
hole = τρύπα
horn = σειρήνα, κόρνα
horsepower = ιπποδύναμη
household = σπιτικό, νοικοκυριό, οικογένεια
housewife = οικοδέσποινα, νοικοκυρά
however = όμως, παρ' όλα αυτά, οπωσδήποτε
hydraulic = υδραυλικός-ή-ό

I

ice-box = ψυγείο πάγου
identification = συνταύτιση, εξακρίβωση ταυτότητας, αναγνώριση
identify = ταυτίζω, αναγνωρίζω, προσδιορίζω, ταυτοποιώ, εξακριβώνω
ignite = ανάβω, αναφλέγομαι, παίρνω φωτιά
ignorance = άγνοια
ignore = αγνοώ
illuminate = φωτίζω, φωταγωγώ, φωτίζομαι
illustrate = εικονογραφώ, επεξηγώ
imaginary = φανταστικός, της φαντασίας
imitate = μιμούμαι, απομιμούμαι
immediately = αμέσως
immerse = εμβαπτίζω, βυθίζω, καταδύω
impact = σύγκρουση, χτύπημα, επίδραση
imperative = προστακτική, προστακτικός, επιτακτικός
impose = επιβάλλω
impress = εντυπωσιάζω, προκαλώ αίσθηση
impressed = εντυπωσιασμένος
impressive = εντυπωσιακός
improper = απρεπής, ανάρμοστος, εσφαλμένος
improperly = ανάρμοστα, ακατάλληλα
improve = βελτιώνω
in action = σε λειτουργία
inadequate = ανεπαρκής
incline = κάμπτω, κλίνω, γέρνω, κλίση
include = περιλαμβάνω, περικλείω
inconvenience = δυσκολία, ενόχληση, μπελάς

incorrect = ανακριβής, λανθασμένος
increase = αυξάνω, αύξηση
index = δείκτης, πίνακας περιεχομένων, ευρετήριο
indicator = δείκτης, ενδεικτικός
indication = ένδειξη
individual = ατομικός, μόνος, άτομο
indoor = εσωτερικός (χώρος)
induce = επάγω, επιφέρω
inductance = επαγωγή, αυτεπαγωγή, εισαγωγή
induction = εισαγωγή, επαγωγή
induction AC motor with sliprings (collector rings) = επαγωγικός ηλ/τήρας Ε.Ρ. με δακτυλίους
induction AC motor with squirrel cage rotor = επαγωγικός ηλ/τήρας Ε.Ρ. με βραχυκυκλωμένο δρομέα
induction AC motor with capacitor start = επαγωγικός ηλ/τήρας Ε.Ρ. με πυκνωτή εκκινήσεως
induction AC motor with permanent split capacitor = επαγωγικός ηλ/τήρας Ε.Ρ. με πυκνωτή εκκινήσεως & λειτουργίας
induction AC motor with split phase = επαγωγικός ηλ/τήρας Ε.Ρ. με αντίσταση
induction AC motor with shaded pole = επαγωγικός ηλ/τήρας Ε.Ρ. με βραχυκυκλωμένες σπείρες στους πόλους
inductor = επαγωγέας, το επαγώγιμο, επαγωγική αντίσταση
industrial = βιομηχανικός
industry = βιομηχανία
inequality = ανισότητα
inevitable = αναπόφευκτος
inexhaustible = ανεξάντλητος
infinitive = απαρέμφατο
influence = επιρροή, επίδραση
inform = πληροφορώ, ενημερώνω
informative = πληροφοριακός
initial = πρωταρχικός, αρχικός
initiative = πρωτοβουλία
injured = αυτός που έχει πάθει ζημιά, πληγωμένος, τραυματισμένος
injury = βλάβη, ζημιά, τραύμα
inlet = είσοδος, εισαγωγή
innovative = ανακαινιστικός, νεωτεριστικός
inquire = ζητώ πληροφορίες, ρωτώ
inquiry = ζήτηση πληροφοριών, έρευνα
insert = παρεμβάλλω, καταχωρώ, εισάγω, παρεμβολή
insist = επιμένω
install = εγκαθιστώ, ιδρύω, τοποθετώ
installation = εγκατάσταση, εγκαθίδρυση
for instance = για παράδειγμα

instead (of) = αντί (για...)
instruction = οδηγία
instructor = εκπαιδευτής, δάσκαλος
instrument = όργανο
instrument transformer = μετασχηματιστής ρεύματος οργάνων
insulate = μονώνω
insulation = μόνωση
insulator = μονωτής, κακός αγωγός
integer = ακέραιος (αριθμός)
intend = σκοπεύω, έχω την πρόθεση
intensity = ένταση, ισχύς
interact = αλληλοεπιδρώ
interaction = αλληλοεπίδραση
interconnection = διασύνδεση
interface = διάμεσο, διεπιφάνεια
internal = εσωτερικός
interrupt = διακόπτω, σταματώ, εμποδίζω
interruption = διακοπή
interview = συνέντευξη
introduce = εισάγω
introduction = εισαγωγή
introductory = εισαγωγικός
invent = εφευρίσκω
invention = εφεύρεση
inventiveness = εφευρετικότητα
investigation = έρευνα, ανάκριση
investment = επένδυση
involve = εμπλέκω
be/get involved in (to) = εμπλέκομαι, είμαι μπερδεμένος / ανακατεμένος, ασχολούμαι με...
irregular = ανώμαλος
isolate = απομονώνω
isolation = απομόνωση
issue = ζήτημα, έκδοση, τεύχος, εκδίδω, θέτω σε κυκλοφορία
item = αντικείμενο, τεμάχιο, εμπόρευμα, μονάδα

J

jack = ρευματοδότης, υποδοχή τοποθετήσεως βύσματος, γρύλος (ανύψωσης αυτοκινήτου)
jewellery = κοσμήματα
join = συνδέω, ενώνω, ένωση, σύνδεση
joint = σύνδεση, σύνδεσμος, αρμός, άρθρωση

joint box = κουτί συνδέσεων
jumbled = ανακατεμένος
junction box = κουτί διανομής, κουτί διασταυρώσεως ή συνδεσμολογίας
justify = δικαιολογώ, δικαιώνω

K

keep apart = παραμένω / κρατώ μακρυά
keep informed = κρατώ κάποιον ενήμερο
kill = σκοτώνω
knife = μαχαίρι, σουγιάς
knob = κουμπί

L

lab(oratory) = εργαστήριο
label = ετικέτα, επιγραφή
labour = εργασία, κόπος, μόχθος, εργάζομαι (χειρωνακτικά)
lack = έλλειψη, στέρηση
ladder = σκάλα
lamination = έλασμα, λάμα, ελασματοποίηση
landscape = τοπίο
latter = ο δεύτερος από δύο, όψιμος, ύστερος, τελευταίος
layer = στρώμα, στρώση
lay out = διατάσσω, καταστρώνω, σχεδιάζω, τακτοποιώ, διάταξη, διαρρύθμιση
lead = μόλυβδος (λεντ) / άκρο καλωδίου (ληντ)
lead on = οδηγώ, δείχνω το δρόμο (ληντ)
leadership = ηγεσία, αρχηγία
leaflet = φυλλάδιο
leakage = διαρροή, διαφυγή, εκροή, απώλεια
least = ελάχιστος
  at least = τουλάχιστον
leave = φεύγω, αφήνω, εγκαταλείπω
leaving certificate = απολυτήριο (Γυμνασίου / Λυκείου)
length = μήκος
level = οριζόντια στάθμη, αλφάδι, στάθμη επιφάνειας, οριζόντιος, ισοπεδώνω
lever = μοχλός, λαβίδα, λεβιές
lie = βρίσκομαι, κείμαι
lift = ανύψωση, σήκωμα, ανελκυστήρας, σηκώνω
light = φως, φωτίζω, ανάβω, ελαφρός
light(ing) fixture = φωτιστικό (εξάρτημα)
lighting = φωτισμός, άναμμα

lighting point = σημείο φωτισμού (εγκατάστασης φωτιστικού)
likely = πιθανός, ίσως, πιθανώς
limit = όριο, περιορισμός, θέτω όρια
limited = περιορισμένος
line = γραμμή
on line = σε λειτουργία, συνδεδεμένος στο σύστημα
link = δεσμός, σύνδεσμος, συνδέω
linking words = συνδετικές λέξεις
liquid = υγρό
liquid (insulated) transformer = μετασχηματιστής (με μόνωση) λαδιού
live = ζω, διαμένω, κατοικώ
live (e.g. circuit, conductor, wire) = ζωντανός, γεμάτος ενέργεια, ρευματοφόρος
load = φορτίο, φορτώνω
locate = τοποθετώ, εντοπίζω (θέση, τοποθεσία), εγκαθίσταμαι
location = τοποθεσία, τόπος, μέρος, εντοπισμός
longlife = μεγάλη διάρκεια ζωής, μακροχρόνιος
look for = ψάχνω
look forward to = προσδοκώ, περιμένω με ανυπομονησία
look up = ψάχνω, προσπαθώ να βρω (σε κατάλογο, λεξικό)
loop = θηλειά, βρόχος, σπείρα
loose = χαλαρώνω, λασκάρω, λύνω, χαλαρός
loosen = χαλαρώνω, ξεσφίγγω
loss = απώλεια
loudspeaker = μεγάφωνο
lower = κατεβάζω, χαμηλώνω, χαμηλότερος, χαμήλωμα
lubrication = λίπανση, γρασσάρισμα
luminaire = φωτιστικό (σώμα)
luminous = φωτεινός

M

machine = μηχάνημα, μηχανή
machinery = μηχανήματα, μηχανισμός
magnetic field = μαγνητικό πεδίο
magnetic field winding = περιέλιξη μαγνητικού πεδίου
mail = ταχυδρομώ, ταχυδρομείο
mail pigeon = ταχυδρομικό περιστέρι
main = κύριος, βασικός, ουσιώδης
mains = αγωγός κυρίου ρεύματος, παροχή ηλ. ρεύματος
maintain = συντηρώ, διατηρώ σε καλή κατάσταση, υποστηρίζω
maintenance = συντήρηση, διατήρηση, υποστήριξη
major = μεγαλύτερος, σημαντικότερος, κυριότερος
make up = συγκροτώ, συμπληρώνω, ετοιμάζω, κατασκευάζω, κατασκεύασμα

male = αρσενικός, άνδρας
malfunction = κακή λειτουργία, βλάβη
manage = διευθύνω, κατορθώνω, διαχειρίζομαι, ρυθμίζω, διευθετώ
manager = διευθυντής, διαχειριστής, ρυθμιστής
mankind = οι άνθρωποι, το ανθρώπινο γένος / είδος
manual = χειροκίνητος, χειρωνακτικός, εγχειρίδιο
manually = με τα χέρια
manufacture = κατασκευάζω, παράγω, κατασκευή, βιομηχανία
manufacturer = κατασκευαστής, παραγωγός βιομηχανικών προϊόντων
mark = σημαδεύω, σημάδι, βαθμός
mat = χαλί, στρωσίδι
material = υλικό
matter = ύλη, ουσία, υπόθεση, θέμα, ενδιαφέρω
means = το μέσο, ο τρόπος, τα μέσα
by means of = με, με τη βοήθεια του
measure = μετρώ, καταμετρώ, μέτρο
measurement = μέτρηση, μέτρημα
medium = μέσο, μεσαίος, ενδιάμεσος, μέτριος
meet = συναντώ, εκπληρώ, ικανοποιώ, ανταποκρίνομαι σε (αναγκαιότητα, απαίτηση κ.λπ.)
melt = λιώνω, τήκω, λιώσιμο
meltdown = τήξη
mention = αναφέρω, μνημονεύω, αναφορά, μνεία
microprocessor = μικροεπεξεργαστής
military = στρατιωτικός
million = εκατομμύριο
miniature circuit breaker = μικροαυτόματος (θερμοδιακόπτης ή ραγοδιακόπτης)
minimize = ελαχιστοποιώ, μειώνω στο έπακρο
minister = υπουργός
ministry = υπουργείο, η υπουργία, υπουργική θητεία
minus = μείον, πλην
misprinting = τυπογραφικό λάθος
miss = χάνω (ευκαιρία π.χ.), επιθυμώ, μου λείπει (πρόσωπο π.χ.), αποτυγχάνω, αστοχώ
misuse = κάνω κακή χρήση, κακή χρήση
mixer = (ανα)μικτής, αναμικτήρας
mixture = μίγμα
modulation = διαμόρφωση, τροποποίηση, ρύθμιση
moisture = υγρασία
molecule = μόριο, μικρό κομματάκι
motor = κινητήρας, μοτέρ
mount = ανεβαίνω, τοποθετώ επάνω, ενσωματώνω, στερεώνω
mounted = συναρμολογημένος, δεμένος, μονταρισμένος, στερεωμένος, τοποθετημένος

movement = κίνηση, μετακίνηση
multimeter = πολύμετρο
multi- (multi-) = πολύ-
multiplication = πολλαπλασιασμός
multiplier = πολλαπλασιαστής
multiply = πολλαπλασιάζω
multi-pole representation = πολυγραμμική αναπαράσταση / σχεδιάγραμμα
multi-storey = πολυώροφος
multitester = πολύμετρο
muscular = μυϊκός
mushroom = μανιτάρι

N

nameplate = πινακίδα αναγραφής τεχνικών χαρακτηριστικών
nation = έθνος, λαός
national = εθνικός
nationality = εθνότητα, εθνικότητα
natural = φυσικός
nature = φύση
neat = καθαρός, κομψός, περιποιημένος
necessity = αναγκαιότητα
needless = άχρηστος, μάταιος
negative = αρνητικός
network = δίκτυο
network diagram = διάγραμμα δικτύων
neutral = ουδέτερος
neutron = νετρόνιο, ουδετερόνιο
neutron flux = ροή ηλεκτρονίων
newscaster = εκφωνητής ειδήσεων
north = βορράς
notice = ειδοποίηση, είδηση, προσέχω
nuclear = πυρηνικός
nucleus = πυρήνας
numerator = αριθμητής
numerical = αριθμητικός
numerical operation = αριθμητική πράξη
nut = παξιμάδι βίδας, περικόχλιο

O

obey = υπακούω, υποτάσσομαι
object = αντικείμενο

objective = αντικειμενικός σκοπός
obligation = υποχρέωση
oblige = υποχρεώνω, επιβάλλω
oblique = πλάγιος, λοξός
obtain = αποκτώ, επιτυγχάνω
obvious = φανερός, προφανής, ευνόητος
occupation = απασχόληση, επάγγελμα, κατάληψη, κατοχή
occupy = καταλαμβάνω, κατέχω
occur = συμβαίνει
offset screwdriver = σταυροκατσάβιδο
oil = πετρέλαιο, λάδι
oil cooker = γκαζιέρα
oil lamp = λάμπα πετρελαίου
oiler = λαδωτήρι, λαδικό
omission = παράλειψη, αμέλεια
omit = παραλείπω, αμελώ
ohmmeter = ωμόμετρο
open circuit = ανοιχτό κύκλωμα
operation = λειτουργία, χειρισμός, εγχείρηση, μαθηματική πράξη
opportunity = ευκαιρία
oppose = αντιτάσσω, αντιτάσσομαι, αντικρούω
opposition = αντίθεση, αντίδραση, αντίσταση, αξιωματική αντιπολίτευση
optimum = το καλύτερο
option = επιλογή, δικαίωμα επιλογής, προαίρεση
oral = προφορικός
orbit = τροχιά
order = εντολή, διαταγή, σειρά, τάξη
in order = σε σειρά
i**n order to** = ώστε να, για να
ordinal number = τακτικό αριθμητικό
original = πρωτότυπος, αρχικός
oscillator = ταλαντωτής
oscilloscope = παλμογράφος
otherwise = αλλιώς, διαφορετικά
ought to = πρέπει να, έπρεπε να, όφειλε να
outdoor = υπαίθριος, εξωτερικός
outlet = έξοδος, υποδοχή όπου καταλήγει γραμμή τάσης
outline = σκιαγραφώ, εκθέτω τις γενικές γραμμές, σκιαγραφία, περίγραμμα, περίμετρος
output = έξοδος, απόδοση (μηχανήματος, συσκευής κ.λπ.) τα σημεία από τα οποία παίρνεται η έξοδος
oven = φούρνος, κλίβανος
overall = συνολικός, γενικός, ολοσχερής
overhead = από πάνω, ψηλά, εναέριος
overhead projector = προβολέας διαφανειών

overheat = υπερθερμαίνω, υπερθερμαίνομαι, ανάβω
overcurrent = ένταση ρεύματος μεγαλύτερη του κανονικού
overload = υπερφορτώνω, υπερφόρτωση
overloading = υπερφόρτωση
overuse = κατάχρηση
oxide = οξείδιο
oxidation = οξείδωση
owner = ιδιοκτήτης, κάτοχος

P

pack = δέμα, πακέτο, συσκευάζω
package = πακετάρισμα, συσκευασία, πακέτο
painful = οδυνηρός, θλιβερός
pan = τηγάνι
panel = πλαίσιο, πλάκα, πίνακας χειρισμού ή ελέγχου ηλ. συσκευής
participant = μέτοχος, μεριδιούχος, μέλος (σε συγκέντρωση π.χ.), συμμετέχων
participate = συμμετέχω, συμμερίζομαι, παίρνω μέρος
participle = μετοχή
particle = μόριο, σωματίδιο
particular = ιδιαίτερος, συγκεκριμένος, ακριβής
in particular = συγκεκριμένα, ειδικά, ιδιαίτερα
particularity = ιδιομορφία, ιδιαιτερότητα
particularly = ειδικά, ιδιαίτερα, συγκεκριμένα
partnership = συνεταιρισμός, συνεργασία
pass = πέρασμα, περνώ, διέρχομαι
path = μονοπάτι, πέρασμα
pathway = μονοπάτι, δρομάκος, πέρασμα
pattern = πρότυπο, υπόδειγμα, χνάρι
payment = πληρωμή, καταβολή
peacefulness = ησυχία, ηρεμία
pen-friend = φίλος με αλληλογραφία
per cent = τοις εκατό (%)
perform = εκτελώ, δίνω παράσταση, διεξάγω
performance = εκτέλεση, παράσταση, διεξαγωγή
permission = άδεια, έγκριση
permit = επιτρέπω, άδεια
personally = προσωπικά
personnel = προσωπικό, (υπάλληλοι)
persuade = πείθω
phase = φάση
pictorial diagram = εικονογραφημένο διάγραμμα
pin = καρφίτσα, λεπτό καρφί, καρφιτσώνω, περόνη

place = τόπος, θέση, μέρος, τοποθετώ
place an order = παραγγέλλω, κάνω παραγγελία
plan = σχέδιο, προγραμματισμός, σχεδιάζω, προγραμματίζω
plant = φυτό, φυτεύω, βιομηχανικό συγκρότημα
plaster = σοβάς, σοβαντίζω
plate = μεταλλική πλάκα, πίνακας ηλ. συσκευής, πιάτο
pleasant = ευχάριστος, συμπαθητικός, χαριτωμένος
plentiful = άφθονος
pliers = πένσα, τανάλια
plot = σχεδιάγραμμα, γραφική παράσταση, πλοκή έργου, σχεδιάζω, μηχανορραφώ
plug = ρευματολήπτης, βύσμα ηλ. συσκευής τοποθετούμενο σε ειδική υποδοχή
plus = συν, επί πλέον
point = σημείο, άκρο, βαθμός, ζήτημα, αιχμή, δείχνω
pointed-nose pliers = μυτοτσίμπιδο
point of view = άποψη, γνώμη
polarity = πολικότητα
pole = πόλος
polite = ευγενής
politeness = ευγένεια
pollute = μολύνω, ρυπαίνω
pollution = μόλυνση, ρύπανση
popular = λαϊκός, δημοφιλής
port = λιμάνι, είσοδος
pose = στάση, θέση, τοποθετώ, ποζάρω, αναφέρω
position = θέση, στάση, κατάσταση, τοποθετώ
positive = θετικός
post = στύλος, σταθμός, θέση, πόστο, ταχυδρομείο, ταχυδρομώ
potential = δυναμικό, ηλεκτρική πίεση
power = ισχύς, δύναμη, εξουσία
power distribution = διανομή ηλ. ρεύματος
power (system) engineer = ενεργειακός μηχανικός
power plant = εργοστάσιο παραγωγής ηλεκτρικής ενέργειας
power supply = τροφοδοτικό ισχύος, παροχή ηλεκτρικού ρεύματος
power system = σύστημα ηλεκτρικής ενέργειας (παραγωγής, μεταφοράς, διανομής)
power tool = ηλεκτρικό εργαλείο
power transmission = μεταφορά ηλεκτρικής ενέργειας
powers = δυνάμεις (μαθηματικά)
practice = πρακτική, πράξη, εφαρμογή, άσκηση, εξάσκηση
practise = ασκώ, εξασκώ, γυμνάζω
precaution = προφύλαξη
precise = ακριβής
precision = ακρίβεια

prefer = προτιμώ
preference = προτίμηση
prefix = πρόθεμα
preheating = προθέρμανση
preposition = πρόθεση
present = παρών, το παρόν (πρέζεντ), παρουσιάζω, εκθέτω (πρηζέντ)
preserve = προστατεύω, συντηρώ, διατηρώ
press = πιέζω, πιεστήριο, πρέσσα, τύπος
pressure = πίεση
prevent = προλαμβάνω, εμποδίζω, αποτρέπω
previous = προηγούμενος
price = τιμή, αξία, καθορίζω, τιμή
pride = υπερηφάνεια, εγωισμός
primarily = αρχικά, πρωταρχικά, κατ' αρχήν, κατά κύριο λόγο
primary = πρώτος, αρχικός, πρωταρχικός, αρχέγονος, ουσιώδης, κύριος
principal = κύριος, κυριώτερος, διευθυντής
principle = αρχή (ηθική π.χ.), πρωταρχικός, νόμος (φυσικής π.χ.)
prior (to) = προηγούμενος, προγενέστερος, πριν από
private = ιδιωτικός, προσωπικός, ατομικός
prize = βραβείο
proceed = προχωρώ, συνεχίζω, ενεργώ
procedure = μέθοδος, πορεία, διαδικασία
process = μέθοδος, πορεία, διαδικασία
processing = πορεία, επεξεργασία
produce = παράγω
product = προϊόν
production = παραγωγή
profession = επάγγελμα, σταδιοδρομία
profit = όφελος, κέρδος, ωφελώ, κερδίζω
profitable = επικερδής, επωφελής, συμφέρων
progress = πρόοδος (πρόγκρες), προοδεύω, προχωρώ (προγκρές)
progressive = προοδευτικός
project = σχέδιο, σχεδιάζω, προβάλλω, προεξέχω
promise = υπόσχομαι
promote = προάγω, προβιβάζω, προωθώ, διαφημίζω
promotion = προαγωγή, προώθηση, προβιβασμός
pronoun = αντωνυμία
proof = απόδειξη
proper = κατάλληλος, αρμόδιος, ταιριαστός, πρέπων
properly = κατάλληλα, όπως πρέπει / αρμόζει
property = περιουσία, ιδιοκτησία
proportional (to) = ανάλογο (του.../προς το...)
proposal = πρόταση
propose = προτείνω
protect = προστατεύω

protection = προστασία
protractor = μοιρογνωμόνιο
prove = αποδεικνύω, δοκιμάζω, αποδεικνύομαι
provide = προμηθεύω, προνοώ
public = δημόσιος, το κοινό
publicity = δημοσιότητα
publisher = εκδότης
pull = σύρω, τραβώ, έλκω
pull on (cord) = τραβώ (καλώδιο)
punch = πόντα, ζουμπάς
punish = τιμωρώ
purpose = σκοπός
pushbutton = κουμπί επαφής
put out = σβήνω (φωτιά, τσιγάρο κ.λπ.), βγάζω, ταράζω, ενοχλώ
pylon = πυλώνας

Q

qualification(s) = προσόν(τα)
qualified = αυτός που έχει τα προσόντα, κατάλληλος
qualifier = προσδιοριστικός, προσδιορισμός
qualify = έχω τα προσόντα, χαρακτηρίζω
quality = ποιότητα
quarrel = φιλονικία, καυγάς, τσακώνομαι, καυγαδίζω

R

radiant = αυτός που ακτινοβολεί
radioactive = ραδιενεργός
radioactivity = ραδιενέργεια
radiate = ακτινοβολώ
radiation = ακτινοβολία
rag = κουρέλι, κουρελιάζω, ξεφτάω
raise = σηκώνω, υψώνω, ανεβάζω
range = σειρά, γκάμα, περιοχή συχνοτήτων
rate = τιμή, αξία, βαθμός, τάξη, αναλογία
ray = ακτίνα
react = αντιδρώ
reaction = αντίδραση
reactor = αντιδραστήρας
readiness = ετοιμότης, προθυμία, ευχέρεια
real = αληθινός, πραγματικός, ειλικρινής

reality = πραγματικότης, αλήθεια
realize = αντιλαμβάνομαι, κατανοώ, συνειδητοποιώ, υλοποιώ, πραγματοποιώ
reason = λόγος, αιτία, το λογικό, κρίνω
reasonable = λογικός
recalibration = διόρθωση μέτρησης, καλιμπράρισμα, ρύθμιση
receive = δέχομαι, λαμβάνω, υποδέχομαι
receiver = (απο)δέκτης
recent = πρόσφατος
recently = πρόσφατα
recognize = αναγνωρίζω
recommend = συστήνω, συμβουλεύω
recommendation = σύσταση, υπόδειξη
record = καταγράφω, καταγραφή δεδομένων, κάνω εγγραφή, εγγραφή, ρεκόρ, δίσκος πικ-απ
record player = πικ-απ
rectifier = ανορθωτής
reduce = σμικρύνω, μικραίνω, μειώνω, ελαττώνω
reduction = σμίκρυνση, μείωση, ελάττωση
refer = αναφέρω, αναφέρομαι, παραπέμπω
reference = αναφορά, παραπομπή
refitting = ανασυναρμολόγηση
refrigerator = ψυγείο
regard = άποψη, προσοχή, σεβασμός, νομίζω, αφορώ, αναφέρομαι σε
regardless (of) = αδιάφορα, ανεξάρτητα από, χωρίς να παρθεί υπόψη
regret = λυπούμαι, μετανιώνω, μετάνοια, λύπη, συλλυπητήρια
regular = τακτικός, κανονικός, ομαλός
regularly = κανονικά, ομαλά
regulate = κανονίζω, ρυθμίζω
regulation = ρύθμιση, κανονισμός, διάταξη
regulator = ρυθμιστής
reinforce = ενισχύω, ενίσχυση, ενδυνάμωση
reinforcement = ενίσχυση, ενδυνάμωση
reject = απορρίπτω, αποβάλλω
relate = αναφέρω, συσχετίζω, έχω σχέση (με)
relation = σχέση, συνάφεια, συγγένεια, συσχετισμός
relationship = σχέση, συνάφεια πραγμάτων, συγγένεια
relative = σχετικός, αναφορικός, αναφερόμενος, συγγενής
relatively = σχετικά, αναφορικώς με, σε σχέση με
relay = ρελέ, ηλεκτρονόμος
release = απελευθερώνω, απαλλάσσω, απαλλαγή, απελευθέρωση
relevant = σχετικός
reliable = αξιόπιστος
relief = απελευθέρωση, ανακούφιση, περίθαλψη
remain = απομένω, μένω, παραμένω
remedy = αποκατάσταση βλάβης / ζημιάς, επισκευή, θεραπεία

remind = υπενθυμίζω, θυμίζω
removal = αφαίρεση, βγάλσιμο, απομάκρυνση, αποκατάσταση (βλάβης)
remove = απομακρύνω, μετακινώ, μεταφέρω, αφαιρώ
renew = ανανεώνω, ανακαινίζω
renewable = ανανεώσιμος
repair = επισκευάζω, διορθώνω
repairman = επισκευαστής, τεχνίτης επισκευών
repel = αποκρούω, απωθώ
replace = επαναθέτω, αντικαθιστώ, αναπληρώνω, ξανατοποθετώ
replacement = ανατοποθέτηση, αντικατάσταση, αναπλήρωση, ανταλλακτικό
report = αναφορά, έκθεση, αναφέρω, εκθέτω γεγονότα
represent = αντιπροσωπεύω
representation = αναπαράσταση, απεικόνιση, αντιπροσώπευση
representative = αντιπρόσωπος, αντιπροσωπευτικός
repulsion = άπωση, απώθηση
repulsive = απωθητικός
require = ζητώ, απαιτώ, χρειάζομαι
requirement = απαίτηση, ανάγκη, προδιαγραφή
research = έρευνα
reservoir = δεξαμενή, υδαταποθήκη
residential = οικιακός, με διαμονή (που παρέχει διαμονή)
resist = αντέχω, ανθίσταμαι, αντιδρώ
resistance = αντίσταση
resistant = ανθεκτικός
resistor = αντιστάτης
resource(s) = πηγή, πόροι, αποθέματα
respect = σέβομαι, λαμβάνω υπόψη, έχω σχέση, αφορώ, σεβασμός
respectful = γεμάτος σεβασμό
responsibility = υπευθυνότητα, ευθύνη
responsible = υπεύθυνος
restrain = αναχαιτίζω, εμποδίζω, συγκροτώ
result = αποτέλεσμα
result from = προέρχεται, προκαλείται από, είναι αποτέλεσμα του...
result in = καταλήγει, οδηγεί σε, έχει σαν αποτέλεσμα
retain = συγκροτώ, κρατώ
retaining screwdriver = κατσαβίδι με καστάνια
reversal = αντιστροφή
reverse = αντίστροφος, αντιστρέφω
in reverse order = με αντίστροφη σειρά, αντιστρόφως
review = αναθεωρώ, επιθεωρώ, κρίνω, αναθεώρηση, επανάληψη, επαναλαμβάνω
revolve = περιστρέφω, στριφογυρίζω
reward = αμείβω, πληρώνω, αμοιβή, βραβείο, έπαινος
rewire = επανακαλωδιώνω
rewiring = επανακαλωδίωση

risk = κίνδυνος, διακινδυνεύω
rock = βράχος, πέτρα
rod = ράβδος, βέργα
root = ρίζα
rotate = περιστρέφομαι, περιστρέφω
rotating = περιστρεφόμενος
rotation = περιστροφή
rotor = ρότορας, δρομέας, κινητός τροχός
round = στρογγυλός, κυκλικός, σφαιρικός
round-nose pliers = στρογγυλοτσίμπιδο
route = διαδρομή, πορεία
rubber = ελαστικό, τρίφτης, γομολάστιχα
rubber soled shoes = παπούτσια με σόλες από ελαστικό
rug = χαλί
rule = κανόνας, νόμος, διοικώ
ruler = κυβερνήτης, χάρακας, κανόνας
run = τρέχω, λειτουργώ, δρόμος, τρέξιμο
run cables = περνάω / εγκαθιστώ καλώδια
run-hour meter = μετρητής κατανάλωσης ηλ. ρεύματος
run low = λιγοστεύω
run out = φθάνω στο τέλος, εξαντλούμαι
run short of = φθάνω στο τέλος, εξαντλούμαι, μου τελειώνει
running cost = έξοδα λειτουργίας
rust = σκουριά, οξειδώνω, σκουριάζω
rusty = σκουριασμένος

S

sad = λυπημένος
saddle = κολλάρο
sadness = θλίψη, μελαγχολία
safe = ασφαλής, σίγουρος
safety = ασφάλεια
salary = μισθός (μηνιαίος)
sale = πώληση
sales manager = διευθυντής πωλήσεων
salt = αλάτι, άλας (χημεία)
sample = δείγμα, υπόδειγμα, δοκιμάζω
sanitary = ο έχων σχέση με την υγεία, υγιεινολογικός
satisfaction = ικανοποίηση
satisfactory = ικανοποιητικός
satisfy = ικανοποιώ
save = εξοικονομώ, σώζω

saw = πριόνι
scale = κλίμακα, διαβάθμιση
schematic = σχηματικός
schematic diagram = σχηματικό διάγραμμα
science = επιστήμη
scientific = επιστημονικός
scientist = επιστήμονας
scissors = ψαλίδι
scholarship = υποτροφία, μόρφωση
scrap paper = πρόχειρο χαρτί
screw = βίδα, βιδώνω
screwdriver = κατσαβίδι
screwholding screwdriver = κατσαβίδι με συγκρατητή βίδας, αρπάζει, κλέφτης
seal = σφραγίζω, στερεώνω, σφραγίδα
search = ψάχνω, ερευνώ, ζητώ
season = εποχή
secondary = δευτερεύων
sector = τομέας
secure = σίγουρος, ασφαλής, ασφαλίζω, εξασφαλίζω, ακινητοποιώ
securely = σίγουρα, με ασφάλεια
security = ασφάλεια, εγγύηση
seem = φαίνομαι, μοιάζω
semi- (semi-) = ημι- (μισός)
semiconductor = ημιαγωγός
sense = αίσθηση, γνώση, νόημα, λογική, αντιλαμβάνομαι
sensitive = ευαίσθητος
sensitivity = ευαισθησία
separate = χωριστός, χωρισμένος, χωρίζω, αποχωρίζω
separate excitation motor = ηλεκτροκινητήρας ανεξάρτητης διέγερσης
series = σειρά, ακολουθία
in series = εν σειρά
series excitation D.C. motor = ηλεκτροκινητήρας Σ.Ρ. με διέγερση σειράς
series asynchronous A.C. motor (with commutator) = ασύγχρονος ηλ/τήρας Ε.Ρ. με συλλέκτη
serious = σοβαρός, σπουδαίος
serve = υπηρετώ, βοηθώ, σερβίρω
service = εξυπηρέτηση, υπηρεσία, φροντίδα
session = σύνοδος, συνεδρίαση, σχολική περίοδος, διδακτική ώρα
set = τοποθετώ, κανονίζω, καθορίζω, προσαρμόζω, στερεώνω, δύω, δύση
setting = τοποθέτηση, σύνθεση, σκηνογραφία, σκηνικό, κατάσταση
severe = αυστηρός, σοβαρός
shaft = άξονας
share = μερίδιο, συμμετοχή, συμμετέχω
sharp = κοφτερός, οξύς, αιχμηρός
sharpness = οξύτητα, μυτεράδα, σφοδρότητα

sheet = φύλλο χαρτιού, έλασμα, στρώμα
shield = προασπίζω, προφυλάσσω, καλύπτω, ασπίδα, προστατευτική κάλυψη
shift = μετατόπιση, βάρδια, μετακινώ
shock = τίναγμα, συγκλονισμός, δόνηση
shopkeeper = καταστηματάρχης
short circuit = βραχυκύκλωμα
short for = συντομογραφία του
shoulder = ώμος, επωμίζομαι, αναλαμβάνω
showroom = αίθουσα εκθέσεων
shunt excitation motor = ηλεκτροκινητήρας παράλληλης διέγερσης
shut down = κλείνω, διακόπτω τη λειτουργία
shut off = κλείνω με διακόπτη
side cutter = πλαγιοκόφτης
signal = σηματοδοτώ, σήμα
signature = υπογραφή
significance = σημασία, νόημα, σπουδαιότητα
significant = σημαντικός
similar = όμοιος, παρεμφερής, παρόμοιος
similarity = ομοιότητα
simultaneous = ταυτόχρονος
simultaneously = ταυτόχρονα
since = από, έκτοτε, αφ' ότου, εφ' όσον, μια και, αφού
sincerely = ειλικρινά
single = μονός, χωριστός, άγαμος
single phasing = μονοφασικός
single-pole representation = μονογραμμική αναπαράσταση /σχεδιάγραμμα
siren = σειρήνα
situated = τοποθετημένος, ευρισκόμενος
situation = κατάσταση, τοποθεσία
sketch = σκίτσο, σχέδιο, σκιτσάρω
skilful = ικανός, επιδέξιος
skilfully = με επιδεξιότητα
skilfulness = επιδεξιότητα
skill = ικανότητα, επιδεξιότητα
slipring = δακτυλίδια
slot = σχισμή, εγκοπή
slot screw = βίδα με εγκοπή
snip-nose pliers = μυτοτσίμπιδο
sociable = κοινωνικός (αυτός που αναπτύσσει κοινωνικές σχέσεις)
social = κοινωνικός
sockets = καρυδάκια (εργαλεία)
socket (outlet) = πρίζα, ρευματοδότης
socket spanner = σωληνωτό κλειδί / κατσαβίδι
software = πρόγραμμα του ηλεκτρονικού υπολογιστή, «λογισμικό»
solar = ηλιακός

solder = συγκολλώ, υλικό συγκολλήσεως, καλάϊ, κασσίτερος
soldering = συγκόλληση
soldering gun = κολλητήρι (ηλεκτρικό)
soldering iron = κολλητήρι (κοινό)
soldering tin = κασσιτεροκόλληση (συγκολλητικό υλικό)
solid = στερεός, συμπαγής
solution = λύση, διάλυση, διάλυμα
solve = λύω, διαλύω
sort = είδος, ταξινομώ, διαλέγω
source = πηγή
space = διάστημα, χώρος
special(i)ty = ειδικότητα
specific = ειδικός
specification = προσδιορισμός, προδιαγραφή, σαφής περιγραφή
speech = λόγος, ομιλία
speechless = άφωνος, βουβός
spin = περιστρέφω, περιστροφή, δίνη, τροχιά
spirit level = αλφάδι
split = χωρίζω, διαιρώ
spoil = χαλάω, καταστρέφω
spot = σημείο, στίγμα, κηλίδα, εντοπίζω, σημειώνω, στιγματίζω
spot light = προβολέας
spread = εξάπλωση, απλώνω, στρώνω
spring = ελατήριο, πηγή, άνοιξη, πηγάζω
spring hook = ατσαλίνα
square = τετράγωνο
square brackets = αγκύλες
square root = τετραγωνική ρίζα
squared = τετραγωνισμένος, υψωμένος στο τετράγωνο
staff = προσωπικό, επιτελείο
stage = φάση, στάδιο, σκηνή θεάτρου
stand = στέκομαι, πόστο
stands for = χρησιμοποιείται, τίθεται αντί, συμβολίζει
standard = πρότυπο, μέτρο, κανόνας, επίπεδο
standard of living = επίπεδο ζωής
star connection = σύνδεση αστέρος
starter = εκκινητήρας, μίζα
state = δηλώνω, κατάσταση, πολιτεία
statement = έκθεση, δήλωση, πρόταση
static = στατικός
stationary = στάσιμος, ακίνητος
stator = στάτης, επαγωγέας
steady = στερεός, σταθερός, συνεχής
steam = ατμός
steam boiler = ατμολέβητας

steel = ατσάλι
step = βήμα, σκαλοπάτι
step down = υποβιβάζω
step up = ανυψώνω
sterilizer = αποστειρωτής
store = αποθηκεύω, αποθήκη, κατάστημα
strength = δύναμη, ισχύς
strict = αυστηρός
strike = χτυπώ
strip = ταινία, λωρίδα, αφαιρώ, αποσυναρμολογώ, απογυμνώνω
stripdown procedure = διαδικασία αποσυναρμολόγησης (ξεμονταρίσματος)
stripper = απογυμνωτής
structure = κατασκευή, δομή, οικοδόμημα
stuck = κολλημένος (φρακαρισμένος)
sub- (sub-) = υπό-
sub-board = υποπίνακας
subdivide = υποδιαιρώ
subdivision = υποδιαίρεση
subject = υποκείμενο, θέμα
submit = υποτάσσομαι, υπακούω, υποβάλλω, υπόκειμαι
substance = ουσία
substitute = υποκατάστατο, αντικαθιστώ, αναπληρώνω
subtitle = υπότιτλος
subtract = αφαιρώ
subtransmission level = επίπεδο διανομής ηλ. ενέργειας μέσης τάσης
success = επιτυχία
successful = επιτυχημένος
successfully = επιτυχώς
sudden = ξαφνικός, αιφνίδιος
suddenly = ξαφνικά
suffer = υποφέρω, ανέχομαι, πάσχω
sufficient = αρκετός, επαρκής
sufficiently = επαρκώς, αρκετά
suffix = πρόσφυμα, κατάληξη
suggest = προτείνω, υποδεικνύω
suggestion = πρόταση, υπόδειξη
suit = προσαρμόζω, συναρμολογώ, ταιριάζω, είμαι κατάλληλος για, κοστούμι ανδρικό
suitable = ταιριαστός, κατάλληλος, αρμόδιος
sulphur = θείο, θειάφι
sum = άθροισμα, ποσόν, σύνολο, συνοψίζω
summation transformer = αθροιστικός μετασχηματιστής
summarize = συνοψίζω, κάνω περίληψη, εκθέτω συνοπτικά
summary = περίληψη
supervise = επιβλέπω, επιθεωρώ

supervisor = επιστάτης, επόπτης, επιθεωρητής, διευθυντής
supply = προμηθεύω, προμήθεια, παροχή
support = στήριγμα, υποστήριξη, στηρίζω, υποστηρίζω
surface = επιφάνεια
surface mounted = τοποθετημένος πάνω στο σοβά, επιφανειακός, «επί τοίχου»
surround = περικυκλώνω, περιβάλλω, περιτριγυρίζω
survey = επισκόπηση, επιθεώρηση, χωρογράφηση, συνολική εποπτεία, μελέτη
sustain = υποστηρίζω, στηρίζω, κρατώ
sweep function generator = γεννήτρια σάρωσης
switch = διακόπτης (ηλ. συσκευής)
switch off = σβήνω (φως, ηλ. συσκευή)
switch on = ανάβω (φως, ηλ. συσκευή)
switchboard = ταμπλώ, πίνακας διακοπτών

T

tactfully = με ευγένεια / λεπτότητα (τακτ)
take care of = φροντίζω
take a look at = κυττάζω, ρίχνω μια ματιά
take a risk = διακινδυνεύω
take an interest in = δείχνω / εκφράζω ενδιαφέρον για
take off = βγάζω
take place = λαμβάνω χώρα, συμβαίνει, πραγματοποιείται
tamper = αναμιγνύομαι, ανακατεύομαι (με κακές συνέπειες)
tap = ελέγχω τη ροή (υγρού, ηλ. ρεύματος), βρύση, κάνουλα, κρουνός
tape = κορδέλλα, ταινία
tape recorder = μαγνητόφωνο
telecommunications = τηλεπικοινωνίες
teleprinter = τηλέτυπο
temperature = θερμοκρασία
template = μοντέλο, μήτρα, ομοίωμα σχημάτων, στένσιλ
tend = τείνω, φροντίζω, κατευθύνομαι, έχω την τάση
term = όριο, περίοδος, διάρκεια, όρος
terminal = ακροδέκτης
terminal blocks = συνδετήρες καλωδίων, κλέμες
terminal box = κουτί ακροδεκτών
terminate = τερματίζω, ορίζω, καταλήγω
tester = δοκιμαστής, ελεγκτής, δοκιμαστικό κατσαβίδι
therefore = γι' αυτό
thermal = θερμικός
though = αν και, μολονότι
thread = κλωστή, σπείρωμα, βελονιάζω, κοχλιοτομώ, κάνω σπείρωμα
threaten = απειλώ
through = δια μέσου

throughout = από άκρου εις άκρον, παντού
throw = ρίχνω, πετώ, βολή, ρίξιμο
thus = έτσι, κατ' αυτόν τον τρόπο
tidal = παλιρροϊκός
tie = δεσμός, δέσιμο, συνδετήρας, γραβάτα, δένω
tight = σφιγμένος, τεντωμένος, σφιχτός
tighten = σφίγγω, τεντώνω
time consuming = χρονοβόρος
timer = χρονοδιακόπτης
time relay = χρονοδιακόπτης
time switch = χρονοδιακόπτης
tiny = μικροσκοπικός
ton = τόνος
tool = εργαλείο
torque = ροπή
total = συνολικός, ολόκληρος, σύνολο, άθροισμα, πλήρης
totally = συνολικά, πλήρως
touch = επαφή, άγγιγμα, εγγίζω
towards = προς
tower = πύργος
toy = παιχνίδι
trade = επάγγελμα, τέχνη, δουλειά, εμπόριο
traditional = παραδοσιακός
traffic = κυκλοφορία οχημάτων
traffic lights = φανάρια ρύθμισης κυκλοφορίας
train = προπονώ, (εξ)ασκώ, εκπαιδεύω, γυμνάζω, σύρω, τραίνο
trainee = ασκούμενος, μαθητευόμενος, προπονούμενος
training = άσκηση, εκπαίδευση
transfer = μεταφορά, μεταβίβαση, μεταφέρω
transformer = μετασχηματιστής
transmission = μεταβίβαση, μετάδοση
transmit = μεταβιβάζω, μεταδίδω, εκπέμπω
transportation = μεταφορά εμπορευμάτων
trap = παγίδα, παγιδεύω
trigger = σκανδάλη (όπλου), τραβώ τη σκανδάλη, προκαλώ, ενεργοποιώ
trip = αποζευγνύω, αποζεύκτης, απόζευξη
tripping mechanism = μηχανισμός απόζευξης
trouble = ενόχληση, λύπη, στενοχώρια, φασαρία, ταράσσω, ενοχλώ
troubleshooting = ανίχνευση / εντοπισμός βλάβης
trowel = μυστρί
truly = αληθινά
trust = εμπιστεύομαι
T-square = ταυ (όργανο σχεδίασης)
tungsten = βολφράμιο
turbine = στρόβιλος, ατμοστρόβιλος, τουρμπίνα

turf = τύρφη
turn = στροφή, περιστροφή, στρέφω, γυρίζω
turn on = ανάβω (ηλεκτρική συσκευή, το φως κ.λπ.)
turn off = σβήνω (ηλεκτρική συσκευή, το φως κ.λπ.)
tweezers = λαβίδα, τσιμπίδα, μπροσέλλα
twin = δίδυμος
twist = στρίψιμο, σπείρα, στροφή, στρίβω, συστρέφω
tyre = ελαστικό αυτοκινήτου

U

unavoidable = αναπόφευκτος
underground = υπόγειος
underline = υπογραμμίζω
undertake = αναλαμβάνω, επιχειρώ
undervoltage = τάση λιγότερη από την κανονική
unequal = άνισος
uneven = ανώμαλος, ανομοιόμορφος
unexpected = αναπάντεχος
unfortunately = δυστυχώς
unit = μονάδα, ενότητα
universal pliers = πένσα γενικής χρήσης
universal motor = ηλεκτροκινητήρας τύπου γιουνιβέρσαλ
unless = εκτός εάν
unlike = διαφορετικός, ανόμοιος, διαφορετικά
unlivable = αβίωτος
unprotected = απροστάτευτος
unreal = μη πραγματικός
unuseful = άχρηστος
update = εκσυγχρονίζω
updated = εκσυγχρονισμένος, ανανεωμένος
urge = παροτρύνω, ενθαρρύνω, ώθηση, κίνητρο, ωθώ
useful = χρήσιμος
usefulness = χρησιμότητα

V

vacancy = κενό, κενή θέση
vacuum cleaner = ηλεκτρική σκούπα
value = αξία, τιμή
vehicle = όχημα, φορέας, μεταφέρω με όχημα
ventilate = αερίζω, εξαερίζω

ventilation = εξαερισμός
ventilator = ανεμιστήρας, εξαεριστήρας
vent openings = ανοίγματα εξαερισμού
versatile = μετατρέψιμος, εύστροφος
versatility = μετατρεψιμότητα, ευστροφία
via = δια μέσου
vice = μέγγενη
vice versa = τανάπαλιν, αντιστρόφως
view = θέα, άποψη
viewer = θεατής, επιθεωρητής
violate = παραβιάζω, καταπατώ
violently = βίαια
voltmeter = βολτόμετρο

W

warn = προειδοποιώ
warning = προειδοποίηση
washing machine = πλυντήριο ρούχων
wash tab = σκάφη (για πλύσιμο)
waste = απορρίματα, απόβλητα, σπατάλη, απώλεια, σπαταλώ, καταναλίσκω
waste products = απόβλητα
water heater = θερμοσίφωνας, θερμαντήρας νερού
water pump pliers = γκαζοτανάλια
wave = κύμα
weak = αδύνατος, ασθενής
wealth = πλούτος, αφθονία, ευημερία
welfare = ευημερία, ευτυχία
weigh = ζυγίζω
weight = βάρος
wet = υγρός, βρεγμένος, μουσκεύω
wheel = τροχός
whenever = οποτεδήποτε, κάθε φορά που
whereas = ενώ
whether = εάν
widespread = εξάπλωση, διάδοση, εξαπλώνομαι, διαδεδομένος
wild-life = ο όρος αναφέρεται στο σύνολο των μη καλλιεργημένων φυτών και κύρια στα μη εξημερωμένα / κατοικίδια ζώα
willing = πρόθυμος
willingness = προθυμία
win = κερδίζω, νικώ, νίκη
wind = άνεμος, τυλίγομαι, περιελίσσομαι, τυλίγω
winding = περιέλιξη, τύλιγμα

wire = σύρμα
wire stripper = απογυμνωτής («γδάρτης») καλωδίων
wiring = καλωδίωση
wiring diagram = διάγραμμα καλωδίωσης
within = μέσα σε
wood stove = σόμπα με ξύλα
workshop = εργαστήριο
world = κόσμος
worldwide = ανά τον κόσμο
worn (out) = φθαρμένος
worthwhile = αξίζει τον κόπο
wrap = περιτυλίσσω, διπλώνω, περιβάλλω
wrench = γερμανικό κλειδί

X

x-rays = ακτίνες Χ

Z

zinc = ψευδάργυρος, τσίγκος
zip code = ταχυδρομικός κώδικας
zirconium = ζιργκόνιο

Βάσει του ν. 3966/2011 τα διδακτικά βιβλία του Δημοτικού, του Γυμνασίου, του Λυκείου, των ΕΠΑ.Λ. και των ΕΠΑ.Σ. τυπώνονται από το ΙΤΥΕ - ΔΙΟΦΑΝΤΟΣ και διανέμονται δωρεάν στα Δημόσια Σχολεία. Τα βιβλία μπορεί να διατίθενται προς πώληση, όταν φέρουν στη δεξιά κάτω γωνία του εμπροσθόφυλλου ένδειξη «ΔΙΑΤΙΘΕΤΑΙ ΜΕ ΤΙΜΗ ΠΩΛΗΣΗΣ». Κάθε αντίτυπο που διατίθεται προς πώληση και δεν φέρει την παραπάνω ένδειξη θεωρείται κλεψίτυπο και ο παραβάτης διώκεται σύμφωνα με τις διατάξεις του άρθρου 7 του νόμου 1129 της 15/21 Μαρτίου 1946 (ΦΕΚ 1946,108, Α').

Κωδικός βιβλίου: 0-24-0513
ISBN 978-960-06-4880-5