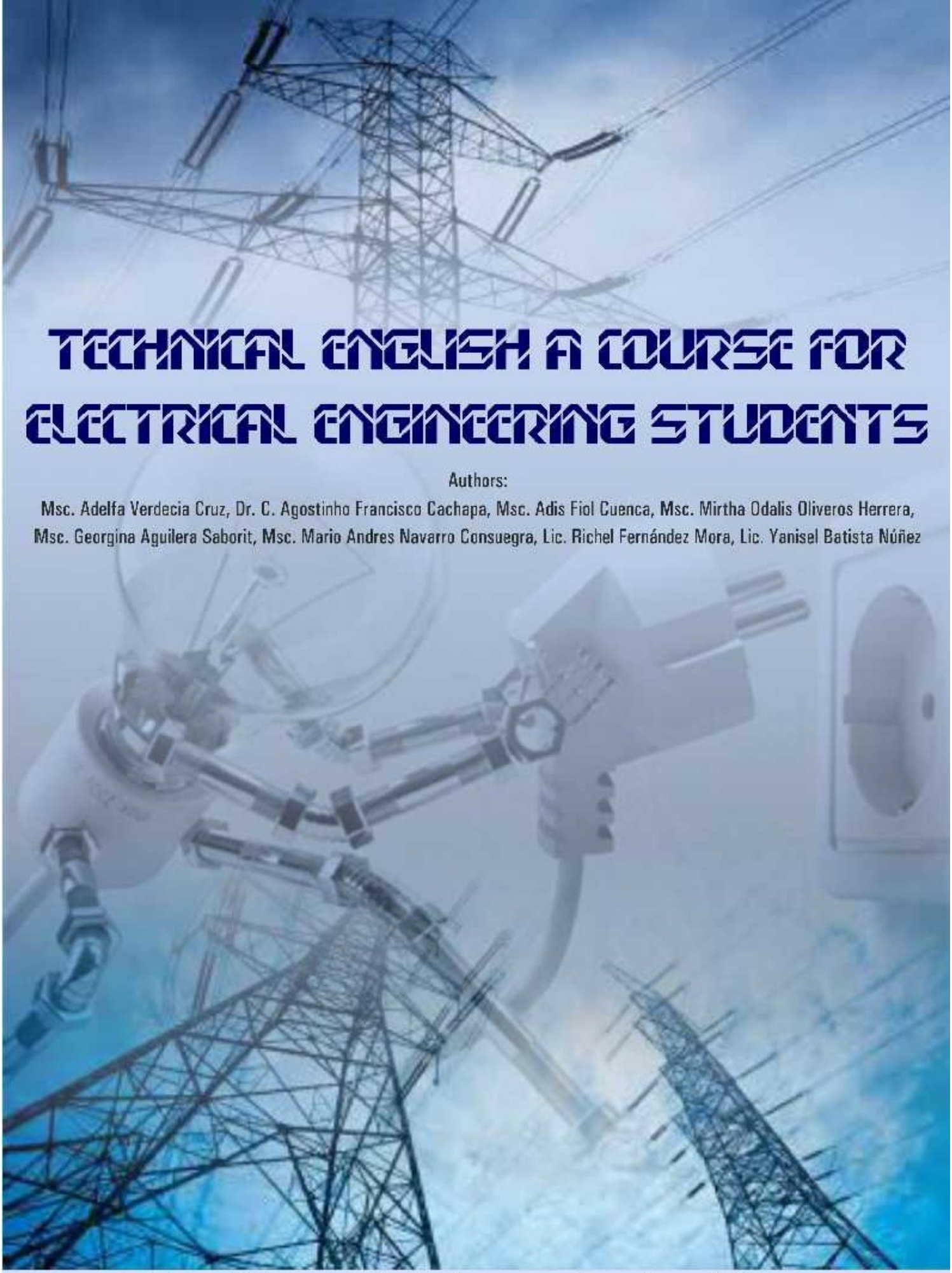

TECHNICAL ENGLISH A COURSE FOR ELECTRICAL ENGINEERING STUDENTS

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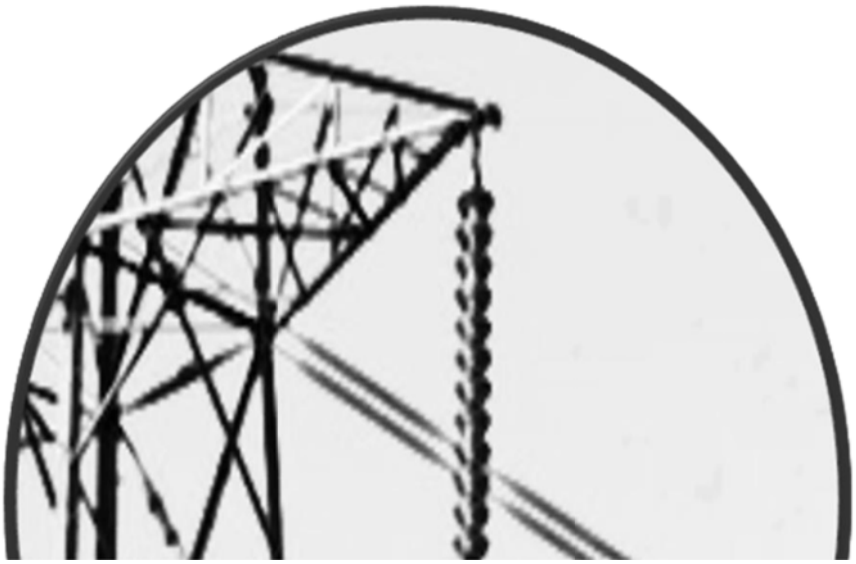
TECHNICAL ENGLISH.
A COURSE FOR ELECTRICAL ENGINEERING STUDENTS



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CONTENTS

PREFACE

This book was designed for electrical engineering students who need to fulfil the demands of communication in English in academic and professional contexts. The material presented throughout the book should provide a solid foundation for more advanced studies.

The content of the book is divided into seven sections, which involve understanding and discourse: reading and comprehension of a text, speaking and listening practice, vocabulary and grammar exercises as well as writing.

The first section is focused mainly on reading skills from which is derived the rest of the activities.

The second section deals with language improvement exercises; centering the students' attention on the acquisition of specialized terms and recognition of language cues.

The third section has the aim of systematizing some grammatical structures focused on how they are used as a resource in the creation of oral and written discourse.

The fourth section deals with the formation of reading comprehension skills

The fifth section helps to improve students´ abilities in listening in two directions: as a means of comprehension of the material presented and the acquisition of knowledge through the content of the material presented. This section is supported by a set of videos selected to perform the task.

Speaking practice aims at the students' participation in different activities for the discussion of the linguistic material presented. Different active methods are suggested in order to carry out learners´ work in this section.

Technical professions require knowledge in writing process. The students will be guided in such a way that they can write summaries and presentations according to the information they have at the different stages of the subject.

In unit II a new section is added: «language uses» due to the students 'needs on getting familiar with the fundamentals of numbers and mathematical expressions.

The book also contains the answer key for the exercises presented in each section, video transcriptions and a glossary, offering students the necessary support.

Unit I Electricity

Section I Reading Practice: What is Electrical Engineering?

Electrical engineering is one of the newer branches of engineering, and dates back to the late 19th century. It is the branch of engineering that deals with the technology of electricity. Electrical engineers are the ones who design and develop new electrical equipment, solve problems and test equipment. They work on a wide range of components, devices and systems, from tiny microchips to huge power station generators.

Early experiments with electricity included primitive batteries and static charges. However, the actual design, construction and manufacturing of useful devices and systems began with the implementation of Michael Faraday's Law of Induction, which essentially states that the voltage in a circuit is proportional to the rate of charge in the magnetic field through the circuit. This law applies to the basic principles of the electric generator, the electric motor and the transformer.

Some of the most prominent pioneers in electrical engineering include Joseph Wilson Swan, Thomas Edison, Heinrich Göbel, Aleksandr Lodygin (the most useful invention since its creation - the electric light bulb); Nicola Tesla (alternating current); N. Tesla, Jorge Cendal (induction motor), Guglielmo Marconi, Tesla, among others (radio); Vladimir Zvorykin and Philo Taylor Farnsworth (television). These innovators turned ideas and concepts about electricity into practical devices and systems used in the modern age.

Section II Vocabulary Practice

Exercise 1

1. These words appear in the reading. Organize the letters to make them meaningful:

paragraph 1

cesvide _____

werpo_____

paragraph 2

rytteba_____

gechar_____

getavol _____

itcucir_____

paragraph 3

inontIduc _____

tnerruc_____

Exercise 2

Use the underlined words in the previous passage, either in their singular or plural forms, to fill the gaps in the following sentences:

a. The Earth produces its own_____, which is important in navigation. It also guards Earth's atmosphere from solar wind.

b. A thing made for a particular purpose; an invention, especially a mechanical or electrical one is called a _____.

c. The _____ is an electric device, which produces light with a wire filament heated to a high temperature.

d. Electric _____ is the flow of charged particles through a conducting medium, such as a wire.

e. There are two types of electric_____: positive and negative.

Exercise 3

From the alternatives given, select the one, which is most similar in meaning to the bolded words, as they are used in the passage:

Early: recent time / far back in time

Charge: a quantity of electricity / attack / The price of an object

Actual: current / real / imaginary

Age: a particular time or period in life / a period in history / the later part of life

Turn: change of direction / to change into something else / transform.

Section III Grammar review

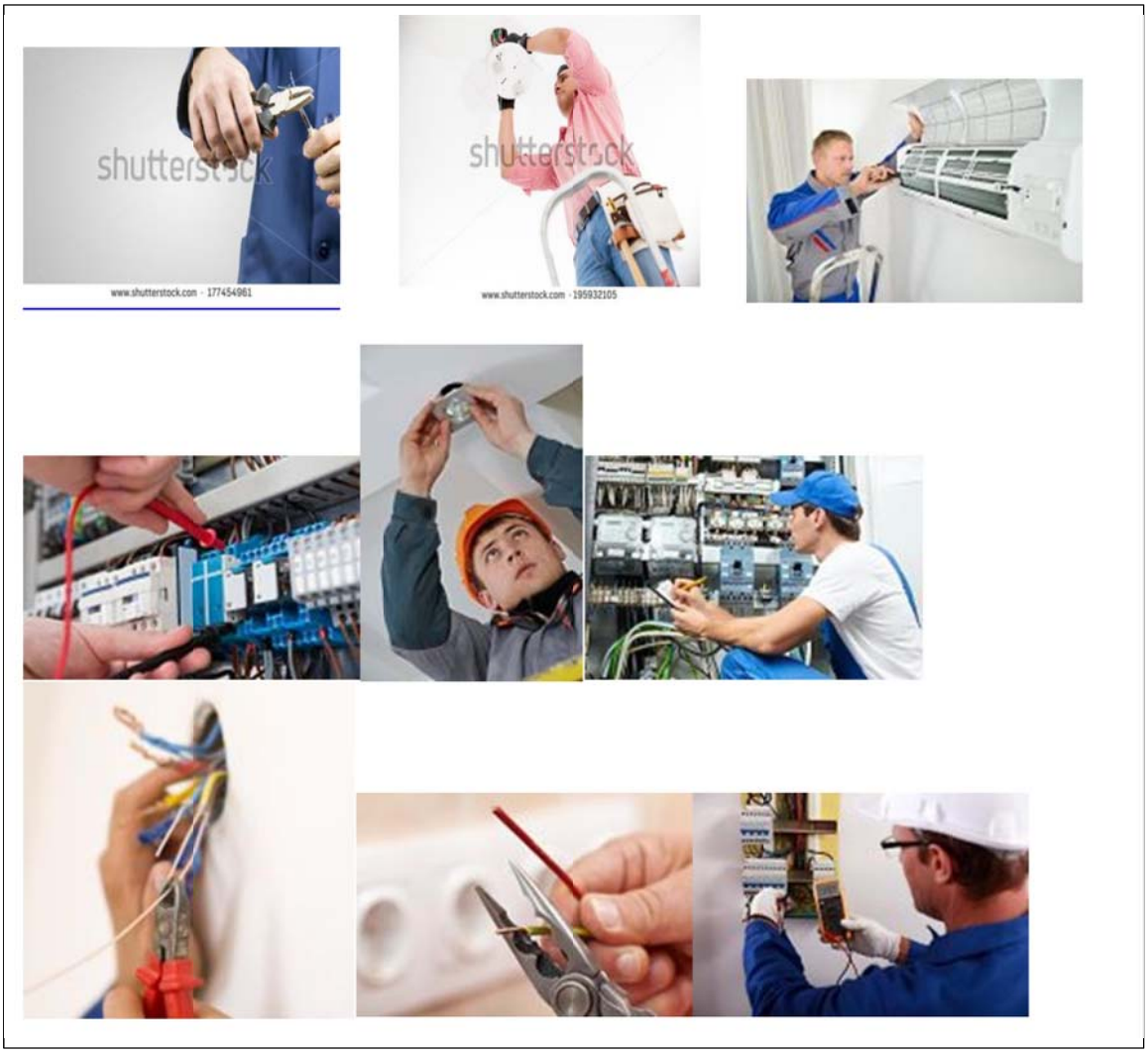
Simple present and simple past

Exercise 1

Pair work. Identify the verbs with the corresponding actions:
Student 1 shows by gestures an action suggested by the professor; student 2 identifies the corresponding verb.

Exercise 2

Say the activities people in the pictures do at work:



Exercise 3

Write the simple past form of the verbs:

cut	install	repair
examine	replace	inspect
bind	peel	check

Exercise 4

Select from the reading two verbs in simple present tense and two verbal forms in simple past. Say if they are regular or irregular verbs:

a. verbs in simple present tense

_____

_____

b. verbs in simple past tense

Verb	Regular	irregular

Exercise 5

Put the verbs in this dialogue in the correct form: simple present or simple past.

a. A: What does electrical engineering deal with?
B: It _____ (deal) with the technology of electricity
b. A: What did Thomas Edison discover?
B: He _____ (discover) the electric light bulb.
c. A. When did the real construction of useful devices and system take place?
B: It _____ (take) place with the implementation of Michael Faraday's Law of Induction.
d. A: Do electrical engineers _____ (work) with power station generators?
B: Yes, they _____

Section IV. Comprehension Practice

Exercise 1 Read the text «Electricity» and answer the questions:

a. Define electrical engineering.

b. How old is electrical engineering?
c. What is the fact that established the design of modern electrical devices and systems?

d. Where is Michael Faraday's Law applied?

e. Why is the electric bulb so important?
f. Give examples demonstrating how Nicola Tesla contributed to the development of the modern electrical devices.

Exercise 2 (Pair work)

a. Read the text again and then make questions, so that the bolded structures provide answers.

Example: ***design and develop new electrical equipment, solve problems and test equipment.***

Question: What do electrical engineers do?

- on a wide range of components, devices and systems

- primitive batteries and static charges.

- that the voltage in a circuit is proportional to the rate of charge in the magnetic field through the circuit.

b. Work on pairs. Practice the previous questions and answers orally.

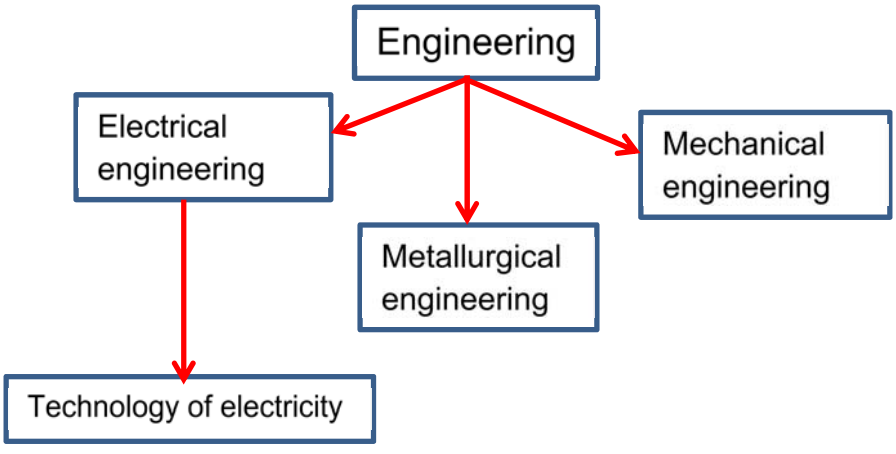
Example:

Student A: What do electrical engineers do?

Student B: ***They design and develop new electrical equipment, solve problems, and test equipment***

Exercise 3

After reading the text, explain the following diagram.



Exercise 4

Write the principal ideas of the reading

Example: Electrical engineering…

Electrical engineering is the branch of engineering that deals with the technology of electricity.

a. Electrical engineers…

b. The actual design…

c. The most prominent pioneers …

Exercise 5

The summary

Summaries are simply shorter versions of the original readings. In written summaries, you adapt the style of the original writer, but present the message in a briefer way. However, you should be able to write more compactly and effectively by creating your own sentences to combine the most important ideas from the original. Summaries can be informative or descriptive.

Informative summaries help you to remember the most important information in the reading in your own way.

Example:

The circuit protection devices are those that protect wires, connectors and devices from being damaged because of an overload or a short-circuit. They are of different types. The most commons are: the fuse and the circuit breakers. Fuses are of two types: blade and cartridge. They are located in series or in a grounded power system, while breakers are usually placed in relays or fuse boxes. Breakers are classified according to:

- their arc quenching media

- their services

- the operating mechanism

-voltage level or installation

Descriptive summaries give a general overview of the selection in your own words and style.

Example:

The reading is about circuit protection devices. The principal ideas are related to the most common types of protective devices which are fuses and breakers, their classification and location.

Steps for summarizing the content of a text:

- Read the text carefully

- Underline the key ideas in each paragraph

- Write the information briefly

- Read and check the information carefully.

Exercise:

Read the text «What is electrical engineering» again and try to complete the following summary.

- What kind of summary is it?

This reading is about_____. The principal ideas are related to electrical engineering as one of the branches of _____ that deals with _____. Other ideas refer to what _____ and where _____. To conclude, the author mentions some of the most prominent _____

Section V Listening Practice

Video: «Electricity».

Exercise 1

Preparatory exercise. Words in context.

Read the sentences and try to infer the meaning of the underlined words.

rubbed: He rubbed the coin with a cloth until it shone.

wool (Handful of wool): Wool is the textile fiber obtained from sheep and certain other animals

light: Paper is very light, it´s not heavy.

feather: Some birds have beautiful and colorful feathers.

shell: Most motors are protected by a shell.

steal: Look! The baseball player is going to steal the second base.

imbalance: The imbalance in men's and women's salaries must be redressed (enmendar).

Exercise 2 Mark with an x before the words you listen in the video.

a. _____ electron

b. _____ atoms

c. _____ conductors

d. _____ device

e. _____ shells

f. _____ feather

g _____ current

h _____ non conductors

Exercise 3

While listening complete the ideas, so that the meaning becomes clear.

a. When you rubbed amber with wool, it develops an electrical _____

b. Amber comes from the Greek _____.

c. When we rubbed amber, it _____ the light scraps of paper near it.

d. Matter is made of _____

e. Atoms are composed of _____ and _____

f. Atoms that lose electrons are left with a _____

g. Atoms that gain electrons are left with a _____.

h. When the amber and the wool are separated, the amber becomes _____and the wool becomes _____

i. Browne didn´t know that the _____was produced because atoms prefer to have a neutral charge

j. Things that conduct electricity well are called _____

k. Things that don´t conduct electricity well, are called _____

Exercise 4

Complete the following ideas appearing in the video so that you can summarize its content.

This video is about _____. The principal aspects are related to an experiment showing how the electric _____ was discovered and its two types: _____ and _____. Another aspect is the composition of matter in _____, which have a nucleus made of _____ and _____.They are surrounding of _____. It is also important in the video the discoveries made in the field of electricity such as conductivity, _____ and the _____ (two useful electric devices)

Summing up, we can say that these discoveries made possible _____.

Section VI. Oral Practice

Giving presentations (Adapted from English for electrical engineering and computing.)

Presentation tips

As a university student, you could be involved in an oral presentation of an academic or scientific study.

The preparation is important. Therefore, the first step is to find out who you´re going to be presenting to, and how much the audience knows about the subject. Be sure everything is ready before the presentation.

The oral presentation is fulfilled in different stages:

1. Opening. (The first step). Here you can use phrases such as:

- On behalf of… may I welcome you to…?
- For those of you who don't know me already, my name is…
- Before I begin, I would like to thank you for inviting me to speak to you.

2. Introduction. Make a brief introduction about the subject you deal with.

Introduce your presentation by talking about its purpose and structure. Tell your audience how you became interested in the subject:

Standard phrases to be used on this stage:

- I'm here today to talk about…
- I have divided my talk into …. (3) parts.
- First, I will look at…, and then I will show you… Finally, I will say a little about….
- Please, feel free to interrupt me during the talk if you have any question
- I will be happy to answer your questions at the end

3. The main body of the presentation.

- First point: Let´s start with the first point
- New points: Moving on now to the next point…/ Let´s turn now to…
- Digressing: Before going on... I´d like to say a little about… (in the case, you want to talk briefly about any related aspect)

-Visual aids: As you can see from the next slide…

- Have a look on the diagram on the… (right, left)

4. Closing. It may include a summary of your talk and your final opinion

- Summarizing: So, just before I finish, let me summarize the main points again.

So, to sum up, I have talked about three main areas. First…, second…, and third…

- Concluding: Right, let´s stop here. Thank you very much for your attention

5. Inviting questions: And now, if you have any questions, I´ll pleased to answer them.

Useful advices:

1. When preparing for the opening, practice it one and over again memorizing it word by word.

2. Write the whole presentation; select the key points; read the full version repeatedly; Write key points or key phrases on small cards (no more than one or two on each card)

3. Use visual aids; face the audience at all times.

Principles to make a presentation:

1. The key points may be organized in the form of a pyramid structure.

2. The key points will constitute the content of the presentation.

3. The slides should look consistent in font and overall design.

4. It is necessary to add a corporate logo.

5. If using scales and numbering system, they should be simple and consistent.

6. Numbers should be rounded off. Example: 97, 3 per cent is made into 97 per cent, etc.

7. Use only the necessary data to support the argument.

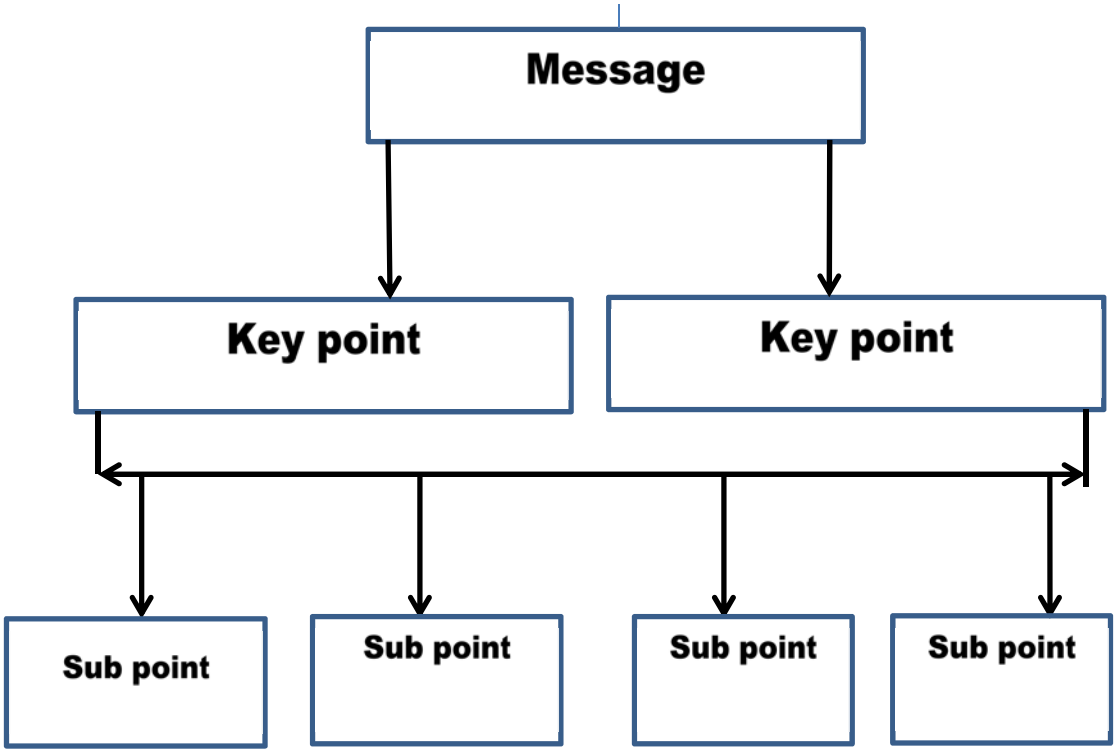
8. The quality of the presentation depends on the use of the corporal language: voice, eyes, gestures, posture, movement, etc.

The pyramid structure model

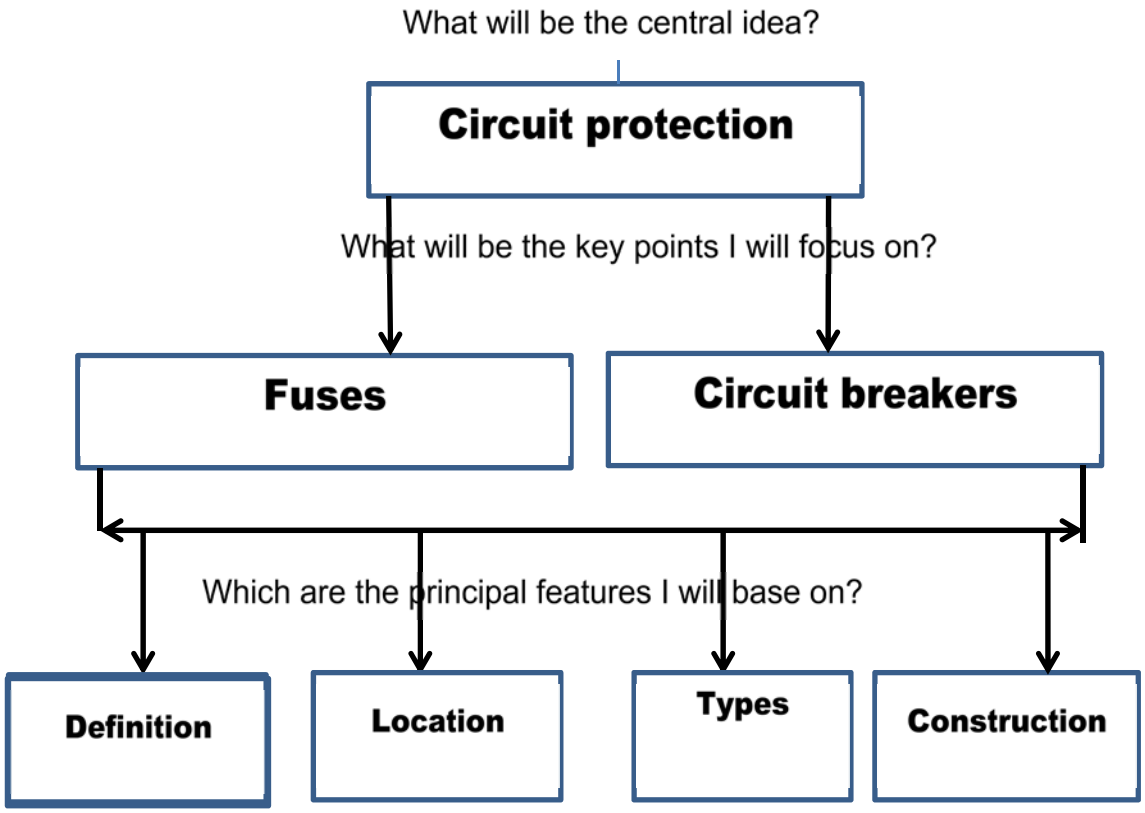
By using the model of a pyramid, the ideas are transferred to the written form (a review paper) and later to the slides of the presentation. Therefore, it is an overview of the whole paper and presentation in miniature.

Every idea is a sentence, each idea must summarize the ideas grouped beneath it; and each idea within a group is an answer to the question provoked by the summarizing idea. Ideas must be ordered in each group in terms of relevance, chronology or logical reasoning.

Pyramid model



Example of a pyramid model



Example of a presentation

2. FUSES

2.4 FUSE CONSTRUCTION

2.4.1 The blade type fuse is a compact design with a metal element and transparent insulating housing which is color-coded for each current rating.

3. CIRCUIT BREAKERS

3.2 LOCATION

- Circuit breakers are usually located in relay/fuse boxes

2. FUSES

2.4 FUSE CONSTRUCTION

2.4.2 Cartridge type fuse. A colored plastic housing contains the fusing portion element which can be viewed through a clear top.

Fuse ratings are also stamped on the case

3. CIRCUIT BREAKERS

3.3 BREAKER TYPES

- According to their arc quenching media: oil, air, SF6 and vacuum circuit breakers.
- According to their services: Outdoor, indoor breakers.
- According to the operating mechanism: Spring operated, pneumatic and Hydrolic circuit breakers.
- According to the voltage level of installation: high, medium and low voltage circuit breakers

3. CIRCUIT BREAKERS

3.1 DEFINITION

It is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by overload or short circuit

3CIRCUIT BREAKERS

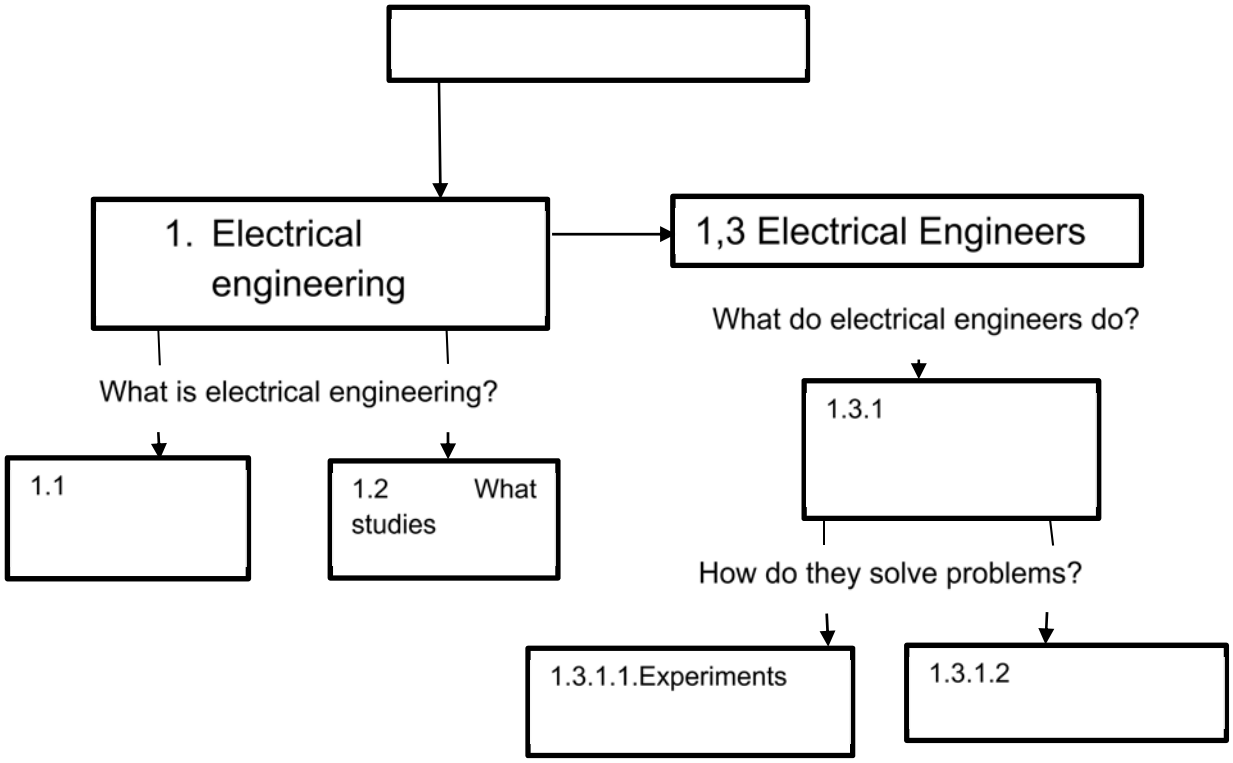
3.4 BREAKER CONSTRUCTION

The circuit breaker mainly consists of fixed contacts and moving contacts.

In normal "on" condition of circuit breaker, these two contacts are physically connected to each other due to applied mechanical pressure on the moving contacts.

Exercise 1

Suppose you should make an oral presentation about electrical engineering, taking into consideration the aspects studied in this unit. Complete the following pyramid structure to outline the key points, and then make an exposition in front of the whole class.



Section VII. Written Practice

Exercise 1 Supposed you were asked to rewrite the ideas focused in your oral presentation. Do it in the form of slides. (You can consult the example of a presentation offered above).

Unit II An Introduction to Circuit Elements

Section I Reading Practice: The Electric Charge

A study of electrical engineering becomes a study of the devices used in energy conversion and transmission. However, before we are in a position to study the behavior of electrical systems and devices, we must first be familiar with the fundamental concepts used to express that behavior.

The most elemental concept is the electric charge, or quantity of electricity. The rate of motion of charge in a circuit is called current. The unit of current is the ampere; one ampere exists when the charge flows at the rate of one coulomb per second.

Charge is the quantity which flows through the circuit; current, the time rate of flow of charge and is analogous to velocity in the mechanical system or to rate of fluid flow in the hydraulic system.

Charges may be positive (as in a proton) or negative as in an electron. In the m.k.s system, charge is measured in coulombs. For example, the charge on an electron is negative and equal to 1.602×10^{-19} coulomb. Conversely, about 6.242×10^{18} electrons are required to form a quantity of electricity equal to 1 coulomb.

The presence of charge gives to the possibility of force effects in the region surrounding it. Specifically, two charges will repel or attract each other (depending on whether their signs are alike or unlike) This effect is often described by saying that a field of force exists in the vicinity of the charge; the field of force is called the electric field.

Charges must move in order to bring about energy transfer. We are particularly interested in those situations where the motion is confined to a definite path formed by materials such as copper and aluminum, which experience has shown to be good conductors of electricity.

By way of contrast, other materials, such as porcelain, mica, glass, and under many conditions, air, are known to be extremely poor conductors. They are called insulators, and are used to confine the electricity to the specific conducting paths, by constituting barriers to departure from these paths. The paths are called circuits.

Section II Vocabulary Practice

Exercise 1

Complete these sentences by using one of the terms from the list:

List: bring about – proton -- flow – circuit -- insulator – electric field.

a. Mica is a material used as _____ because it does not conduct electricity

b. A poor conductor of electricity avoids the _____of current in certain parts of the circuit.

c. Charges move in order to cause or _____ energy transfer.

d. The _____ exists in the region surrounding the charge.

e. Electric current flows in a close path called an electric _____

Exercise 2

The suffix **–** or is added to some verbs to form nouns which are agents or doers of actions.

a) Explain the meaning of the following words according to the given explanation:

Eg. conveyor = that which conveys

a. oscilator = _____ c. isolator = _____

b. generator = _____ d. injector = _____

b) Find another word with this suffix in the reading and explain its meaning:

_____

Section III Grammar review

Passive voice

The passive voice is widely used in scientific writings. Let´s practice it through the following exercises.

Exercise 1

Identify the sentences written in passive voice.

a. ___ The rate of motion of charge in a circuit is called current.

b. ___ Charge is measured in coulombs.

c. ___ A study of electrical engineering becomes a study of the devices used in energy conversion and transmission.

d. ___ Porcelain and mica are known to be extremely poor conductors

e. ___ Two charges will repel or attract each other depending on whether their signs are alike or unlike.

Exercise 2

Mark with an x the idea that completely expresses the meaning of the sentences in passive voice.

a. Energy transfer is brought about by charges movement.

___ Energy transfer brings about charges movement.

___ Charges movement brings about energy transfer.

b. Electricity is confined to specific conducting paths by insulators.

___ Insulators confine electricity to specific conducting paths.

___ Electricity confines insulators to specific conducting paths.

___ The specific conducting paths confine electricity.

c. The devices used in energy conversion and transmission are studied by electrical engineering.

___ The energy conversion and transmission studies the devices used in electrical engineering.

___ Electrical engineering studies the devices used in energy conversion and transmission.

Exercise 3

Complete the sentences using the verbs in parenthesis in passive voice

a. The flow of electron _____ (call) current.

b. Voltage _____ (use) to move electrons.

c. Substances which totally resist the flow of current through them _____ (employ) in electrical appliances as insulators.

d. The relationship between current, voltage and resistance _____ (derive) by the scientist Ohm. («At a constant temperature, the current flowing through the circuit is directly proportional to the voltage and inversely proportional to the resistance»).

Section IV. Comprehension Practice

Exercise 1

Match the two columns to make full sentences.

A	B
1. It is possible to detect force effects…	___ depends on their signs.
2. The attraction or repulsion of charges…	___ of charge in a circuit.
3. To bring about energy transfer…	___ Charges must move.
4. In order to confine the electricity to the specific conducting paths…	___ materials such as porcelain and glass.
5. Current is the rate of motion…	___ poor conductors of electricity are used
	_____ in the vicinity of a charge

Exercise 2

Write R or W according to the information offering in the reading. Support your answer in the case of a wrong statement.

a.___ Charges are always positive.

b.___ In order to get energy transfer charges must be in motion.

c.___ The electric field is located near the charge.

d.___ Copper and aluminum are used as insulators.

e.___ The most important feature of insulators is that they are good conductors of electricity.

Exercise 3

Answer the questions based on the content of the reading.

a. What is the electric charge?

b. Are protons and electrons equal or different? Why?

c. What is the electric field associated with?

d. What happens if charges do not move?

e. How are called the conducting paths where electricity flows?

Section V. Language uses

When solving electrical problems, engineers are often involved in situations where mathematical analysis is needed. In this section, we´re going to get in touch with some fundamental mathematical expressions.

Exercise 1

First, let us review cardinal and ordinal numbers in English.

- Pronounce these cardinal numbers: 1 (one), 2 (two), 6 (six), 11 (eleven), 35 (thirty-five), 100 (one hundred), 124 (One hundred and twenty-four), 2 486 (two thousand and four hundred eighty-six).

- Read the following ordinal numbers: 1^{st} (first), 2^{nd} (second), 3^{rd} (third), 4^{th} (fourth), 16^{th} (sixteenth), 29^{th} (twenty ninth), 50^{th} (fiftieth).

Exercise 2.a)

Practice how to say fractions in English.

$\frac{1}{2}$ one half $\frac{3}{8}$ Three eighths $-\frac{1}{17}$ minus one seventeenth

$\frac{26}{9}$ twenty-six ninths $-\frac{5}{34}$ minus five thirty fourths $2\frac{3}{7}$ two and three seventhsb. Let´s practice some basic arithmetic operations:

Addition:	2 + 4 = 6	two plus four equals (= is equal to) six.
Subtraction:	15 – 20 = -5	fifteen minus twenty equals (= is equal to) minus five.
Multiplication:	5 . 5 = 25	five times five equals (= is equal to) twenty-five.
Division:	22 / 44 = 0.5	twenty-two divided by forty-four equals (= is equal to) zero point five.

Examples:

(2 – 3) . 6 + 1 = -5 two minus three in brackets times six plus one equals minus five.

$\frac{1-3}{2+4}$ = -⅓ one minus three over two plus four equals minus one third

c. Practice exponentiation and roots:

5^2 five squared

5^3 five cubed

5^4 five to the power of four / five fourth / five fourth power

5^{-2} five to the minus two

$\sqrt{3}$ the square root of three

$\sqrt[3]{64}$ the cube root of sixty four

$\sqrt[5]{32}$ the fifth root of thirty two

∫ f (x) dx integral of f of x d x

$\int_a^b t^2\,dt$ integral from a to b of t squared d t

Exercise 3

Match the written numbers with the way they are read:

A	B
1) 8.5%	___ Three and a half
2) ¾	___ x equals minus b plus or minus the square root of b squared minus four ac over two a
3) 3 ½	___ fourteen minus twelve over twelve times one hundred equals…
4) 1 + 2 = 3	___ three fourths
	___ Eight point five percent
5) $\frac{(14 - 12)}{12} \times 100 =$	
	___ one plus two equals three
6) $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	

Exercise 4

Are you ready to read the following mathematical expressions appearing in the previous reading?

$1.602x10^{-19}$ _____

$6.242x10^{18}$ _____

Exercise 5

Write in letters the following mathematical expressions:

3.55 _____

$3x9^{5}$ _____

$4.5x8^{-3}$ _____

¼ _____

⅞ _____

ab / cd _____

7^{2} _____

6^3 _____

x^2 _____

$\sqrt[3]{2}$ _____

$\sqrt{x+y}$ _____

Section VI Listening Practice

Video «Current and Voltage»

VI, 1 Preparatory exercises:

1. Join each word with its definition according to the meaning it has in the video.
2. Pronounce them.
3. Translate them into Spanish.

a. creek	___An expanse of water surrounded by land and unconnected to the sea.
b. charge	___The right or left outside part of a lake
c. coulombs	____An abbreviation of ampere
d. current	___ Without waves in the surface
e. Amp	___ It is the quantity which flows through the circuit
f. lake	___The movement or flow of electric charge, measured in ampere
g. flat	___ A stream smaller than a river
h. side	___The quantity of electricity transported in one second by a current of one ampere.

VI.2 While listening.

1. Select the correct word according to what you listen in the video

a. I think it's easier to think about electricity in analogy to a river or

___ a pit

___ a creek.

b. The fundamental quantity in a river is how much current is

___ flowing

___ going

c. Voltage is a little bit

___ trickier

___ easier

2. Select the correct option according to the video.

a. The amount of water that passes a point in a second is:

___ 16 buckets

___ 50 buckets

___ 15 buckets.

b. The word AMP means that a coulomb passes a point

___ in a second

___ by a second

___ per second

c. The two fundamental quantities in electricity are:

__ ampere

__ current

__ voltage

__ charge

3 (Dictation) while listening the video, try to copy the segment indicated by your professor.

Section VII. Oral Practice (in small groups)

Exercise 1

Arrange the pieces of information you have on the topic of voltage and current and outline the key points for an oral presentation, by using a pyramid structure model.

Exercise 2

Transfer your ideas to small cards just as if they were the slides of your presentation.

Exercise 3

Make the oral exposition of your work.

Exercise 4

Discussion of the presentation with the whole group

Guide for evaluation

The following aspects should be taken into account to evaluate the performance of the participants.

1. Did the presenter seem to be qualified on his performance?

2. Did the presenter make use of an effective non-verbal communication? (Voice, body posture, effective eye contact)

3. Were the visual aids, including figures and charts, used effectively?

4. Did the presentation contain just the necessary elements?

Section VIII. Written Practice

Exercise 1

Write a summary in English about the topic studied in this unit

GLOSSARY

A
actual: verdadero / real
attach: sujetar, atar, adjuntar
attain: alcanzar, lograr, conseguir
B
beadle: bedel
blackout: apagón, oscurecimiento
blade fuse: fusible de hoja
bottom: fondo, parte de abajo, final
box(es): caja(s)
branch: rama
brass rod: vara de metal
breaker: interruptor, disyuntor
breathe: respirar (__a sigh of relief): dar un suspiro de alivio
bright: brillante
bring about: provocar, ocasionar, producir
bucket: cubo, balde
build-up: acumulación
C
capture: capturar
cartridge fuse: fusible de cartucho
century: siglo
chain: cadena
charge: carga
coating: revestimiento, recubrimiento
cork: corcho
creek: arroyo, riachuelo
current: corrente
D
date: datar
deal with: estar relacionado com, ocuparse de, tratar con
design: diseñar
develop: desarrollar
device: dispositivo
drown: anegar, sumergir
E
electricity bill: factura de electricidad
enquiry: pesquisa
F
feather: pluma
filling: relleno de metal
flat: raso / plano / llano / liso
flow: flujo
fright: miedo
fuse: fusible
G
godlike: divino
H
handful: puñado
harnessing: aprovechamiento
hook: gancho
imbalance: desequilibrio
inside: interior
insulator: aislante
J
jar: pote
K
kite: cometa, papalote
L
lake: lago
light bulb: lámpara incandescente
light: liviano
lightning conductor: pararrayos
lightning: raio
M
magnetic field: campo magnético
matter: material, sustancia
O
outside: exterior, fuera, afuera
overload: sobrecarga
P
plumb: examinar, + adverb+ object: instalar, conectar
R
range: gama, variedad, registro, alcance
reach: alcanzar
rub: friccionar
S
scrap: pedazo
shell: estructura, escudo, revestimiento
silk: seda
silver foil: hoja, lámina de plata
slide: diapositiva, transparencia
source: fuente
spark: chispa
spread: propagar
steam. Vapor
store: almacenar
string: cuerda
strips: tiras

surrounding: alrededor, rodeando
T
tenet: doctrina / principio / premisa
thunderstorm: tormenta eléctrica
tin: estaño
tiny: minúsculo
tricky: difícil
truth: verdad
turn: volver / convertir
twitch: contraer
U
unwilling: poco (mal) dispuesto
useful: útil
W
wide: amplio
wire: alambre
witness: testigo(a)
wool: lana

ANSWER KEY:

Unit I. «Electricity».

Section II Vocabulary Practice

Exercise 1

paragraph 1

devices

power

paragraph 2

battery

charge

voltage

circuit

paragraph 3

induction

current

Exercise 2

a. magnetic field

b. device

c. light bulb

d. current

e. charges

Exercise 3

Far back in time / a quantity of electricity / real / a period in history / to change into something else, transform.

Section III Grammar review

Exercise 1

write / drive / install / cut / join / slip / jump / read / repair

Exercise 2

- He cuts the wires
- He installs a lamp
- He repairs an air conditioner
- He examines a fuse box with a multimeter.
- He replaces a lamp (into ceiling)
- He inspects electric counting equipment.
- He binds some wires together.
- He peels some wires.
- He checks the energy meter.

Exercise 3

Cut	cut	install	Installed	repair	repaired
examine	examined	replace	Replaced	inspect	inspected
Bind	bound	peel	Peeled	check	checked

Exercise 4

a. verbs in simple present tense

dates back / deals / design / develop / solve / test / work / states / applies / include

b. verbs in simple past tense

Verb	Regular	irregular
Included	X	
Began		x
Turned	X	

Exercise 5

a. deals

b. discovered

c. took

d. work / do

Section IV Comprehension Practice

Exercise 1

a. Electrical engineering is one of the newer branches of engineering which deals with the technology of electricity.

b. It (electrical engineering) dates back to the late 19th century.

c. It began with the implementation of Michael Faraday's Law.

d. This law (it) is applied to the basic principles of the electric generator, the electric motor and the transformer.

e. It is important because it is used everywhere….

f. Nicola Tesla contributed to the invention of: alternating current, induction motor and the radio among others.

Exercise 2 (Pair work)

a.

- Where do electrical engineers work?

- What did early experiments with electricity include?

- What does Michael Faraday's Law of Induction state?

b.

student A: - Where do electrical engineers work?

student B: -They work on a wide range of components, devices and systems

student A: - What did early experiments with electricity include?

student B: -Early experiments included primitive batteries and static charges.

student A: - What does Michael Faraday's Law of Induction state?

student B: -This law states that the voltage in a circuit is proportional to the rate of charge in the magnetic field through the circuit.

Exercise 3

The diagram shows that electrical engineering is one of the branches of engineering. It deals with the technology of electricity.

Exercise 4

a. Electrical engineers… design and develop new electrical equipment, solve problems and test equipment on a wide range of components, devices and systems

b. The actual design… of useful devices and systems began with the implementation of Michael Faraday's Law of Induction

c. The most prominent pioneers … in electrical engineering include Thomas Edison, George Westinghouse, Nikola Tesla, Guglielmo Marconi, and Philo T. Farnsworth.

Exercise 5

- Descriptive summary

This reading is about electrical engineering. The principal ideas are related to Electrical engineering as one of the branches of engineering that deals with the technology of electricity. Other ideas refer to what electrical engineers do and where they work. To conclude, the author mention some of the most prominent pioneers of electrical engineering.

Section V Listening Practice

Exercise 1

rubbed: friccionado(a)

wool: lana

light: ligero(a), liviano(a)

feather: pluma

shells: estructura

steal: robar

imbalance: desequilíbrio

Exercise 2

a. ___x__ electron

b. ___x__ atoms

c. ___x__ conductors

d. _____

e. ___x__ shells

f. __x___ feather

g. _____ current

h. ___x__ non conductors

Exercise 3

a. charge

b. elektron

c. attracts

d. atoms

e. neutrons / protons

f. positive charge

g. negative charge

h. negatively charged / positively charged.

i. force of attraction

j. conductors

k. non-conductors

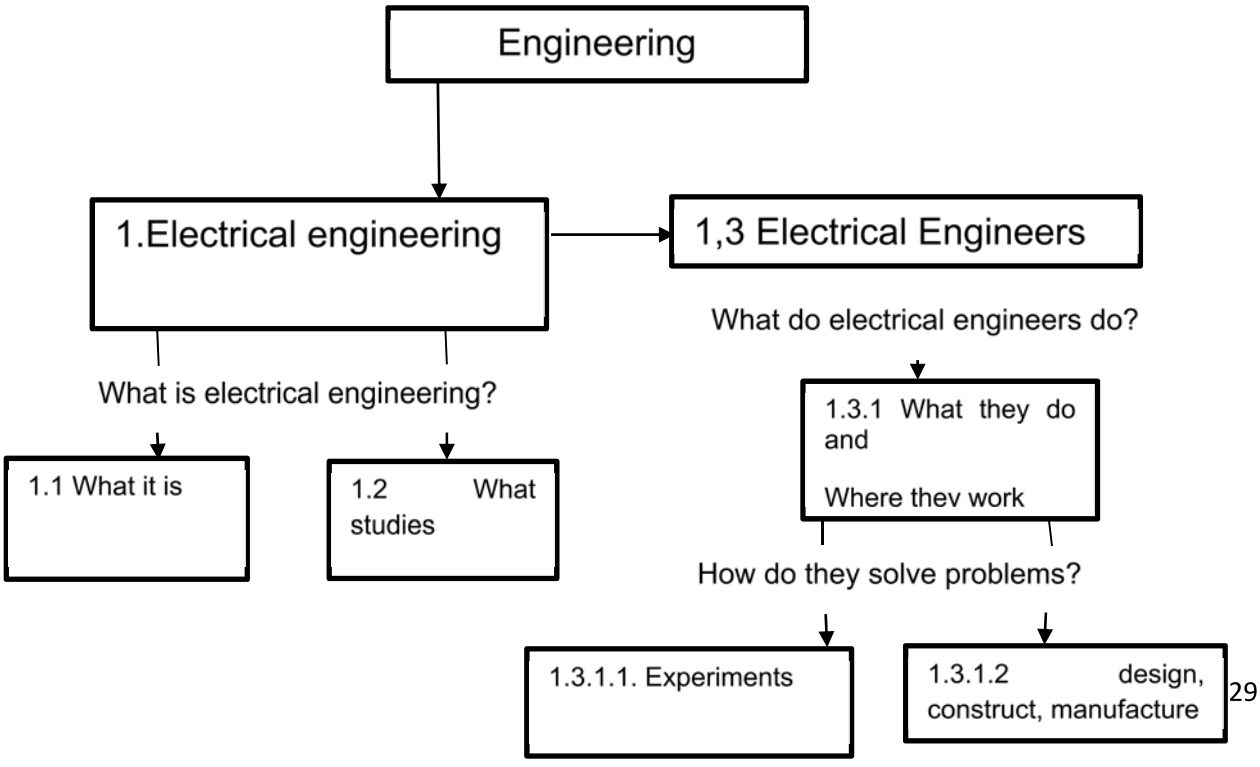
Exercise 4

This video is about electricity. The principal aspects are related to an experiment showing how electric charge was discovered and its two types: positive and negative. Another aspect is the composition of matter in atoms, which have a nucleus made of neutrons and protons. They are surrounding by electrons. It is also important in the video the discoveries made in the field of electricity such as conductivity, the battery and the generator

Summing up, we can say that these discoveries made possible improvements in modern life (society….).

Section VI. Oral Practice

Exercise 1



Unit II. An Introduction to Circuit Elements

Section II Vocabulary Practice

Exercise 1

a. insulator
b. flow
c. bring about
d. Electric fields
f. circuit.

Exercise 2

a. oscilator = that which oscilates
b. generator = that which generates
b) conductor = that which conduct
d. Isolator = that which isolates
e. Injector = that which injects

Section III Grammar review

Exercise 1

a. X.
b. X.
c. ___.
d. X
e. ___.

Exercise 2

a.
X Charges movement brings about energy transfer.
b.
X Insulators confine electricity to specific conducting paths.
c.

X Electrical engineering studies the devices used in energy conversion and transmission.

Exercise 3

Complete the sentences using the verbs in parenthesis in passive voice

a. is called

b. is used

c. are employed.

d. was derived

Section IV. Comprehension Practice

Exercise 1

Match the two columns to make full sentences.

B

2 depends on their signs.

5 of charge in a circuit.

3 Charges must move.

_ materials such as porcelain and glass.

4 poor conductors of electricity are used.

1 in the vicinity of a charge

Exercise 2

a. W Charges are negative or positive.

b. R

c. R

d. W Because they are good conductors of electricity.

f. W They are poor conductors.

Exercise 3

a. Electric charge is the quantity which flows through the circuit.

b. They are different. Protons have positive charges and electrons have negative charges.

c. The electric field is associated with electric charges.

d. If charges do not move, they do not bring about energy transfer.

e. They are called electric circuits.

Section V. Language uses

Exercise 3

B

3 Three and a half

6 x equals minus b plus the square root of b squared minus four ac over two a

5 fourteen minus twelve over twelve times one hundred equals…

2 three fourths

1 Eight point five percent

4 one plus two equals three

Exercise 4

$1.591x10^{-19}$ = one point five nine one times ten to the minus nineteen

$6.4x10^{18}$ = six point four times ten to the power of eighteen

Exercise 5

3.55 = three point five five

$3x9^{5}$ = three times nine to the power of five (to the fifth), (to the fifth power)

$4.5x8^{-3}$ = four point five times eight to the minus three

¼ = one quarter / a quarter

⅞ = seven eighths

ab / cd = a times b over times d

7^{2} = seven squared

6^{3} = six cubed

x^2 = x squared

$\sqrt[3]{2}$ = the cube root of two

$\sqrt{x+y}$ = the square root of the sum of x plus y

Section VI Listening Practice

Video «Current and Voltage»

Preparatory exercises:

a. creek	riacho / arroyo	f. An expanse of water surrounded by land and unconnected to the sea.
b. charge	carga	h The right or left outside part of a lake
c. coulomb	coulomb	e An abbreviation of ampere
d. current	corrente	g Without waves in the surface
e. Amp	ampère	b It is the quantity which flows through the circuit
f. lake	lago	d The movement or flow of electric charge, measured in ampere
g. flat	raso / plano / liso	a A stream smaller than a river
h. side	lado	c The quantity of electricity transported in one second by a current of one ampere.

While listening

1.

a. I think it's easier to think about electricity in analogy to a river or a creek.

b. The fundamental quantity in a river is how much current is flowing.

c. Voltage is a little bit trickier.

2.

a. The amount of water that passes a point in a second is 15 buckets.

b. The word AMP means that a coulomb passes a point in a second

c. The two fundamental quantities in electricity are:

__ current

__ voltage

3

Dictation (2: 18)

In electricity is a very similar thing: the way we make current flow is to produce a potential difference in the wire. Not a gravitational potential difference at this time, an electrical potential difference.

Section VII. Oral Practice (in small groups of 3 or 4 students)

Exercise 1

Arrange the information you have on the topic of voltage and current and outline the key points for an oral presentation, by using a pyramid structure model.

VIDEO TRANSCRIPTS:

Unit I Electricity.

Section V Listening Practice

Video: «Electricity». Learn English Vocabulary

Without electricity you wouldn´t be watching this video now. But what exactly is electricity?

Electricity gets its name from amber. It gets its name from amber because amber was the first material to be shown to develop an electrical charge when rubbed with wool. The Greek for amber was electron. Now, of course, when somebody first rubbed a piece of amber with a handful of wool they had no idea what electricity was.

What they noticed, however, was that the amber they rubbed was suddenly able to attract anything light placed near it, like a scrap of paper or a feather.

We now know that this force of attraction is produced by a build-up of elektrons on the amber.

All matter is made up of atoms. Atoms themselves have a nucleus made of neutrons and protons. Surrounding the nucleus are shells of electrons. There is normally just the right number of electrons to match the number of protons in each atom. Then we say that there´s a neutral charge on the atom.

Some atoms are very attached to their electrons and refuse to let them go. Other atoms lose their electrons more easily when they touch other atoms. Atoms that lose electrons are left with a positive charge. Other atoms steal electrons from other atoms that they come in contact with. Atoms that gain electrons are left with a negative charge.

So, when the piece of amber, which like to steal electrons, comes into contact with a piece of wool, which easily loses electrons, electrons on the surface of the wool are captured on the surface of the amber. When the amber and the wool are separated, the wool becomes positively charged by losing electrons, and the amber becomes negatively charged by gaining electrons. A charge imbalance exists.

It was an Englishman, William Gilbert, who, around 1570, started experimenting with amber. It was Gilbert who first used the term electrics for objects that attracted other objects after being rubbed. At this time, of course, neither Gilbert nor anybody else knew anything about atoms and electrons.

In 1646, another Englishman, Sir Thomas Browne, wrote the Pseudodoxia Epidemica, or Enquiries into very many received tenets and commonly presumed truths. It was in this book that the terms electric and electricity first appeared.

Electricity described the force of attraction caused by what we know now to be electrical charge.

Neither Browne nor anybody else had any idea that the force of attraction was produced because atoms prefer to have a neutral charge. Nor did he realize that what he had called electricity was simply the flow of electrons from a negatively charged object to a positively charged object.

By 1731, another Englishman by the name of Stephen Gray, did experiments to show that the electricity could flow over great distances. We still talk about the flow of electricity as if it were a fluid like water.

Gray also found that metal conducted electricity better than other materials. Since then, things that conduct electricity well are called conductors and those that don´t, like amber, are called non-conductors.

Unit II. An Introduction to Circuit Elements

Section VI Listening Practice

Video «Current and Voltage»

In this segment I´m gonna deal with basics of electricity. I think it´s easiest to think about electricity in analogy to a river or a creek. A fundamental quantity in a river is how much current is flowing. In other words, how much water is passing a point in a second.

With electricity, current is also really important, but now we´re are talking about charge that passes a point in a second, not water.

We measure that charge passing a point in a second in coulombs. So the current, which is given the symbol (I) should be measured in a number of coulombs that pass a point in a second.

Just like in a river, we might measure the amount of water that´s flowing and pass a point in a number of buckets of water that is passing a point in a second, say 15 buckets a second. In a wire, we count the number of coulombs that go to pass the point and that, is the value of current. Say three coulombs per second. A coulomb per second is given a special name. That name is an Amp. We must never forget the word Amp means. It means that a coulomb passes a point in a second, so if there´s a current of five Amps flowing, that means five coulombs are passing a point in one second.

Current is the easy part of electricity, because I think it´s not too difficult to think on the number of coulombs that are passing a point in a second.

Voltage is a little bit trickier. Voltage or the potential difference. I think the best way to think about that, is to think about a lake. Here we´re a lake. There´ll be no current flowing. Why is that? The reason is because the water in the lake is flat. If you pick up one side of the lake and lift it up a little bit, and then the water will start flowing down with the other side. Leave it down soon creating a difference in potential; gravitational potential energy. The side that we lifted up now has more gravitational potential energy than the other side. So the water will rush down from high potential to lower potential.

In electricity it is a very similar thing; the way we make current flow is what produce a potential difference in the wire. Not a gravitational potential difference at this time, an electrical potential difference.

Where can we do that? It´s, with the battery. With the battery we´re picking up one side of the wire and putting it at a higher electrical potential to the other side of

the wire, the other hand. So, electrons then can flow from a higher potential down to the lower potential. And the great the potential we apply, the more the electrons will flow, the great of the current we´ll get. Very similar like to the river; the great is the difference in height in a river, the more the current will flow.

So, why do we use the word potential? What does that mean? The word potential refers to the potential to do work. The potential to do work is given in units of J/C that is the energy clear in a charge. But 1 J/C is given another name. It´s called a Volt. We must remember if someone tells you, that there is a potential difference across the wire of ten Volts, that means that one coulomb of charge at a higher potential Amp, can do ten Jules of work on its way down to the lower potential Amp, or it can do ten Jules of work more than the charge, 1 coulomb a charge, at the lower potential Amp.

So, let´s think about this, as an example of the 1.5 v tablet battery, standard battery. What does that mean with the 1.5 v battery? Well, it means that if 1 coulomb of charge came out of one side, it could do 1.5 Jules of work before reentering on the other side of the battery, so, connecting the battery up to a light bulb, each coulomb came out of the top of the battery went through the light bulb and will give up 1.5 Jules of light before reentering the other side

So, summarizing, there are two fundamental quantities in electricity: current and voltage.

Current is the easier one. It´s just the number of coulombs, that are passing a point in a second. It´s given the letter (I), the symbol I, and its units are Amps. Don't forget 1 Amp just means C/S.

Voltage is a little bit trickier, refers to the difference in potential to do work in a wire, difference in electric potential. It´s measured in the number of Jules/ each coulomb. For that is given a special name, the volt. The great is the amount of voltage that is supplied across the wire; the great is the current that will flow in a wire.

APPENDIX A

Grammar review. Simple present tense

The simple present tense is used to express habitual actions.

Observe the forms used to ask for and offer information in simple present tense.

AFFIRMATIVE	NEGATIVE	INTERROGATIVE
Currents always flow from positive side to the negative side of the source.	Currents do not (don´t) flow from low potential to higher potential.	Do currents flow from positive to the negative side of the source?
Current direction depends on the polarity of the source voltage in the circuit.	The independent source does not (doesn't) depend on any other voltage or current variable in the circuit.	Does an independent source depend on any other voltage in the circuit?

What does the current polarity depend on?

The 3rd person singular

The majority of the verbs in the third person singular, ends in –s when used in simple present tense.

Examples:

The atom contains two types of particles.

The number of protons in the nucleus of atom gives the atomic number.

The universe consists of five big natural energy sources.

However, -es is added to the verbs ending in –sh, -ch, -ss, -x, -o

Example:

The Ampere is the quantity of the total charge that passes through an arbitrary cross section of a conducting material per unit second.

-es is also added to the verbs ending in consonant+ y. The y is substituted by i

Example:

The neutron carries no charge.

Pronunciation

The pronunciation of –s/-es ending varies according to final sound of the verb.

/s/	/iz/	/z/
constitutes	misses	signifies
works	rises	repairs
provides	uses	leaves
acts	changes	refers

Observe that:
/s/ is pronounced when the final sound of the verb is /f/, /k/ or /t/
/iz/ is pronounced when the verbs end in the sounds /s/, /ʃ/, /tʃ/,/dz/, /z/
/z/ is pronounced when the verbs end in any other sound.

APPENDIX B

Grammar review. Simple past tense

The simple past or past simple is the basic form of the past tense in English. It is used principally to describe actions and events in the past
The English verbs in past are divided into two groups: regular and irregular. Regular verbs form the simple past in –ed. However, there are a few hundred irregular verbs with different forms.
Most verbs have a single form of the simple past, independent of the person or number of the subject. However, the verb to be has two past tense forms: **was** for the first and third person singular, and **were** in other instances.
We use did to make negative sentences and questions in the past simple tense.

Examples

Affirmative	Negative	Yes or no questions	Wh questions
I installed the line	I didn´t install the line	Did I install the line?	What did I install? Who installed the line?
He wound the coil perfectly	He didn´t wind the coil very well.	Did he wind the coil?	What did he wind?
Four engines powered the plane in the way back to New York.	The engines didn´t power the plane.	Did the engines power the plane?	When did the engines power the plane?

Some common regular verbs in electrical engineering:

Verb	**Simple past form**	**Verb**	**Simple past form**
adjust	adjusted	heat	heated
apply	applied	increase	increased
assume	assumed	insulate	insulated
carry	carried	join	joined
change	changed	light	lighted
charge	charged	manufacture	manufactured
conduct	conducted	match	matched
connect	connected	measure	measured
convert	converted	mix	mixed
cover	covered	operate	operated
decrease	decreased	overload	overloaded
deliver	delivered	power	powered
design	designed	rate	rated
desire	desired	reduce	reduced
differ	differed	remain	remained

discharge	discharged	remove	removed
dissipate	dissipated	resist	resisted
drop	dropped	store	stored
enter	entered	supply	supplied
Fail	failed	switch /on /off	switched /on /off
fasten	fastened	transport	transported
flow	flowed	use	used
form	formed	vary	varied
generate	generated	wire	wired
ground	grounded	wrap	wrapped
harden	hardened		

Some common irregular verbs in electrical engineering

verb	**simple past form**	**Verb**	**simple past form**
bind	bound	lead	led
blow	blew	lose	lost
drive	drove	make	made
feed	fed	rise	rose
give	gave	set /up	set /up
have	had	take	took
hold	held	wear	wore
keep	kept	wind	wond

APPENDIX C

Grammar review. Passive voice.

English and Spanish languages have the possibility to express the actions of transitive verbs in passive and active voices. In both languages, the main function of passive voice is to emphasize the result of the action.

It is particularly useful in scientific or technical writings in those situations where the actor or doer of the action is not important, but the process or principle being described.

Although the passive can be used in various tenses, it is frequently found in simple present, simple past and modal verbs. Let´s take a look of the passive forms of the verb **charge**

Tense	**Subject**	**Singular**	**Plural**	**Past Participle**
Simple present	An object/ The objects	is	are	charged
Present perfect		has been	have been	
Simple past		was	were	
Past perfect		had been	had been	
Future		will be	will be	
Future perfect		will have been	will have been	
Present progressive		Is being	are being	
Past progressive		was being	were being	
Modal verbs		can be / may be / could be…		

APPENDIX D

How to read numbers and some mathematical expressions in English

The cardinal numbers

0	zero	13	thirteen	50	fifty
1	one	14	fourteen	60	sixty
	two	15	fifteen	70	seventy
2					
3	three	16	sixteen	80	eighty
4	four	17	seventeen	90	ninety
5	five	18	eighteen	100	one hundred
6	six	19	nineteen	101	one hundred and one
7	seven	20	twenty	200	two hundred
8	eight	21	twenty-one	901	nine hundred and one
9	nine	22	twenty-two	927	nine hundred and twenty seven
10	ten	30	thirty	999	nine hundred and ninety nine
11	eleven	31	thirty-one	1000	one thousand
12	twelve	40	forty	1000 000	one million

The ordinal numbers

1st	first	11th	eleventh	21st	twenty first
2nd	second	12th	twelfth	22nd	twenty second
3rd	third	13t	thirteenth	30th	thirtieth
4th	fourth	14th	fourteenth	40th	fortieth
5th	fifth	15th	fifteenth	50th	fiftieth
6th	sixth	16th	sixteenth	60th	sixtieth
7th	seventh	17th	seventeenth	70th	seventieth
8th	eighth	18th	eighteenth	80th	eightieth
9th	ninth	19th	nineteenth	90th	ninetieth
10th	tenth	20th	twentieth	100th	one hundredth

Fractions:

a / b	a over b	¾	three quarters
ab / cd	a times b over c times d	⅝	five eighths
⅓	one third	7⅜	seven and three eights
¼	one quarter	- ⅔	minus two thirds

Basic arithmetic operations

Addition	10 + 2 = 12	ten plus two equals (is equal to) twelve
Subtraction	43 – 11 = 32	forty three minus eleven equals (is equal to) thirty two

Multiplication	9 . 2 = 18	nine times two equals (is equal to) eighteen
Division	13 / 22 = 0.6	thirteen divided by twenty two equals zero point six

Powers, roots

7^2	seven squared	5^4	five four (five to the power of four) (five fourth)
8^3	eight cubed	$a^2 + b^2 = c^2$	a squared plus b squared equals c squared
6^{-4}	six to the minus four (six to the power minus four)	$\sqrt{a^2 + b^2}$	the square root of a squared plus b squared
$\sqrt[3]{6}$	the cube root of six	$\sqrt{8}$	the square root of eight
$\sqrt[4]{45}$	the fourth root of forty five	$\sqrt{x} + \sqrt[3]{y}$	the square root of x plus the cube root of y

Integrals

∫∫	double integral	$\iint_S h(x,y)\,dx\,dy$	doble integral over s of h of x y d x d y
∫∫∫	triple integral	$\int_a^b f(x)\mathrm{d}x$	the integral from a to b of f of x with respect to x
∫ f(x) dx	integral of f of x d x	$\int_a^b t^{2}\,dt$	integral from a to b of t squared d t

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