UNIVERSIDAD MAYOR DE SAN ANDRES
FACULTAD TÉCNICA
CARRERA MECÁNICA AUTOMOTRIZ

PROJECT OF DEGREE
"Proyecto de Grado"

LEVEL: LICENCIATURA

READING COMPREHENSION FOR AUTO-MECHANICS
"Lectura de Comprensión para Mecánica Automotriz"

AUTHOR: T.S. GREGORIO SALOMÓN HURTADO CERRUTO

LA PAZ- BOLIVIA
2009

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Inscription

I want to thank you Daddy for your support, honesty, hard work, courage and wisdom. I'm sure God will take good care of you in his kingdom. There's no doubt I'll see you again. That's why, I just say see you later my dear "JEFE".

Acknowledgments

The C.B.A., La Paz has given me the opportunity to learn and teach English for more than 14 years; therefore, I’m grateful to this institution which made me feel a useful human being. I also want to mention San Andres University because it has helped me reach my dreams in foreign countries.

UNIT 1
INTRODUCTION

Technical English has gradually become widespread in the last years, largely on account of a huge need to use English in the field of auto-mechanics. Learners in Latin America are increasingly seeking proficiency in the English language in specific domains of use to serve limited purposes.

These learners retain a bilingual use of their native language for social and informal purposes. The native language is used for school and university subjects which reflect indigenous cultures and which are learned in the language of a country; examples of such subjects outside the field of science and technology are history, sociology, political science, and education. In countries where the native language is used as the medium of instruction for lectures in science, knowledge of English is crucial to gain access to the bulk of scientific material published in books, magazines, and journals.
This trend toward special purpose language instruction is mainly focused to the instruction on the needs of the learner.

1.1 BACKGROUND

The concept of English for a special purpose (ESP) arose in the early 1960s in response to the recognized need for improved communication between the developed and the developing countries of the world. The developing nations were hungry for the explosion of technical information, and the developed nations were anxious to provide appropriate aid. Due to the fact the most technical information has been written in English, it has become the language that is mostly spoken in the international community. What's more, it is considered a natural link between multi-cultural and multi-lingual societies. It is a vehicle for international communication, as a global carrier-wave for news, information, entertainment and administration. This global state of affairs in conjunction with the increasing recognition of the need for relevance in English language teaching and the work of recognized writers on language in social contexts all came together under the acronym ESP, English for Special (now Specific) Purpose.

The first focus of ESP was on the lexis (vocabulary). The idea was that normal ESL (English as a Second Language) material would be used but that subject- specific lexical items (word and phrases) would be substituted for more general terms (Ex."It is a house" might be replaced by "It is a crankshaft"). For science, the grammatical differences from "general English" were fewer than imagined, but what was clear was that simple lexical substitution would be insufficient. The idea that the described rhetorical and discourse structures might be true across languages led to a new concept: that second language learners would learn English by practicing scientific tasks that were already familiar to them in their native languages. Thus a new motivation was described, not just to learn English but to learn English in order to manipulate difficult intellectual material in it.

The focus on the need of the learner as opposed to the inculcation of linguistic facts led to a general shift away from teacher-centeredness to learner-centeredness. ESP practitioners were encouraged to find and use of authentic materials (not invented ones) in trying to best meet the needs of their students. ESP really offered the most practical means of identifying learners need and meeting them directly.

1.2 PROBLEM PROPOSAL

Language use varies country by country, and so also do the requirements for students' proficiency in understanding reading material. Bolivian university students usually ask themselves if it is possible to understand automotive reading material in English with a beginning or no English level. Throughout this project they will realize they surely understand more than they can imagine.

1.3 GENERAL OBJECTIVE

The main purpose of this project is to build up the comprehension skill in the field of auto-mechanics. At the same time, it is intended to be a reading comprehension text for students who want concentrated practice in reading technical material. Although it is unarguably true that listening, speaking, and writing practice enhance the reading skill, practice in reading itself is a more direct route to this goal. This project also elicits some production of written English. On the contrary, speaking and listening activities will not be included. What is provided here, then, is an alternate path focused entirely on reading comprehension.

1.3.1 SPECIFIC OBJECTIVES

The "reading comprehension approach" will be based on the implication of the students' science background, functional, and linguistic objectives. In this connection, certain abilities have to be developed.

1. Knowledge of the word meaning.
2. Ability to select the appropriate meaning for a word or phrase in the light of its particular contextual setting.
3. Ability to select the main thought of a passage
4. Ability to answer questions that are specifically answered in a passage
5. Ability to answer question that are answered in a passage but not in the words in which the question is asked.
6. Ability to understand grammar rules in context.
7. Develop a technical and meaningful vocabulary for auto-mechanics

The teaching of reading to non-native speakers is going to be restricted to the above seven points. Therefore, it has to be found and used texts or science articles which exemplify the functions of language as they are realized in the actual language, in concepts, processes, experiments, and so on.

1.4 JUSTIFICATION

Among the millions of students who have encountered the need of updating their knowledge in a technical field, nobody can deny that the majority of these students require training oriented towards the acquisition and the practice of English in a "specialized" context.

Most of what this project is going to deal with has been taken from my experience with technical terms in the field of auto-mechanics, the area in which I hold a degree as a superior technician. I also want to point out that I have taught commercial English at a language institute and technical English at San Andres University for more than ten years. Therefore, I consider myself capable enough to cope with some of the expectations students have while reading technical English.

Because much ESP is closely related to the content of a subject specialism, the subject specialist instructor is a very important resource person during all phases of the project development. He is able to find out the kind of activities and skills the students are likely to encounter in their specific areas so that this same type of activity and skill can be employed in the class to make it more meaningful and useful to the learners.

It is my belief that a subject specialist contributes more effectively providing a specific text when it is needed, so that the materials writer does not have to search blindly for such information in the library.

1.4.1 SOCIAL

Not long ago, illiteracy was a barrier that stopped poor countries from developing as nations. Once they have overcome that problem, they encountered a new kind of illiteracy, reading comprehension in English. Unfortunately, Bolivia might be considered a Third Word Country because of its teaching practices. We still use some methodologies that were used a century ago as teaching of a language system, with use of grammar-based syllabus.

The practical result of such a teaching practice could easily be evidenced from the learner's failure to comprehend what he is reading. If a person wants to update his knowledge, he has to read about what is hot in the market. And to have access to this information, he needs to know English because most new books and articles are written in English.

1.4.2 TECHNICAL

There are lots of books that deal with ESP; nevertheless, none of them were developed for auto-mechanics. A student in auto-mechanics needs to know specific vocabulary, useful grammar structures, and overall, understand what he is reading. The vocabulary that is presented in each chapter is made up of technical and sub-

technical vocabulary. Almost all these words will be found sooner or later in students' independent reading, regardless of their specialized interests. Each word is defined in the limited sense in which it is used in the reading selection to follow. The word is then presented in a simple contextual sentence which further conveys and fixes its meaning. Where necessary or helpful, an illustration might also be provided as a meaning conveyor. Besides, each chapter includes certain syntactical and grammatical features which occur frequently.

1.4.3 ECONOMICAL

In order to learn English up to an intermediate level in an institute or at a private university in Bolivia, students typically have to spend two to three-hundred hours of classroom instruction. The average tuition costs 40 dollars a month without considering books, dictionaries, transportation, etc. If we consider all these items, we will realize that the cost of learning English is too high. Besides, the places mentioned above are fairly expensive for people who come from public schools specially. Since this material is going to be available at the San Andres University library, students will have free axcess to it. In most cases we have to consider that students do not want to become fluent in English. They just want to learn one or two specific skills to be applied in their jobs.

1.5 FEASIBILITY

English is being recognized as a world language, and many people believe that the earlier students start reading technical articles written in English, the better. The underlying assumption is that learnes will be more successful if they begin reading what they know about or what they are interested in.

There has been an enormous push to introduce Technical English as an important subject to university students because of the new technological advances in science and technology spread worldwide. Since most students are eager to apply new knowledge to their careers, they realize English is the bridge that will help them fulfil their expectations.

Students have come to me several times asking for some advice to learn technical English. Some of them were told that they had to learn commercial English first. It is my believe that they can learn technical English without a prior knowledge of it if they are exposed to short reading articles since the very beginning. Since I have been using some of this material at the Technical Faculty- U.M.S.A. for about two years, I am sure it works. It is amazing how much students understand some technical reading in English. I have also found out they can answer Yes/No questions in English easily. What's more, they can answer Information Questions in Spanish. Students not only have developed some reading skills but grammar structures and word order as well.

1.6 SCOPE AND CONTRIBUTION OF THE PROJECT

Since the purpose of this project as a whole is to prepare students to read and understand authentic published source materials in the field of auto-mechanics, it concentrates on reading selections especially written to ready students for this goal by illustrating the use of high-frequency technical vocabulary and important concepts in grammar and syntax.

Students have to be exposed, at one time or another (and with greater or lesser amounts of success), to the basic structures of the language, and a fair amount vocabulary covering manuals or technical material. They will understand more difficult language than that which they can produce on their own. Their reading ability will correspond to what they can say, because they have studied from text in their native language (Spanish).

It should be kept in mind that the students for whom this material will be developed won't be English majors, but rather specialists (or specialists in training) in auto-mechanics.

This project is going to contribute in providing specialized material to be used not only to understand technical auto-mechanics readings but also a meaningful dictionary English-Spanish.

1.7 METHODOLOGY

The acronym ESP to most ESL teacher signifies needs analysis and the development of purpose-specific materials for students specializing in science and technology. A large part of ESP is concerned with needs analysis and materials development. But it is not the most important aspect: indeed, I believe that ESP stands or falls by what happens methodologically in the classroom, not what occurs before the course begins.

There are two approaches to teaching language as communication. Orthodox ESP predicts the needs of learners before instruction begins. Here, methodology is often treated as an afterthought; the teaching techniques that mediate the materials are thus often surprisingly teacher-centered. Methodological ESP often emphasizes the importance of needs analysis and materials writing but promotes the use of methodologies that can be quite radically student-centered. Even though one of them might overweigh the other, there is room for both approaches; the approach we choose depends on how teacher-dependent our students are. In Bolivia, for example, the first approach might be preferable. We must therefore try to use teaching techniques that challenge the learners to communicate on their own account in the classroom. The role of the teacher is primarily that of organizer of class activities and facilitator of communicative tasks. This implies that the focus of instruction should be on communication, not grammar. However, this does not mean that grammar is ignored. What distinguishes communicative language teaching from traditional approaches is that learners are required to communicate with all available resources

first, and only then are asked to focus on the grammatical accuracy of the language they produce.

UNIT 2

THEORETICAL FRAME WORK

2.1 INTRODUCTION

In recent years, English language teachers have benefited from a growing body of research that describes how learning strategies can help students improve their acquisition of the language. Teachers and students alike can easily find useful references that list the numerous learning strategies and explain how to apply them to each of the four skills (Oxford 1990). According to O'Malley and Chamkot (1990), learning strategies can be organized into three main categories: social-affective, cognitive, and metacognitive. Social-affective strategies include interacting and cooperating with others to assist learning; cognitive strategies involve manipulating the language to be learned; and metacognitive strategies encourage learners to reflect on thought processes and to plan, monitor, and evaluate aspects of their learning.

These strategies can be valuable instructional tools, especially for the reading skill, because many English as a Foreign Language (EFL) teachers find that there is insufficient practice time for students who are required to cope with studying a new language and to read for content. The need is heightened because at the post-secondary level, and particularly at the graduate and post-graduate levels, English suddenly becomes increasingly important for students who must take English for Special Purposes (ESP) courses and read technical subject matter in English. In some subjects English is the medium of instruction and a vehicle of content information. Although there are clear prescriptions from syllabus designers and curriculum developers to encourage activities that require the use of strategies such as **scanning (reading a text quickly for specific details),** and **skimming (reading or previewing a text to find the main idea)**, in many EFL classrooms these terms are no more than clichés, and very little training is provided on how to actually use these strategies. As a result, students experience difficulties when reading research articles in subjects related to science and technology.

In this context, where being able to read efficiently and effectively is essential for academic success, training students to use learning strategies can have a significant effect. Since the goal of metacognitive learning strategies is to strengthen students' awareness of what makes their language learning successful, it is especially important for the reading teacher to understand how to use such strategies.

2.2 METACOGNITION AND READING

Grabe and Stoller (2002) indicate that reading long selections of text quickly for general comprehension, which most fluent readers con do in their native language, is difficult to achieve and may not be a skill that is readily transferable to their second language. In the EFL classroom, many readers tend to rely on the slow and careful reading of texts from start to finish, and they have difficulties with reading activities requiring the use of strategies for reading quickly and efficiently, such as skimming a lengthy research article for main ideas (Urquhart and Weir 1998; Weir 1983). As many practitioners have found, metacognitive strategies are one way to overcome these problems.

Metacognition is variously defined as "cognition of cognition" (Carrell, Pharis, and Liberto 1989), "the conscious awareness of cognitive processes" (Bernhardt 1991), "knowledge about learning" (Wenden 1998). In relation to reading comprehension, metacognition is the "knowledge that takes as its object or regulates any aspect of any cognitive endeavour" (Flavell 1979). This definition suggests that metacognition not only relates to the individual thought processes one uses to learn but also to the self-regulation of cognition. Williams and Burden (1997), for instance, say that metacognitive strategies "include an ability to manage and regulate consciously the use of appropriate learning strategies for different situations. They involve an awareness of one's mental processes and an ability to reflect on how one learns, in other words, knowing about one's knowing." lAccording to O'Malley and Chamot (1990), metacognitive strategies include selective attention to the task, planning, self-monitoring, and self-evaluating. As applied to reading, these metacognitive strategies entail specifying a purpose for reading, planning how the text will be read, self-monitoring for errors in reading comprehension, and self-evaluating how well the overall objectives are being fulfilled, which allows for taking corrective measures if comprehension is not being achieved.

2.3 METACOGNITIVE STRATEGY TRAINING IN READING

Even though students' reading ability can be improved when they discover and use specific learning strategies, research indicates that it is not sufficient to present discrete lists of strategies and suggests that setting up contexts where the reason for strategy use are made explicit may help readers better appreciate strategies an use them more effectively Anderson 1991). In other words, even if students receive lectures on strategies and are provided with lists and descriptions, this does not mean that they will incorporate them into tasks of learning a foreign language.As Nunan (1999) says, it is "a mistake to assume that learners come into the language classroom with a sophisticated knowledge of pedagogy, or with a natural ability to make informed choices about their own learning processes". However, with strategy training, readers can make concrete gains in their reading (Block 1992). According to Carrell (1998), this training must be clearly sequenced. In addition, there must be a clear rationale for using specific strategies (Oxford 1990). For example, strategy training should include explicit instructions on when and how to use a particular strategy, and should incorporate metacognitive elements of planning, self-monitoring,

and self-evaluation into the task. When this is accomplished, metacognitive strategy improves ESP students' efficiency in reading research articles, particularly with tasks requiring fast, selective reading such as skimming (Dhieb-Henia 2003).

Students who identify and solve problems at the vocabulary, clause, and text levels are utilizing the metacognitive strategy for reading, and they are typically "characterized as purposeful, strategic, and persistent in their learning. They posses the ability to evaluate their own process in relation to the goals they have set and to adjust subsequent behaviour in light of those self-evaluations" (Purdie, Hattie, and Douglas 1996). Several studies establish that the best readers are those who engage in such active, conscious reading.

Information processing is a theory that hypothesizes how metacognitive makes learning strategies an automatic part of one's cognitive makeup. According to this theory, metacognition is divided into **declarative** and **procedural** knowledge (Anderson 1983). Declarative knowledge refers to knowing what something is but not necessarily knowing how to use the knowledge, while procedural knowledge refers to knowing hot to do something or putting the knowledge into action. The transfer of declarative knowledge into procedural knowledge is accomplished by first ensuring that students have solid knowledge about pertinent learning strategies and then applying metacognition so students reflect on what they know and use planning, self-monitoring, and self-evaluating to make the strategies a part of their long-term learning processes. This idea suggests that it is possible to develop declarative knowledge of the type "I know what X is", and then to develop procedural knowledge by applying strategy training to guide students' behaviour when reading "I know how to do Y". As declarative knowledge becomes procedural, students will find that first language reading strategies will transfer to the second language more easily.

2.4 ESTABLISHING A PURPOSE FOR READING

Second language reading research also suggests that the successful use of reading strategies is less dependent on their availability and more dependent on students' awareness of strategies and their ability to be flexible when using them according to the purpose of the task or the problem to be solved (Carrell, 1998; Carrell, Pharis and Liberto 1989; Jiménez, Garcia, and Pearson 1996). This indicates that establishing a purpose for any reading activity is crucial to the choice of the reading strategy to be adopted. Indeed, to decide whether to read a text selectively or straight through, and to separate relevant from irrelevant information, one first needs to have a clear sense of the purpose of reading (Anderson 1991).

The research on teaching ESP indicates that the different strategies adopted by scientists reading in their fields are closely connected to the scientists' own agendas; that is their purpose for reading (Bazerman 1985). For example, different purposes may require different approaches to reading, such as scanning the table contents, reading quickly to get an overall impression of a document, skipping whole parts if

the information is familiar, and reading more carefully when something important is spotted.

2.5 LESSON PLAN

A sample lesson plan is going to be based on real material about the Internal Combustion Engine that appears at the beginning of the first lesson. Some students probably know a little about engines; therefore, they may have some information about how engines work. The lesson is designed to give students an opportunity to practice an important reading skill: scanning for specific information. It is also includes basic grammar structures. Each lesson has functional and linguistic objectives.

Level: beginner
Focus: Reading skills (scanning for specific information), simple present and past tense "to be".
Materials: The Internal Combustion Engine article; whiteboard/markers.

Activity 1
Warm-up: Creating an engine vocabulary web.
To get the students warmed up, start with the following activity.
In the middle of the board, write the word engine and draw a star around it. Tell the students that they will have two or three minutes to brainstorm as many vocabulary words as possible that are related to the topic of engines. They can be nouns, adjectives or verbs. You might also want to tell them that, at this point, you are the recorder-not their teacher-so they shouldn´t worry about giving a "wrong answer." (During this part of the activity, you should just write every word they say on the board either in Spanish or English).

After your students have brainstormed a number of "engine" words, circle all the vocabulary items you have written on the board. Then ask your students to consider how the words are related. For example, if the students came up with words *heavy*, *hot* and *cool*, they might recognize that these are adjectives. (You may have to prompt them the first few times, until they figure out what you want them to do.) You would then write the word adjectives on the board and draw a square around it. Next, to build the vocabulary web, you would draw lines from each of the circled words (heavy, hot and cool) to the square (adjectives) and from the square to the star (engine). During this part of the activity, the students can also explain why they called out any words that seem to be unrelated to the topic of engines. If their explanation makes sense, you should keep the word on the board and ask the students to consider how it is related to other words. If an explanation does not make sense, then erase the word. Your students will identify how words are related grammatically by, for example, grouping all of the nouns together, all of the verbs together, etc. The important point is that students are recognizing connections among different words. When drawing lines to represent connections between different words, you also

shouldn´t be surprised if some words to many other words. It is also possible that some words will not be related to any other words.

Activity 2
Prereading: Activating Background Knowledge
Before your students go over the text, have them complete the prereading quiz (learning with pictures). Depending upon how your class is arranged, you may wish to photocopy the quiz.

After the students have finished the quiz, do not give them the correct answers right away. Instead, have them find the answers as part of Activity 3 (Scanning for Specific Information). You will check the answers with the class after students have finished the scanning activity.

Activity 3
Reading: Scanning for Specific Information
Preparation: For the reading activity, you will need at least one copy of the Subtechnical Vocabulary sheet for each group.

Before students read the text, divide the class into small groups (2-4 students). Briefly review the instructions for the Vocabulary Practice activity and make sure they understand the information questions. (Again, these questions can be photocopied or written on the board.

If your students have never practiced scanning before, explain that they should only look for the information that will help them answer the questions, rather than trying to understand every word or sentence. Tell the students they will have five minutes to check their prereading answers (Learning with Pictures Activity) and to answer the seven additional questions. (This time limit can be increased or decreased according to your students' reading ability. However, to make sure students are forced to truly scan, there should be some time pressure. Another option is to make this activity a competition to see which group can answer all of the questions first). Allow the group to divide the workload among group members as they wish before you start the timer. For example, if there are enough copies of the text for each student in the group, one student might check the Learnig with Pictures activity while another student tries to answer the seven Vocabulary Practice questions.

Stop the groups after five minutes to check answers as a whole class. The answers are expected to be in Spanish.

Activity 4
Grammar Frame
Once they have completed the reading activity point out the use of Simple Present Tense "TO BE" in the reading selection. Ask them to go over the grammar frame explanation, matching, short answers, fill in the blanks and scrambled words.

UNIT 3
PROJECT PROPOSAL

3.1 INTRODUCTION

This text has been developed using authentic material that stimulates a feeling of success and achievement as students read some technical material. As they engage in a variety of exercises that practice basic linguistic functions and the introductions of subtechnical vocabulary, students are guided toward the understanding of real technical English. Both the functional objectives and linguistic ones are carefully graded according to simplicity and usefulness. Sometimes students encounter and use grammar that is not formally introduced until later lessons. The goal is to provide students with a continuous stream of input that challenges their current knowledge of English, thereby allowing them a progress naturally to a higher level of competence.

3.2. OBJECTIVE FOR THE PROJECT PROPOSAL

The syllabus of this project is one in which there is less immediate opportunity or need for oral English. The project is going to be restricted to the lexico-semantic (words, phrases, and their meanings) and syntactic elements (the rules of grammar) of the scientific register found in practical reports and manuals. The teaching content for ESP should then be drawn from practical technical articles, features taken from Science magazines, and other authentic sources. The special meaning of certain language features in scientific reading can be illustrated in context as students use the language features in the reading of procedures and processes.
Students who are already familiar with science content in their own language can become familiar with the specific formal properties which English uses in science by special information transfer exercises that make use of nonverbal illustration of familiar scientific processes.

The needs of students are linguistics in nature. At the same time, they are motivated by material from their own fields. Consequently, they usually end up offering a mixture of both content and linguistic instruction.

3.3. DESCRIPTION

There is much debate about whether an implicit or explicit approach is better to understand an article. It seems undeniable that extensive reading or substantial contact with the target language will improve not only vocabulary but reading comprehension. In order to understand technical reading material, vocabulary learning in context is the key to have a great understanding of new material. Vocabulary learning can be enhanced when the learner's attention is directed consciously to vocabulary items or strategies. There appears to be no valid reason for advocating any approach in isolation; thus this project argues for direct instruction of strategies, supported by extensive student reading.

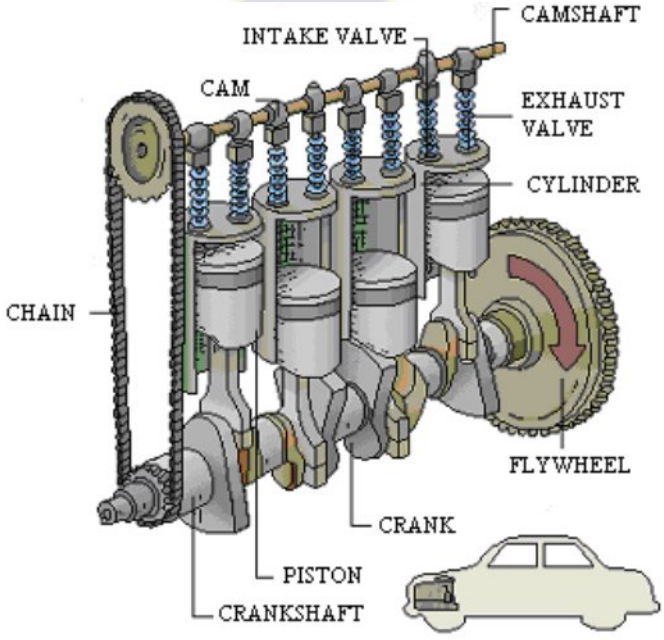
Some students already use reading strategies such as cognates; however, they often do so unconsciously, and vocabulary learning strategies are more likely to be effective when their use is conscious and directed. Furthermore, certain strategies are not intrinsically good, but even recognised useful ones need to be practised to be used efficiently. Finally, students are often unaware of strategies other than the ones they already use. Therefore, it is hoped that some direct instruction in strategy use will benefit students by developing their metacognitive knowledge about different strategies, by showing them how to use strategies efficiently, and by widening the range of strategies from which they can choose.

The aim here is not to teach a single set of strategies used by supposedly "good" learners or to exemplify supposedly "good" strategies. Rather, it is to help students, as unique individuals, become aware of their own strategy use and the range of potential strategies available for learning vocabulary.

Each lesson starts with a reading material which has some underlined words. The purpose of this activity is to point out subtechnical vocabulary and grammar structures. Throughout the lessons there are grammar frames and technical vocabulary to be learned through a brief explanation of grammar rules and useful exercises to be done by the learner. These activities include matching, filling in the blanks, underlining, unscrambling, learning with pictures, sentence formation, yes/no questions, information questions, word order, error correction, and so on.

Besides, the lessons are designed to learn vocabulary in context. To reach this objective, some subtechnical vocabulary has been pointed out. What's more, there are vocabulary practice and reading comprehension activities. True or false, multiple choice, word choice, and some other activities have also been added to make this material easy to learn.

LESSON 1



3.4 THE INTERNAL COMBUSTION ENGINE

Combustion **is** a word for fire or **burning**; an internal combustion engine is one in which a fire inside the engine itself makes the engine work. Despite its polluting emissions, this **is** one of the most significant inventions of all time, specially because of its primary uses as a portable power source. The **steam** engine uses a fire in a boiler rather than inside the engine; for this reason steam engines **are** sometimes called external combustion engines.

Experiments with internal combustion **go back to** the seventeenth century. The first fuel tried **was** gunpowder, with a predictably explosive result. Other experiments **were** made with different kinds of gases including hydrogen which is explosively combustible. It **was** not until the second half of the nineteenth century that the development of petroleum products made possible today's internal combustion engine. Kerosene for lamps and stoves **was** the product first **sought** from petroleum

while gasoline seemed nothing more than a dangerous **by-product**. But after other fuels had been tried it **was** gasoline that emerged as the most practical for internal combustion.

The first genuinely marketable internal combustion engine **was** the work of a German inventor, Nikolaus August Otto. The Otto **device** was a **four-stroke engine** in which each piston made four movements (two up and two down) for each combustion in the cylinder using gasoline vaporized and mixed with air in a **carburettor**. It utilized a cycle in which the combustible mixture is drawn into the cylinder of an internal combustion engine on a suction stroke , is compressed and **ignited** by a **spark plug** on a compression stroke, burns and performs work on an expansion stroke, expels combustion products on an exhaust stroke.

Since only the third stroke produces work, the piston needs help over the other strokes. This **is** given by a **flywheel** attached to the crankshaft. The flywheel in effect **stores** energy from the power stroke; this energy then carries the piston through the three strokes until the next power stroke caused by the combustion **is** repeated.

Another necessary component of the four-stroke engine **is** a **camshaft** which controls the cams that open or close valves to **let** gases in and out of the cylinder. The camshaft makes one revolution for every two of the crankshaft since the valves open only on every other stroke.

The engine designed by Otto **was** an immediate success. When he died in 1891, 30,000 of his engines had been sold, but they **were suitable** only for stationary use. Another German, Gottlieb Daimler, pioneered in adapting the Otto engine so that it could be used to power vehicles. By 1900 automobiles appeared with increasing frequency, first on the streets of Europe and then in the United States. This series of inventions has changed daily life for most people as much as any other in our history. It has made possible great industries, provided convenient transportation for millions of people and **established** new patterns of living.

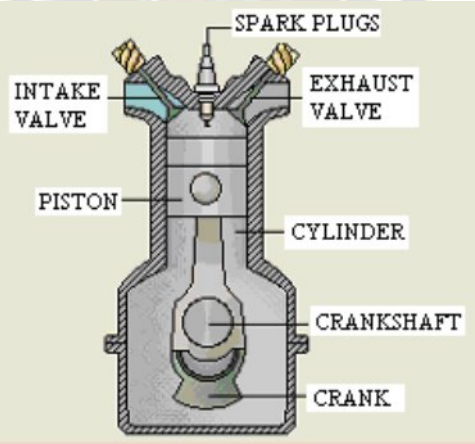
The automobile **emerged** and developed because of the ingenuity of many different inventors. As an addition to the basic four-stroke engine, increasingly efficient carburettors **were** designed. The first improved carburettors replaced coal gas with petroleum products like benzine and gasoline. Another development **was** the use of several cylinders rather than the one in the first Otto engines. At various times automobile engines have had from two to sixteen cylinders; the standard numbers today **are** four, six, and eight. Other problems solved to **achieve** the efficiency of modern automobiles include **ignition systems** that cause combustion several hundred times a minute and cooling systems for cylinders rapidly heated by this combustion. Methods that employ both air and water to cool the engine have been engineered though most modern cars **are** water-cooled.

Another type of internal combustion engine **is** the **diesel engine**, named for its German inventor, Rudolf Diesel. In a diesel engine air **is** compressed to a very small proportion of its original volume; this causes the air to **become** so hot that combustion takes place when fuel **is** injected into the cylinder. Diesel engines have several advantages: they do not **require** a spark, they operate with cheaper fuel than other internal combustion engines, and they have a higher thermal efficiency thereby developing more power in ratio to the amount of fuel used.

Diesel engines have gained wide acceptance for many **heavy-duty** vehicles, including ships, trucks, heavy equipment, and some types of passenger cars. Diesel locomotives have almost completely replaced steam engines on railroads. As an example of the complexity of modern machinery, diesel engines **are** used to provide power to run electric generators whose electricity is then used by the electric motors that **perform** the actual work on diesel locomotives.

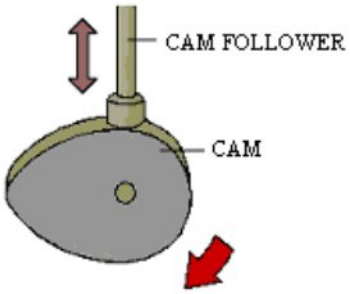
3.4.1 THE FOUR-STROKE ENGINE.

A **four-stroke engine** provides power for a car by **burning** fuel and air in a series of precisely timed explosions. The explosions inside the cylinders drive pistons downward. This movement turns a **crankshaft** which carries power to the transmission and to a **camshaft**. The camshaft synchronizes the opening of valves, so that each cylinder fires at just the right moment.



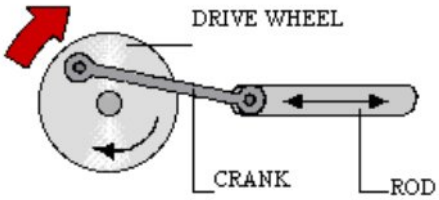
3.4.2 PISTON

Each piston in the engine goes through a cycle of four movements, or strokes, for every explosion in the cylinder. The downward induction stroke sucks in the fuel-air mixture; the upward compression stroke squashes the mixture; the downward power stroke drives the crankshaft; and the upward exhaust stroke pushes out exhaust gas.



3.4.3 CAMS

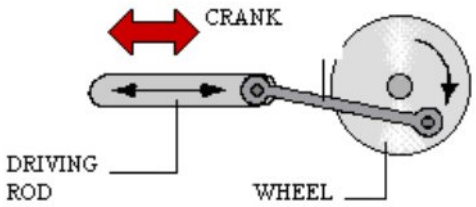
Cams **are** like oval wheels on which a rod called a cam-follower rests. As the cam rotates, it moves the cam-follower back and forth by a precise amount. Cams **are** often used for controlling or synchronizing processes, making sure that different actions take place at the right moment.



3.4.4 CRANKS

3.4.4.1 WHEEL DRIVE

When a wheel drives a crank, the rotation of the wheel **is** converted to a back- and-forth movement of the rod.



3.4.4.2 ROD DRIVE

With a rod drive, a crank converts back-and-forth movements into rotation. When the rod moves backward and forward, the crank wheel rotates.

3.4.5 GRAMMAR FRAME

3.4.5.1 SIMPLE PRESENT TENSE “TO BE”

From the reading selection

Combustion **is** a word for fire or burning.
This **is** one of the most significant inventions.
Cams **are** like oval wheels.

Use the verb "to be" to give information about the subject of a sentence. The subject of a sentence can be a noun or a pronoun.

(noun)		(subject)	(pronoun)		(subject)
The **teacher**	is	**Bolivian**	**We**	are	**mechanics**

There are three forms of the verb "to be" in the present tense: "am", "are", and "is"
Add "not" after the verb "to be" to formulate negative statements.

Affirmative statements			Negative statements			
I	am	a professor.	I	am	not	in Bolivia.
You	are	a doctor.	You	are	not	in a garage. *singular
He	is	a pilot.	He	is	not	in a bank.
She	is	a nurse.	She	is	not	in an office.
It	is	a screwdriver.	It	is	not	a gearbox.
We	are	engineers.	We	are	not	in class.
You	are	farmers.	You	are	not	in a house. *plural
They	are	musicians.	They	are	not	in a garage.

In speaking and informal writing, contract "be" with subject and pronouns.

Affirmative sentences		Contractions
I am an accountant.	=	I'm an accountant.
You are a banker.	=	You're a banker.
He is a lifeguard	=	He's a lifeguard.
She is in an office.	=	She's in an office.
It is on the hood.	=	It's on the hood.
We are in class.	=	We're in class.
You are in a house.	=	You're in a house.
They are in a workshop.	=	They're in a workshop.

There are two ways to contract in negative sentences.

He's not a pilot	or	He isn't a pilot
They're not musicians	or	They aren't musicians

Note: There's only one kind of negative contraction for "I am not" = "I'm not".
It's common to answer yes/ no questions with short answers. Don't use contractions with affirmative short answers.

Yes/no questions	Affirmative short answers	Negative short answers
Am I a pilot?	Yes, you are. (NOT Yes, you're).	No, you're not.
Are you at home?	Yes, I am.	No, I'm not.
Are you a tailor?	Yes, I am. (NOT Yes, I'm).	No, I'm not.
Is he Chinese?	Yes, he is. (NOT Yes, he's).	No, he's not/ he isn't.
Are they student?	Yes, they are. (NOT They're).	No, they're not/they aren't.

3.4.5.2 MATCHING

Choose an answer for each question.

_____ 1. Are they architects?	a. Yes, it is.
_____ 2. Are you happy?	b. No, I'm not.
_____ 3. Is he a mechanic?	c. No, she isn't.
_____ 4. Is she Japanese?	d. Yes, they are.
_____ 5. Am I in your class?	e. Yes, he is.
_____ 6. Is it an engine?	f. Yes, you are.

3.4.5.3 SHORT ANSWERS

Answer the questions with short answers

1. Is La Paz in Bolivia? Yes, it is	4. Is technical English necessary? Yes,___
2. Are cams wheels? No,_____	5. Is a hammer soft? No,_____
3. Are you a student? _____	6. Are engines heavy? _____

Use "Who" to ask about people, "What" to ask about things, and "Where" to ask about places.

Singular nouns	Plural nouns
Who's your teacher?	Who are the new accountants?
What's your name?	What are their occupations?
Where is the windshield?	Where are your wrenches?

3.4.5.4 THE PAST TENSE OF "TO BE"

From the reading selection

The first fuel tried **was** gunpowder.
The Otto device **was** a four-stroke engine.
Efficient carburettors **were** designed..

Use "was" or "were" for affirmative statements. Use "wasn't" or "weren't" for negative statements.

Affirmative statements	Negative statements

I	was	a student.	I	wasn't	here yesterday.
You	were	a friend.	You	weren't	at home last week.
He	was	a lawyer.	He	wasn't	on the car.
She	was	a nice dancer.	She	wasn't	next to me.
It	was	hot.	It	wasn't	above the hood.
We	were	good students.	We	weren't	in front of the bumper.
You	were	sad.	You	weren't	on the street.
They	were	happy.	They	weren't	behind the door.

Yes/no questions	Short answers
Were you angry?	Yes, I was. /No I, wasn't.
Was he sick?	Yes, he was. /No, he wasn't.
Was it warm?	Yes, it was. /No, it wasn't.

Information questions	
Where were they?	They were at the airport.
How long was the flight?	It was one hour long.
When was he sick?	He was sick yesterday.

3.4.5.5 FILL IN THE BLANKS

Complete the conversations with "was", "were", "wasn't", or "weren't".

1. A: Were you out of town last month?
   B: No, _____
2. A: How _____ the food?
   B: Great! The fish and chicken _____ delicious.
3. A: _____ your vacation nice?
   B: No, it _____. The people _____ unfriendly.
4. A: Where _____ you last Sunday.
   B: I ____ on vacation.

3.4.5.6 SCRAMBLED WORDS

Write questions with the scrambled words.

1. A: Was your vacation very long? (your/vacation/was/very long)
   B: No, it wasn't. It was pretty short, actually.
2. A: _____? (your luggage/was/where)
   B: It was at the airport.
3. A: _____? (the car/was/comfortable)
   B: Excellent.
4. A: _____? (you/were/on the morning flight)

B: Yes, I was.

3.4.6.1 SUBTECHNICAL VOCABULARY

Burning (adjective): Marked by flames or intense heat.
A burning engine is the result of insufficient water.

Steam (noun): The gas that water produces when it is boiled.
Steam engines are called external combustion engines.

To go back to (phrasal verb): To have its origin in a particular time in the past.
The company's history **goes back to** 1925.

To seek (verb; sought , sought): To try to find or get something.
I **sought** advice from a lawyer last month.

By-product (noun): Something that is made during the process of making something else.
Plutonium is a **by-product** of nuclear processing.

Device (noun): A machine or tool used for a particular purpose.
The four-stroke engine is a powerful **device**.

Four-stroke Engine (noun compound): A device in which the piston makes four strokes or movements, two up and two down, for each charge of fuel.
A **four-stroke engine** provides power for a car by burning fuel and air.

Carburettor (noun): A device in which gasoline is changed into a vapor and mixed with air.
The **carburettor** controls the mixture of gasoline and air.

To ignite (verb): To start burning, or to make something start burning.
Petrol **ignites** very easily.

Spark Plug (noun compound): An apparatus that forms a spark causing the gas and air mixture in an internal combustion engine to burn.
Spark plugs ignite the vaporized mixture of fuel.

Flywheel (noun): A heavy wheel attached to the crankshaft that stores energy to help the piston make the first, second, and fourth strokes in a four- stroke cycle.
The engine crankshaft turns the **flywheel**.

To store (verb): To put things away and keep them there until you need them.
We **store** furniture when we travel abroad.

Camshaft (noun): A device to control the valves that let gases in and out of the cylinder.

A **camshaft** controls the cams that open or close valves.

To let (verb): To allow something to happen.

She **let** the handkerchief fall to the ground.

Suitable (adjective): Right or acceptable for a particular purpose or situation.

This is a **suitable** moment to discuss your report.

To establish (verb): To start a company, organization etc that will exist for a long time.

The school was **established** in 1922.

To emerge (verb): To appear or come out from somewhere.

He **emerged** from his hiding place.

To achieve (verb): To succeed in doing something good or getting the result you want.

He will never **achieve** anything if he doesn't work harder.

Ignition System (noun compound): The devices that ignite, or set on fire, the fuel in an internal combustion engine.

New **ignition systems** achieve the efficiency of modern automobiles.

Diesel Engine (noun compound): An internal combustion engine that compresses air until it becomes so hot that burning occurs when fuel is injected into the cylinder; no ignition spark is needed.

A **diesel engine** is another type of internal combustion engine.

To become (verb; became, become): to come to be.

Kennedy **became** the first Catholic president.

To require (verb): To need something.

Pets **require** a lot of care.

Heavy-duty (adjective): Strong enough to be used often or for hard work.

There are heavy-duty plastic gloves for construction.

To perform (verb): To do something such as a job or piece of work.

Electric motors **perform** the work of team engines.

3.4.6.2 VOCABULARY PRACTICE

1. Describe a ***four-stroke*** engine.
2. What does a ***carburettor*** do?
3. What does a ***spark plug*** do?

4. What is the purpose of a ***flywheel***?
5. What does a ***camshaft*** do?
6. What is an ***ignition system***?
7. Describe a ***diesel engine***.

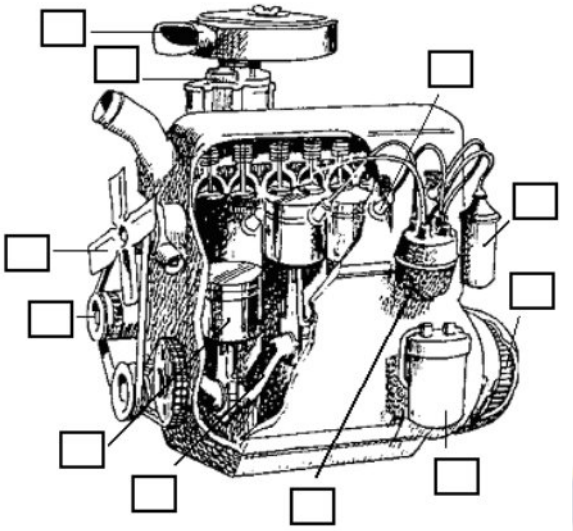
3.4.6.3 FILL IN THE BLANKS

Complete the following sentences with the appropriate word or phrase.

1. _____ is a word that means fire or burning.
2. In a _____ engine the piston makes two upward and two downward movements.
3. The first successful internal combustion engine, the _____ engine, was invented by a German.
4. Gasoline is changed into a vapor and mixed with air in a _____.
5. A _____ stores energy that is used to help the piston make the first two strokes in a four-stroke cycle.
6. A _____, which controls the opening and closing of the valves in the cylinder, makes only one revolution to every two of the crankshaft.
7. In an internal combustion engine, a fire or combustion takes place inside the _ _____ of the engine.
8. _____, a German inventor, was a pioneer in adapting the internal combustion engine for transportation in the form of the automobile.
9. The_____ system causes combustion in car cylinders several hundred times a minute.
10. An internal combustion engine that compresses air until it becomes so hot that an explosion takes place when fuel is injected into the cylinder is known as a _____ engine.

3.4.6.4 LEARNING WITH PICTURES

Label the parts in this diagram of the internal combustion engine. Then explain briefly what function each one of these performs.



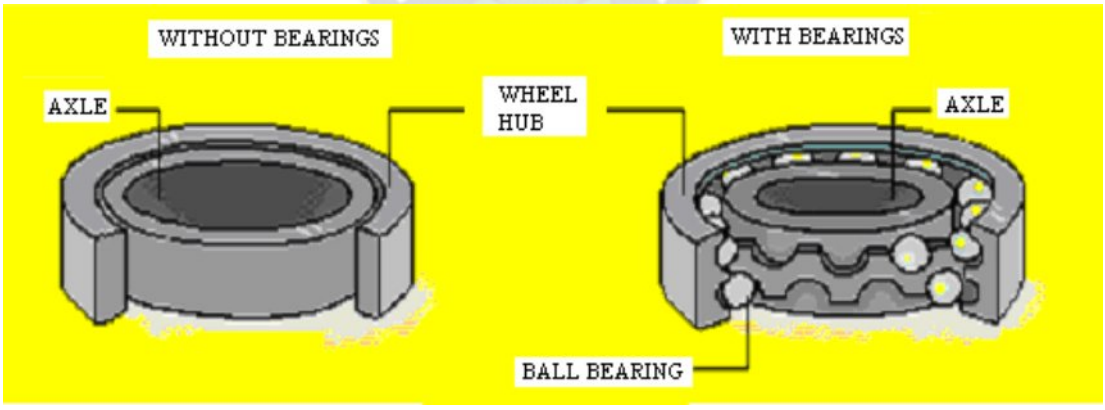
1. AIR FILTER
2. DISTRIBUTOR
3. PISTON
4. FAN
5. CARBURETTOR
6. OIL FILTER
7. SPARK PLUGS
8. FLYWHEEL
9. CRANKSHAFT
10. GENERATOR
11. COIL

3.4.6.5 READING COMPREHENSION

Answer the following questions either in Spanish or English

1. Why is a steam engine sometimes called an external combustion engine?
2. What were some of the early fuels used for internal combustion engines?
3. Who invented the first workable internal combustion engine?
4. Describe the working of a four-stroke engine.
5. What do the carburettor, the spark plugs, and the valves do in a four-stroke engine?
6. What helps the piston over its first two strokes?
7. Name another necessary component of the four-stroke engine. Why does it make only one revolution for every two of the crankshaft?
8. Was Otto's engine successful?
9. Name one of the pioneers in adapting the Otto engine to transportation.
10. What other vehicle developed at about the time that automobiles became popular?
11. Who was Rudolf Diesel?
12. What is the principle on which a diesel engine works?
13. What are some advantages of the diesel engine?
14. What are some uses of the diesel engine?
15. How does a diesel locomotive work?

LESSON 2



3.5 FRICTION

Friction **reduces** the efficiency of machines but it is also indispensable. When you **try** to walk on ice, slipping and sliding and perhaps falling down, you **realize** the importance of friction. Ice **has** a low **coefficient of friction** and that is what makes it so

difficult to walk on. Without friction it would be impossible to walk at all and our trains and cars could not move.

There are three different kinds of mechanical friction: **static**, **sliding**, and **rolling**. Static friction is the resistance to motion between two bodies in contact but at rest. The resistance of static friction is **greater** than that of sliding friction which is resistance to continued motion after one body has started to move. Rolling friction **occurs** when resistance is reduced to its **lowest** degree by rotary motion not on the same axis.

Note these three kinds of friction at work: it **takes** a **stronger** effort to put a box into motion (static friction) then it **does** to keep it moving across the floor once started (sliding friction); if there are rollers under the box it takes still less effort to keep it in motion (rolling friction).

One way to reduce friction in machines is through the materials for the parts that contact each other. The **coefficient of friction** is the constant ratio of the friction to the force pressing the surfaces together. Coefficients have been equated for different common materials using the three types of friction. Steel on steel or glass on glass **have** high coefficients but some new substances have much **lower** coefficients. One of these is **babbitt metal**, an alloy made of tin, copper, and **antimony***;* another is **teflon**, a plastic containing fluorine that is sometimes used in cooking utensils.

Another way of reducing friction is by means of **lubrication**, applying oil or grease to the points or surfaces where the parts of a machine contact each other. Petroleum products are the principal modern lubricants; some of them include **polymers**, the long, heavy, complex molecules that occur in plastics.

A vital mechanism for reducing friction is the **bearing** which basically is a device that bears the friction of parts in motion. Often one of the parts will be moving and the other will be stationary. Logs used to move heavy stones in early times were the primitive form of a bearing. They were efficient because they changed sliding friction to rolling friction, thereby decreasing the effort necessary to move the stones.

Reducing friction between the parts of a machine is the principal purpose of bearings. Different types have been designed for use at various points of contact to fit the kinds of motion at work. Probably **the most** familiar are **ball bearings** which are used in many machines. Small balls are fitted into a **cage**, a container that **separates** them. Cage and bearings are then sealed, often in a lubricant, between rings which are called **races**. The entire assembly is a ball bearing.

Another familiar type is the **roller bearing**, a modern version of the logs that were used as primitive bearings. Roller bearings **contain** small cylinders on which the bearing races can roll. They are usually fitted with the same kind of holding cage and races as ball bearings. In order to sustain pressure from different directions, bearing rollers are sometimes **tapered** or shaped like cut-off cones and set at an angle to the races. A

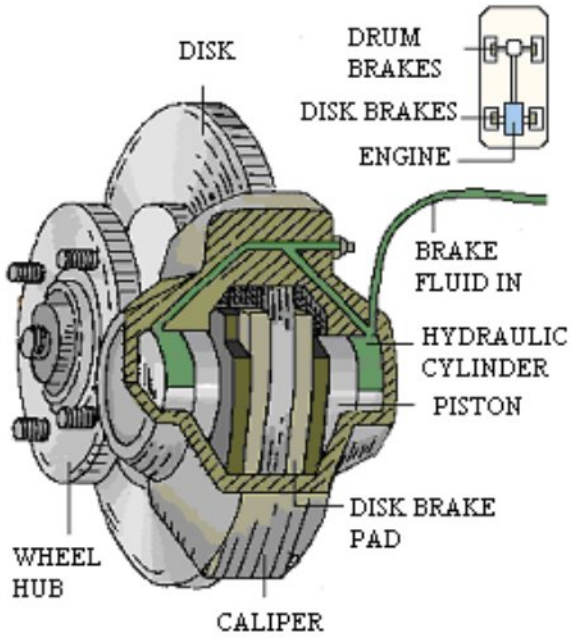
variation is the **needle bearing** with cylinders of very small diameter. Needle bearings **need** not be contained in a cage or between races. Their advantage is **greater** load-carrying capacity with more friction than ball bearings of comparable size.

A modern development is the **non-contact bearing** in which there is contact between the machine parts only at rest; when in motion they are separated by a thin layer of gas or fluid. This prevents **wear** between the moving parts. Non-contact bearings have been developed for such complex and sophisticated systems as missile guidance. The possibility of using cushions of compressed air in transportation systems has been discussed frequently in recent years.

While bearings are used to minimize friction other mechanical devices put friction to work. The car that **rolls** without acceleration is gradually brought to a stop by friction. A long gradual stop is far from suitable, however, to traffic conditions where speed must be controlled and where sudden and frequent stops are necessary. **Braking devices** put friction to work to provide the necessary control over motion in automobiles and other kinds of machines.

The most common types of brakes ordinarily consist of a rotating component that is brought into contact with a friction component designed so that the mechanical energy is changed into heat which is dissipated into the air. The friction material may be metal, ceramic, or a substance like asbestos. Old-fashioned automobile brakes were made of a steel band that could be pressed down against the outside of the brake drum. When they got wet, however, their friction coefficient was often dangerously reduced, a condition known as **fading**. This led to the development of **drum brakes** with a friction lining on the inside of the drum. These are less likely to fade. A still more recent braking device is the **disk brake**. It **consists** of metal disks that turn with the wheel and can be brought into contact against friction pads.

Another mechanism necessary for road vehicles is a **clutch** device so that the motor shaft can be connected or disconnected from the wheel shaft while the motor is running. The type in common use today is the **disk clutch** in which connection is made by applying pressure so that pairs of disks lined with friction material are brought into contact or released to increase or decrease power to the output shaft. In many cars pressure **comes** when the driver **steps on** the clutch pedal; with some automatic transmissions pressure is applied automatically through fluids as speed changes. Any kind of clutch **depends on** friction.

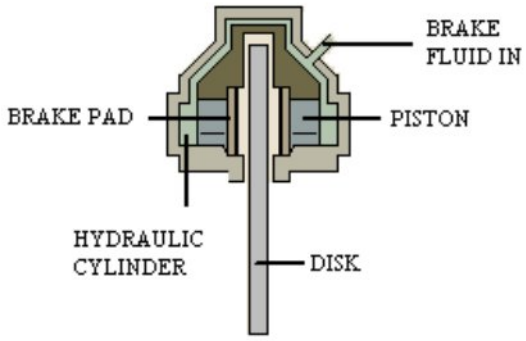


3.5.1 BRAKES

Most cars **have** two kinds of brakes: disk and drum brakes. The pressure of the driver's foot on the brake pedal is amplified by a hydraulic system. This forces brake pads against a metal disk or drum attached to the wheel. Friction between the two surfaces **slows** the wheel, turning the car's movement energy into heat.

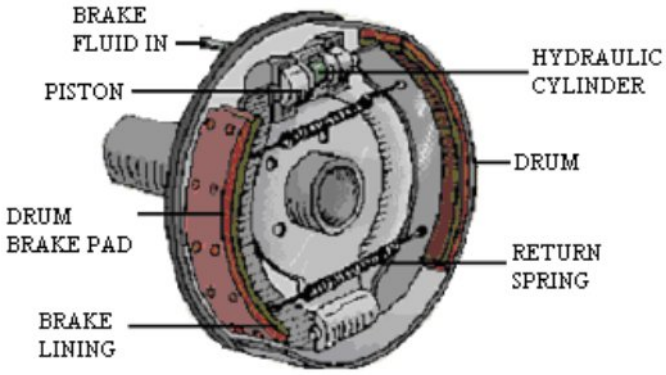
3.5.1.1 DISK BRAKES.

In disk brakes, the brake pads **push** on both sides of a disk that **spins** with the wheel. Disk brakes are usually fitted to the front wheels of a car, where more braking power is needed.



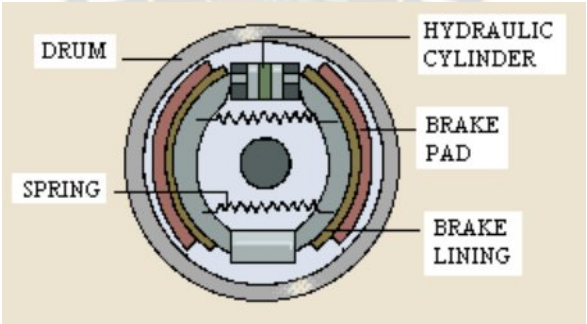
3.5.1.1.1 DISK BRAKE PAD

Pressing the brake pedal forces brake fluid into the cylinders. The fluid **pushes** on pistons, which squeeze the brake pads against the spinning disk. The pads are made of heat-resistant material that can produce a lot of friction on with the metal of the disk



3.5.1.2 DRUM BRAKES

Drum brakes are not as powerful as disk brakes, but they **work** in a similar way. Brake fluid pushes the brake pads apart. The brake pads **apply** friction to the inside spinning drum, which is attached to the wheel.



3.5.1.2.1 DRUM BRAKE PAD

The brake pedal forces fluid into the hydraulic cylinder of the drum brake. The fluid pushes the brake pads out, forcing them against the spinning drum. When the driver **releases** the brake, springs **pull** the pads away front the drum.

3.5.2 GRAMMAR FRAME

3.5.2.1 THE SIMPLE PRESENT TENSE

From the reading

Friction **reduces** the efficiency of machines.
Most cars **have** two kinds of brakes.

Ice **has** a low coefficient of friction.
The fluid **pushes** on pistons.

Use the simple present tense to talk about facts and habitual actions in the present.

Facts	Habitual actions
Raul speaks English very well.	I wake up at 6:00 a.m. every day.
I work at San Andres University	She eats chicken at home.

Add "s" to the base form of the verb for third-person singular (he, she, it).

Affirmative statements			Negative statements				
I	pull	the pads.	I	do	not	pull	the pads.
You	release	the brakes.	You	do	not	release	the brakes.
He	learn**s**	Korean	He	**does**	not	**learn**	Japanese.
She	turn**s**	a wheel.	She	**does**	not	**turn**	a wheel.
It	close**s**	at 11:00 p.m.	It	**does**	not	**close**	at noon.
You	open	the door.	You	do	not	open	the window.
They	apply	friction.	They	do	not	apply	friction.
We	work	in a school.	We	do	not	work	in a restaurant.

Use "don't" or "do not" for I, you, they, we and "doesn't" or "does not" for he, she, it + the base form of the verb to make negative statements.

I don't go home. **Maria doesn't** speak Italian very well.

Use "do" or "does" and the base form to make "yes/no questions" in the simple present tense.

Yes/no questions				Information questions			
Do	I	learn	Spanish?	What	do	I	learn?
Do	you	play	soccer?	What	do	you	pay?
Does	he	**learn**	Korean?	What	**does**	he	**learn**?
Does	she	**play**	soccer.?	What	**does**	she	**play**?
Does	it	**close**	at midnight?	When	**does**	it	**close**?
Do	you	open	the door?	What	do	you	open?
Do	they	study	chemistry?	What	do	they	study?
Do	we	work	in a school?	Where	do	we	work?

Does she live near here?
NOT Does she lives near here?

Does he have a car?
NOT Does he has a car?

Use a question word followed by ""do" or "does" + subject + base form of the verb for information questions.

Where do you buy bolts?
What does your uncle do?
When do you visit your friends?
What time does she leave the garage?

3.5.2.2 SENTENCE FORMATION

Write negative sentences.

1. Maria likes cars(Her niece) Her niece does not like cars.
2. German lives in Quito. (His sons)
   _____
3. Juan works in a mine. (His mother)
   _____
4. My father has a truck. (My mother)
   _____
5. Evo's niece takes a bus to school. (His nephew) -
_____

3.5.2.3 YES/NO QUESTIONS

Write yes/no questions.

1. Does he drink milk? No, he doesn't. My sister drinks coffee.
2. _____ mother? Yes, I do. I really look like my mother.
3. _____ children? No, we don't have any yet.
4. _____ in La Paz? No, my relatives live in Oruro.
5. _____ Spanish? Yes, she does. My aunt speaks it well.

3.5.2.4 WORD ORDER

Model.

He drinks milk. (Affirmative statement)
He doesn't drink milk. (Negative statement)
Does he drink milk? (Yes/no question)
What does he drink? (Information question)

Complete the following activity according to the model.

1. The pads produce friction. (Affirmative statement)
   _____. (Negative statement)
   _____? (Yes/no question)
   _____? (Information question)

2. The driver steps on the clutch. (Affirmative statement)
   _____. (Negative statement)
   _____? (Yes/no question)
   _____? (Information question)
3. We work in a garage. (Affirmative statement)
   _____. (Negative statement)
   _____? (Yes/no question)
   _____? (Information question)

4. This prevents wear between parts. (Affirmative statement)
_____. (Negative statement)
_____? (Yes/no question)
_____? (Information question)

Don't use "do" or "does" with "Who". Always use the third-person singular to ask information question with "Who" in the simple present tense.

Subject question
Who works here? My sisters do.
Who repairs cars? My sister does.

Complete the questions with information questions and subject questions.

1. Where do your children live ? They live in China.
2. _____ your son work? He works across the park.
3. _____ speaks Spanish? My sister does.
4. _____ has two screwdrivers? My cousins do.

3.5.2.5 VERBS THAT END IN "O", "S", "SH", "X", "Z", "Y"

From the reading

The fluid **pushes** on pistons.
Each piston in the engine **goes** through a cycle.
A **crankshaft** carries power to the transmission.

Add "s" to form the third person singular of most verbs. Add "es" instead of "s" in the following cases:

a. When the verb end in "o"
   go-goes do-does
b. When the verb ends in "s", "sh", "ch", "x", or "z"
   teach-teaches wash-washes fix-fixes pass-passes
c. When the verb ends in "y" (in this case, the "y" is changed to "i" before adding "es" if the "y" is preceded by a consonant.
   study-studies cry-cries marry-marries

Affirmative statements			Negative statements				
I	wash	my car.	I	do	not	wash	my car.
You	go	home.	You	do	not	go	home.
He	fix**es**	a car	He	**does**	not	**fix**	a car.
She	teach**es**	French.	She	**does**	not	**teach**	football.
It	cri**es**	at night.	It	**does**	not	**cry**	at night.
You	fix	a truck.	You	do	not	fix	a truck.
They	teach	biology.	They	do	not	teach	biology.

We	cry	every day.		We	do	not	cry	every day.

Yes/no questions				Information questions			
Do	I	teach	Spanish?	What	do	I	teach?
Do	you	carry	boxes?	What	do	you	carry?
Does	he	**go**	home ?	Where	**does**	he	**go**?
Does	she	**carry**	a suitcase?	What	**does**	she	**carry**?
Does	it	**cry**	at midnight?	When	**does**	it	**cry**?
Do	you	go	to La Paz?	Where	do	you	go?
Do	they	cry	at school?	Where	do	they	cry?
Do	we	pass	a test?	What	do	we	pass?

3.5.2.6 UNDERLINING

Underline the correct form.

1. John (study, studies) English every day.
2. Does Grover (go, goes) to the movies very often.
3. Victoria and Domingo do not (carry, carries) books in a briefcase.
4. Rene (play, plays) the violin very well.
5. Do we (play, plays) soccer every afternoon?
6. What does Evo (does, do)?
7. You always (try, tries) to come to school on time.
8. I do not (want, wants) to learn English.
9. The nurse does not (watch, watches) the patients.
10. What do they (teach, teaches)?

3.5.2.7 IRREGULAR VERB "HAVE TO"

Use "have to" + the base form of the verb for obligation.

I can't go hiking today. I have to study for a test.
She can't come home. She has to work all night.
Roxana can sleep late. She doesn't have to work.
Take it easy! You don't have to drive to the airport.

Use "have to" or "has to" with the base form of a verb. Use has to for the third-person singular.

Affirmative sentences

I	have to	go to class now.	
You	have to	study English.	
He	has to	fix his car.	
She	has to	go to class today.	NOT She has to goes to class.
It	has to	be today.	
We	have to	clean our bedroom.	

They have to learn Japanese.

Yes/no questions				Short answers
Do	you	have to study	on Saturday?	Yes, I do/No, I don't.
Does	he	have to go to	school today?	Yes, he does/No, he doesn't.

Information questions

What does he have to do today?	He has to sweep the floor.
How often does he have to work on weekends?	Not often.
When do they have to go shopping?	Today.
Where do you have to go this afternoon?	To the movies.

Subject questions

Who has to print out the report?	Camila.
Who has to cook?	My mother.

3.5.2.8 ERROR CORRECTION

Correct these sentences.

1. My mother **have** to work on the weekend.
2. Do you has to meet Mr. Hurtado at the airport?
3. We don't have to making dinner tonight. We're going out.
4. Miss Ramos has to fills out an application for her English class.
5. Does she have to goes home?

3.5.2.9 FILL IN THE BLANKS

Complete the questions.

1. A: What does she have to do tomorrow?
   B: She has to go to a wedding.
2. A: ____ he ____ take the medicine?
   B: Every four hours.
3. A: ____ she ___ go to the park?
   B: At around ten.
4. A: ____they _____ do after class?
   B: Nothing special.
5. A: ____ we ___ turn off the radio.
   B: Never! Don't ever turn it off.
6. A: __ you __ pick up your son?
   B: At about seven o'clock.

3.5.2.10 THE SIMPLE PAST TENSE

From the reading selections

Gottlieb Daimler **pioneered** in adapting the Otto engine.
The automobile **developed** because of the ingenuity of many inventors.
The first improved carburettor **replaced** coal gas with petroleum products.

Use the simple past tense to talk about a completed action in the past.

I play soccer on Mondays. (present) I played soccer yesterday. (past)
We arrive on time. (present) We arrived on time. (past)

Form the past tense of most regular verbs by adding "ed" to the base form.

like liked rain rained offer offered

For verbs ending in "e" or "ie", add "d".

smile smiled tie tied

For one-syllable verbs ending in consonant + vowel + consonant, double the last consonant and add "ed".

stop stopped plan planned

For verbs ending in a consonant and "y", change the "y" to "i" and add "ed".

study studied cry cried

Do not use "ed" for irregular verbs. See Appendix for a list of irregular verbs in the past tense form.

break broke I broke my leg yesterday.
catch caught He caught a ball.

Use didn't + the base form of a verb.

Negative statements

He didn't go to Germany last week. NOT He didn't goes to Germany last week. They didn't have a good trip. NOT They didn't had a good trip.

Use the base form of the verb for yes/no questions.

Yes/no questions	Short answers
Did you go fishing last Monday?	Yes, I did /No, I didn't.
Did he like turkey?	Yes, he did /No, he didn't.
Did they have a good trip?	Yes, they did /No, they didn't.

NOT Did he liked turkey?

Use a question word followed by "did" for information questions.

Information questions

Where did you go shopping?
When did he leave?
What did you drink last night?

3.5.2.11 SCRAMBLED WORD

Complete the conversations with questions in the simple past tense. Use a capital letter to begin sentences.

1. A: _____? (you/go/where/on vacation last year)

B: We went to the mountains.
2. A: _____? (you/get back/when/from vacation)
B: I got back last Sunday.
3. A: _____? (you/do/what/in Rome)
B: We visited a few museums.
4. A: _____? (your sisters/enjoy/ their trip)
B: Yes, they did.

3.5.2.12 WORD ORDER

Complete the following activity according to the model.

He changed careers.	(Affirmative statement)
He didn't change careers.	(Negative statement)
Did he change careers?	(Yes/no question)
What did he change?	(Information question)

1. They liked trucks.	(Affirmative statement)
_____.	(Negative statement)
_____?	(Yes/no question)
_____?	(Information question)
2. She wanted a nice van.	(Affirmative statement)
_____.	(Negative statement)
_____?	(Yes/no question)
_____?	(Information question)
3. We wrote a letter.	(Affirmative statement)
_____.	(Negative statement)
_____?	(Yes/no question)
_____?	(Information question)
4. He went to his office.	(Affirmative statement)
_____.	(Negative statement)
_____?	(Yes/no question)
_____?	(Information question)

3.5.2.13 COMPARISON WITH ADJECTIVES

From the reading

New substances have much **lower** coefficients.
Resistance is reduced to its **lowest** degree.

Comparative adjectives compare two people, places, or things.

Bolivia is bigger than Taiwan.

Superlative adjectives compare more than two people, places, or things.

Brazil is the biggest country in South America. (compared to al the countries in

South America)

adjective	comparative adjective	superlative adjective
strange	stranger than	the strangest
crowded	more/less crowded than	the most/least crowded
good	better	the best
bad	worse	the worst

3.5.2.14 SUPERLATIVE ADJECTIVES

Add "est" to one-syllable adjectives. If the adjective ends in "e", add "st". Remember to use "the" with superlatives.

cheap the cheapest loose the loosest

If an adjective ends with consonant + vowel + consonant, double the final consonant before adding "est".

thin the thinnest fat the fattest

For most adjectives that end in "y", change the "y" to "i" and add "est".

happy the happiest busy the busiest

To make the superlative form of most adjectives of two or more syllables, use "the most" or "the least".

La Paz is the most interesting city in Bolivia.

Safaris are the least exciting vacations.

3.5.2.15 FILL IN THE BLANKS

Complete each sentence with a comparative or superlative adjective.

1. That breakfast was the most delicious meal on our trip. (delicious)
2. This scanner is _____ than that one. (new)
3. We have many cars, but this one is _____ (convenient)
4. I like that truck, but I think this one is _____ (nice)
5. Sunday is going to be _____ day of the week. (bad)

3.5.2.16 COMPARISONS WITH "AS…. AS"

From the reading

Drum brakes are not **as** powerful **as** disk brakes.

Use "as…. as" to say that two things are equal or the same. Use the adverb "just" for emphasis.

A car is as expensive as a motorcycle.
My new monitor is just as good as the old one.

Use “not as ….. as” to say that two things are different.
My new air conditioner isn’t as noisy as the old one.
A car isn’t as fast as an airplane.

3.5.2.17 ERROR CORRECTION

Each sentence has one error. Correct the error.

1. My old laptop didn’t have as many problems than my new one.
2. The Cannon printer is as better as the HP one.
3. A hammer is as big as a truck.
4. Digital cameras are more expensive as CD players.

3.5.3 SUBTECHNICAL VOCABULARY

Friction (noun): The resistance to relative motion of two bodies moving in contact with each other.

Coefficient of Friction: The constant ratio of the friction to the force pressing the surfaces together.

Static Friction (noun compound): The resistance to motion between two bodies in contact with each other but at rest.

Sliding Friction (noun compound): The resistance to continued motion when one body has started to move.

Rolling Friction (noun compound): The resistance to motion when one or more bodies are rotating or rolling, but not on the same axis.

Babbitt Metal (noun compound): An alloy or mixture of tin, copper, and antimony with a low coefficient of friction.

Teflon (noun) : A plastic containing fluorine with a low coefficient of friction.

Antimony (noun): A metalloid element, silvery-white, "brittle yet soft with the unusual quality of expanding when solidified; used as a constituent of alloys.

Lubrication (noun): Application of a substance, usually oil or grease (a lubricant) to reduce friction.

Polymers (noun): Long, heavy, complex molecules forming repeating structural units that occur in many plastics.

Bearing (noun): That part of a machine which supports parts in relative motion.

Ball Bearings (noun compound): Bearings containing small round balls, sometimes known as anti-friction bearings.

Cage (noun): A device to hold and separate bearings.

Races (noun): Rings within which cages of bearings are sealed.

Roller Bearings (noun compound): Bearings with rolling elements in the shape of cylinders or tapered cylinders or needles; they have a greater load-carrying capacity but more friction than ball bearings of similar size.

Non-contact Bearings (noun compound): Bearings that touch only at rest; in motion they are separated by gas or fluid.

Brakes and Braking Devices (noun compound): Devices to slow and control motion in a machine, usually through some form of friction.

Drum Brake (noun compound): A braking device with friction material pressing on the inside of a metal drum.

Fading (noun): Lowering the coefficient of friction in a braking device.

Disk Brake (noun compound): A braking device of metal disks which can be brought into contact against friction pads.

Clutch (noun): A device by which different parts of a machine can be connected or disconnected without bringing the parts to rest.

Disk Clutch: (noun compound): A clutching device that uses disks lined with friction material and no lubrication.

3.5.3.1 VOCABULARY PRACTICE

1. What is the ***coefficient of friction****?*
2. How do ***static, sliding,*** **and** ***rolling friction*** differ from each other?
3. What is ***babbitt*** *metal?*
4. What is ***teflon****?*
5. What is ***antimony*** used for?
6. What does ***lubrication*** mean? What is a ***lubricant****?*
7. What are ***polymers****?*
8. What is a ***bearing****?*
9. What are ***ball bearings****?*

10. What do ***cage*** and ***races*** mean in connection with bearings?
11. What are some different types of ***roller bearings****?*
12. Are ***non-contact bearings*** separated by bearings?
13. What are ***brakes*** **or** ***braking devices****?*
14. Are a ***drum brake*** and a ***disc brake*** the same?.
15. What does ***fading*** do to braking devices?
16. What does a ***clutch*** do?
17. How does a ***disc clutch*** work?

3.5.3.2 MATCHING

Match the terms on the left with the statements on the right.

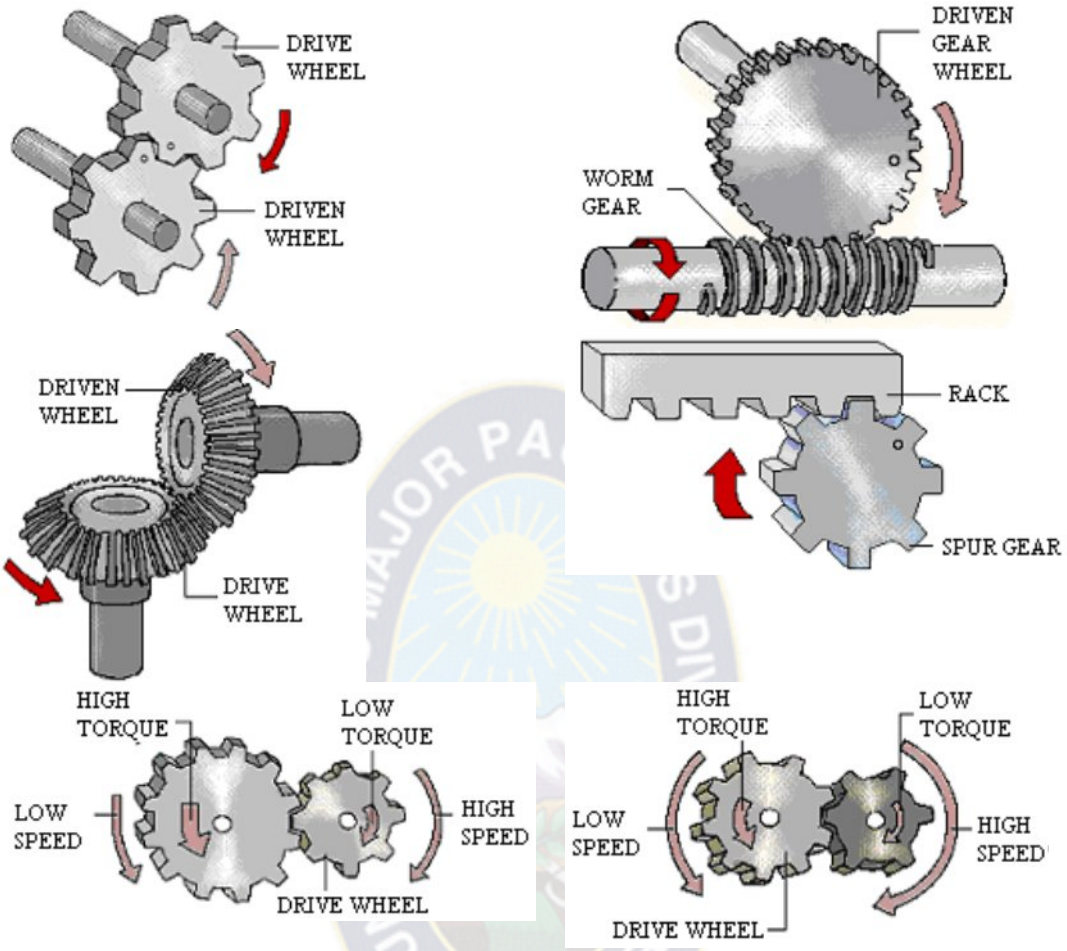
1. Friction	__A plastic that contains flourine with a low coefficient of friction.
2. Coefficient of Friction	__Long, heavy, complex molecules that occur in many plastics.
3. Static Friction	__Devices to slow and control motion in machines.
4. Sliding Friction	__Bearings separated by gas or fluid when a machine is in motion.
5. Rolling Friction	__A device to hold balls or rollers in order to keep them separate.
6. Babbitt Metal	__Application of a substance such as grease or oil to reduce friction.
7. Teflon	__Bearings containing cylinders.
8. Antimony	__The resistance to motion produced by two bodies moving in contact with each other.
9. Lubrication	__Devices to connect or disconnect parts of a machine when it is in motion.
10. Polymers	__The constant ratio- of friction to the force pressing the surfaces together.
11. Bearing	__The resistance to motion when one or both bodies is rotating on different axes.
12. Cage	__Bearings with parts in the shape of cut-off cones.
13. Races	__The resistance to motion between two bodies in contact but at rest.
14. Ball Bearings	__An alloy of tin, copper, and antimony with a low coefficient of friction.
15. Roller Bearings	__The resistance to continued motion when one body has started to move.
16. Tapered Bearings	__A brittle yet soft metalloid element which expands when solidified; used in alloys.
17. Needle	__Rings within which cages containing bearings are

Bearings	sealed.
18. Non-contact Bearings	__Bearings containing cylinders of very small diameter.
19. Braking Devices.	__Part of a machine which bears the friction of parts
20. Clutching Devices.	in relative motion. __Bearings containing small round balls.

3.5.3.3 READING COMPREHENSION

1. What does friction do to the efficiency of machines?
2. What does friction make possible?
3. Name the three different kinds of friction.
4. Which kind of friction offers the greatest resistance? The least? Explain and give an example.
5. How can the choice of materials in a machine help reduce friction?
6. What are some substances that have low coefficients of friction?
7. What is another way of reducing friction?
8. Name the principal lubricants and some new variations.
9. Why are logs efficient when used to move heavy objects?
10. What is the most familiar type of bearing? How is it usually enclosed in a machine?
11. What is the modern version of the logs that were used as primitive bearings?
12. Why are roller bearings sometimes tapered?
13. How do needle bearings differ from other types?
14. What kinds of bearings have been developed for use in complex and sophisticated systems such as missile guidance?
15. Why isn't a long gradual stop suitable for automobiles?
16. How do braking devices put friction to work?
17. What do brakes ordinarily consist of? What are some friction materials used in brakes?
18. How did old-fashioned automobile brakes work? What was wrong with them?
19. Describe more recent developments in automobile brakes.
20. What is the purpose of a clutch device in an automobile?
21. What type of clutch is in common use today? How does it use friction to do its work?

LESSON 3



3.6 MACHINE COMPONENTS

Essentially all machines are variations or combinations of the six basic types. There are a number of different kinds of **mechanisms** or components that transmit motion or change it in one way or another. Modern machines and their components **are becoming** so complex that a branch of the science of mechanics called **kinematics** evolved in order to study mechanisms and their actions. Regardless of the original input and final output of most modern machines, it is their mechanisms that give them their great versatility and flexibility.

Gears play such an important part in machines that they have become the symbol for machinery. They are wheels with teeth that engage or mesh with each other so that they work in pairs to transmit or change motion. They are frequently used to reduce or increase the speed of a motion and they **can** also change the direction of motion. The line around which a wheel rotates is its axis; gears **can** change **axial motion**.

By classifying gears according to the shape and arrangement of their teeth we **are going to discover** four basic types. The simplest and most common is the **spur gear**.

Spur gears have teeth that are straight and parallel to the axis. One member of a pair or series of gears receives input motion, usually from a shaft. The teeth of the first gear mesh (engage) with the teeth of the next one, passing the motion (energy) along. If the two gears have the same number of teeth, the velocities will be inversely proportional to the number of teeth. That is, if the first gear has sixty teeth and the second gear has twenty, the second gear **is turning** three times as fast as the first. Spur gears are used for transmitting motion along parallel axes rather than for changing direction.

In **helical gears** the teeth are at such an angle to the wheel that they form helices. There are often two sets of teeth on each gear with the teeth at equal but opposite angles; this variation is called a **herringbone gear**. These gears are particularly useful for transmitting power at high speeds. They are also used to change the direction of motion, most frequently when the axes are crossed through a 90° angle.

A bevel is a surface that is slanted at an angle in relation to another surface. In a **bevel gear** the teeth are slanted in relation to the plane of the wheel. Bevel gears are useful in changing the direction of motion, the change being in proportion to the angle of the beveled surface. One variation is the spiral bevel gear which has the same relationship to bevel gears as helical gears have to spur gears. With a bevel gear one tooth at a time has to bear the entire load but in the spiral configuration more than one tooth always remains in contact.

The fourth basic type is called the **worm gear**. Basically a pair consists of the gear itself, a wheel with teeth which meshes with a worm, a screw which is a helix wrapped around a cylinder. A variation is a worm shaped in an hour-glass figure. Worm gears are used primarily for changing the direction of axial motion.

Another type of gear mechanism is the **rack and pinion**. The rack is a straight bar with teeth and the pinion is a small spur gear.

Gear devices **can** be used in a variety of shapes and combinations. They are essential elements in tiny devices like watches and in large ones like automobiles. Without the gears that transmit motion to the driving wheels we **could** not have the kind of transportation that exists today. In their variations on the basic machines gear mechanisms are key elements that produce enormous versatility.

Another kind of mechanism is the **cam**. Like the gear, it consists of a pair of components; the cam itself is the input member and the **follower** is the output member. The cam is attached to a rotating shaft; it transmits motion to the follower. Cams come in many different shapes, there are heart-shaped cams, clover-leafed cams, elliptical cams and others. By means of these different shapes cams can change rotating into reciprocating (back and forth or up and down) motion or into oscillating or vibrating motion. The follower is usually a rod or shaft. Cams **can** transmit exact motions at specific times in a cycle. They are; therefore, useful where the timing of

complex motions is important. They are in automobile engines to raise and lower the valves and in sewing machines to control the movements of the needle.

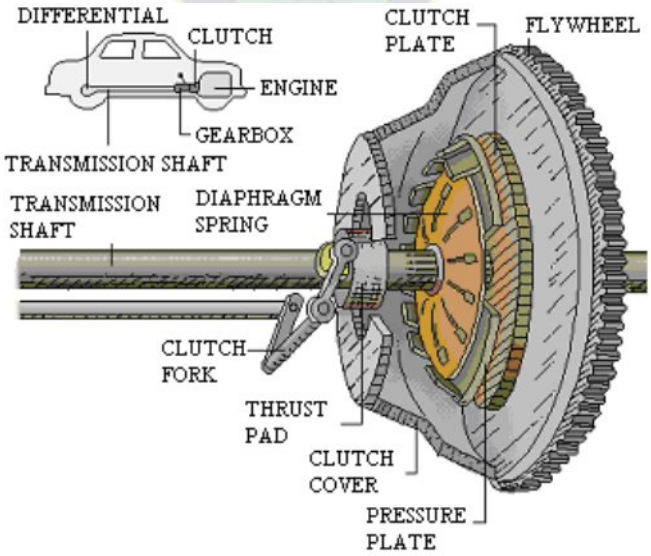
Another kind of mechanism is known as a **linkage**; it is a series of at least three rods or solid links that are connected by joints that permit the links to pivot. When one link is fixed the other links move only in paths that are predetermined. Like cams, linkages are used to change the direction of motion, to transmit different kinds of motion, or to provide variations in timing in different parts of a cycle by varying the lengths of the links in relation to each other.

The **spring** is a mechanism that is used in a wide variety of machines; it is frequently an elastic helical coil that returns to its original shape after being distorted. Springs are essential components in watches; in some cam mechanisms they hold the follower in place; they are found in scales and they help to cushion an automobile ride. There are many variations on the basic coiled or spiral spring, including the **leaf spring** which is made of strips of elastic material and springs that depend on the compression and expansion of air.

A **ratchet** is another paired mechanism consisting of a wheel with teeth and a pawl which drops into the spaces between the teeth. The ratchet mechanism is used to prevent a motion from being reversed or to change reciprocating into rotary motion.

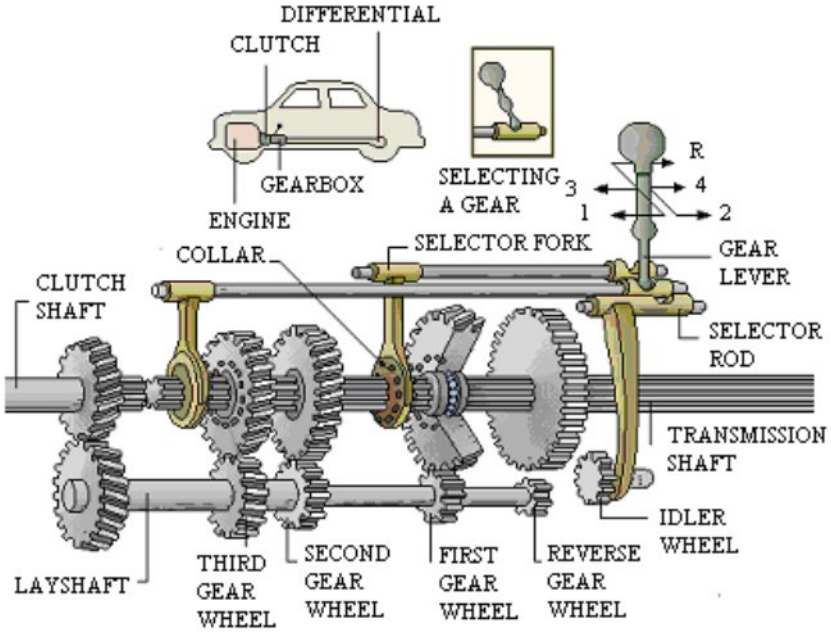
This is a brief introduction to the complex world of machine components. The infinite number of combinations and variations in which these mechanisms **can** be combined is the heart of the work of a mechanical engineer.

3.6.1 AUTOMOBILE MAIN COMPONENTS



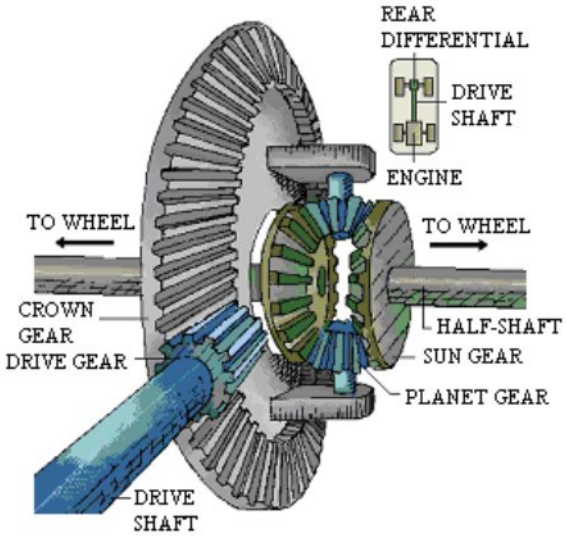
3.6.1.1 CLUTCH

The clutch of a car consists of two plates; one connected to the engine crankshaft, and the other to the gearbox. A diaphragm spring holds the plates together, so that friction transmits the rotation of the crankshaft to the gearbox. When you press the clutch pedal, the spring flips backward, and the plates separate, enabling you to select a different gear.



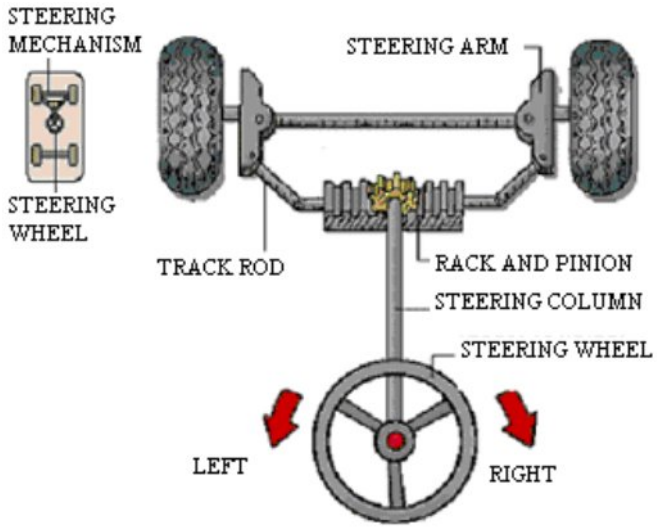
3.6.1.2 GEARBOX

The job of the gearbox is to keep the engine running at its most effective rate, while allowing the car to travel at a wide range of speeds. When the clutch is engaged, the engine turns the clutch shaft. The clutch shaft turns the transmission shaft at a rate that depends upon which gear is selected.



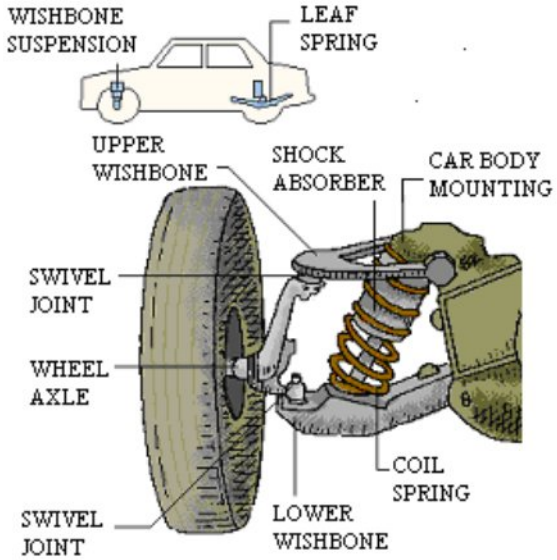
3.6.1.3 DIFFERENTIAL

When a car turns a corner, the wheels on the outside of the bend must turn master than those on the inside. This would be impossible if the engine turned one axle linked to both wheels. So the engine drives a differential, a set of gears that allows the power to be split between two half-shafts, each driving one wheel.



3.6.1.4 CAR STEERING

When a car driver turns the steering wheel, a small gear (pinion), at the end of the steering column slides a rack to the left or to the right. Track rods attached to the ends of the rack push or pull on the steering arms, changing the angle of the wheels. This clever arrangement multiplies the force of your hands on the steering wheels so they can turn the front wheels of the car.

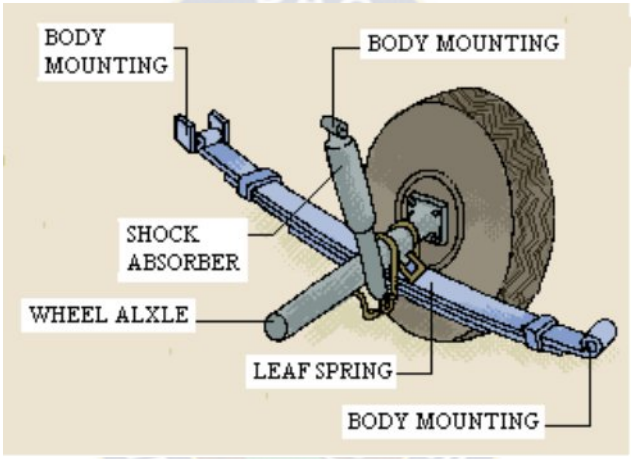


3.6.1.5 CAR SUSPENSION

The suspension of a car smoothes the ride on a bumpy road. When the wheels jolt up and down, springs between the wheel axles and the car body absorb the energy of the jolts. Springs alone give an unpleasant bouncing sensation, so a suspension system has chock absorbers to dampen the springs' movements.

3.6.1.5.1 WISHBONE SUSPENSION.

The front wheels of most cars use coil springs to absorb jolts. The car body rides on top of the spring; its lower end presses on a hinged arm, or wishbone, that supports the wheels. A shock absorber inside the spring stops the car from bouncing.



3.6.1.5.2 LEAF SPRINGS

Larger vehicles often use leaf spring suspension. The spring is a stack of steel strips, fixed at each end to the car body. The wheel axle is attached to the middle of the spring. A shock absorber links the axle to the body.

3.6.2 GRAMMAR FRAME

3.6.2.1 THE PRESENT CONTINUOUS

From the reading

Modern machines and their components **<u>are becoming</u>** so complex.
The second gear **<u>is turning</u>** three times as fast as the first.

Use the present continuous for actions in progress now and for some future actions. Form the present continuous with "be" and a present participle (base form + ing).

<u>Affirmative statements</u>

I'm looking for a laptop. (action in progress now)
I'm going to England tomorrow. (future action)

Negative statements
I'm not learning Greek.
He's not reading a book.
They're not fixing a car.

Yes/no questions.	Short answers
Are you looking for a hammer?	Yes, I am. /No, I'm not.
Is she using her computer?	Yes, she is. /No, she's not.
Are they selling van?	Yes, they are. /No, they're not.

Information question

What are you drinking?	I'm drinking water.
Where is he going?	He's going home.
When is she travelling)	She's travelling next week.

Subject questions

Who's working now?	My sister is.
Who's studying right now?	Pedro and Mercedes are.

3.6.2.2 SENTENCE FORMATION

Change each affirmative statement to a negative statement. Use contractions.

1. She is going to a movie. She's not going to a movie
2. They are arriving this afternoon. _____
3. I am selling my truck tomorrow. _____
4. Arturo is taking the bus to movies. _____

3.6.2.3 SHORT ANSWERS

Write answers to the questions.

1. Are you working alone this year? Yes, I am.
2. When are you taking a vacation? _____
3. Is it raining now? _____
4. Where are you going tonight? _____
5. Are you listening to me? _____

3.6.2.4 YES/NO QUESTIONS- INFORMATION QUESTIONS

Complete each conversation with a question in the present continuous.

1. A: Is Grover studying right now?
   B: No. Grover's not studying right now.
2. A: _____?
   B: Yes, he's working this afternoon.
3. A: _____?
   B: I'm calling a friend.
4. A: _____?
   B: She's coming home tonight.

3.6.2.5 FUTURE TENSES

There are five ways to express future actions using the present tenses. These are similar in meaning.

1. "be going to" + base form usually expresses a future plan or certain knowledge about the future.

I'm going to travel to Asia.
It's going to snow tomorrow.
They're not going to wear formal clothes for the party.

2. The "present continuous" can also express a future plan.

They're coming tonight.
He isn't working next week.
We're camping next Sunday.

3. The simple present tense can express a future action, almost always with verb of motion: arrive, come, depart, fly, go, head, leave, sail, and start, especially when on a schedule or timetable. When the simple present tense expresses the future, there is almost always a word, phrase, or clause indicating the future time.

The train leaves this Tuesday.

4. The present tense of "be" can describe a future event if it includes a word or phrase that indicates the future.

The ceremony is on Friday.

5. Use "will " and the base form of a verb to talk about the future.

He will travel tonight. = He'll travel tonight.
She will not call before noon. = She won't call before noon.

3.6.2.6 WORD ORDER

Answer the following questions. Make sure you use the right form.

1. When will you buy a house? I will buy a house next year
2. What are you eating for lunch? _____
3. Where is he going to work? _____
4. When is the baptism? _____
5. When does he arrive? _____

3.6.2.7 MODAL AUXILIARY "CAN"

From the reading

Gears **can** change axial motion.
They **can** also change the direction of motion.

Use can + the base for of a verb to express ability or possibility.

I can drive a car, but I can't drive a truck.
I can' study today. I'm too busy.

Yes/no questions	Short answers
Can you play soccer?	Yes, I can /No, I can't.
Can he come today?	Yes, he can /No, he can't.

Information questions with "can"

Where can I go today?	Try the park.
When can you come for lunch?	How about next Friday?
How often can you go running?	No more than once a week.
What languages can he speak?	He can speak seven languages.

Subject questions

Who can drive?	We can.
Who can play jazz?	She can.

Note. Use "can" with the base forma of a verb.

She can speak five languages.	NOT She cans speak five languages.
	NOT She can speaks five languages.
	NOT She can to speak five languages.

There are three negative forms of "can".

He can't swim. = He cannot swim. = He can not swim.

3.6.2.8 FILL IN THE BLANKS

Complete the questions, using "can".

1. A: Where can I do aerobics around here? (Where/I/do).
   B: Why don't you try Iron Flex. They have great instructors.
2. A: _____ English together? (When/we/study)
   B: Let's get together tonight.
3. We need some fresh air. _____ walking? (Where/we/go)
   B: Well, we can go over to Park Avenue. It's very nice.
4. _____ golf? (How often/Ramon/play)
   B: Not very often. He's starting a new job
5. ____ dinner tonight? (Who/make)
   B: What about Maria? She's not doing anything.

3.6.2.9 MODALS AUXILIARIES "CAN", "SHOULD", AND "COULD".

Use “can” to express ability or possibility.

I can speak English Can you be here tomorrow?

Use “could” to suggest an alternative or to make a weak suggestion.

They could work today, or they could take it easy.

Use “should” to give advice or to express criticism.

You should learn Chinese.

Never add “s” to the third-person singular form of modals

He should buy a ticket in advance. NOT He shoulds buy a ticket in advance.

Never use “to” between modals and the base form.

You could take a taxi. NOT You could to take a taxi.

Use “not” between the modal and the base form.

He shouldn’t stay here.

They can’t take express bus.

In “yes/no” question, the modal comes before the subject. In information question, the question word precedes the modal.

Yes/no question	Information question
Should I buy a house?	Which bus should I take?
Can you swim?	Where can he learn Aymara?
Could she walk?	When should they arrive?

3.6.2.10 SCRAMBLED WORDS

Complete each sentence or question.

1. Where <u>can I find</u> a hotel? (I can find/can I find)
2. _____ you when I arrive? (I should call /Should I call)
3. We _____ the bus. (can to not take/can’t take)
4. When _____ him the ticker? (should you giving/should you give)

3.6.3 SUBTECHNICAL VOCABULARY

Mechanism: A component of a machine that transmits or changes motion.

Kinematics: A branch of the science of mechanics that deals with aspects of motion apart from considerations of mass and force.

Gear: A wheel with teeth that can engage another wheel with teeth; gears work in pairs to transmit or change motion.

Axial Motion: Motion around an axis, the line around which a wheel rotates.

Spur Gear: A gear with straight teeth parallel to the axis.

Pinion: The smaller member of a pair of gears or the smallest gear of a series; gear is used to designate the larger member.

Helical Gear: A gear with teeth cut in the shape of a helix.

Herringbone Gear: A helical gear with two sets of teeth at equal but opposite angles to
each other.

Bevel Gear: A gear with teeth slanted at an angle to the plane of the wheel itself.

Worm Gear: A mechanism consisting of a gear that meshes with a worm, a screw with
helical teeth.

Rack and Pinion: A gear mechanism composed of a rack (a straight bar with teeth) and a pinion (a spur gear).

Cam: A rotating or sliding piece of machinery that acts as part of a pair to impart or receive motion.

Follower: The other part of a cam mechanism, usually a rod and shaft that receives and
transmits motion from the cam.

Linkage: A mechanism consisting of rods connected to each other by joints that permit
motion.

Spring: An elastic material that returns to its original shape after being forced out of that
shape.

Leaf Spring: A spring made of strips, rather than a spiral of elastic material which is usually metal.

Ratchet: A mechanism that works with a pawl. The ratchet is a bar or wheel with inclined teeth; the pawl is usually a rod that can drop between the teeth to permit motion in only one direction.

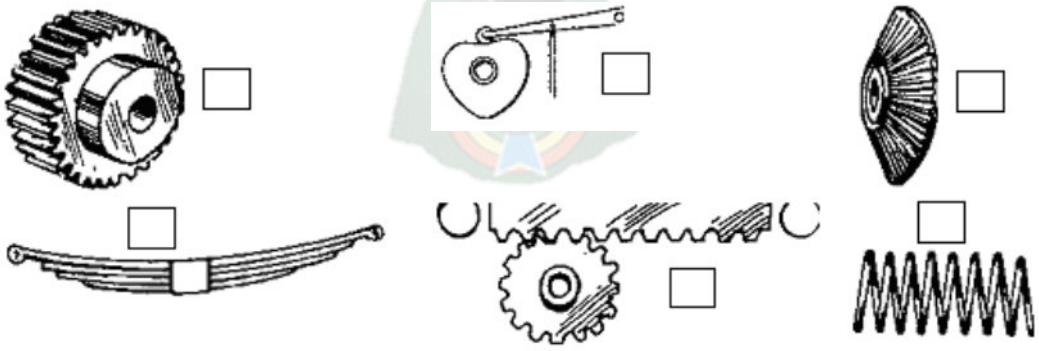
3.6.3.1 VOCABULARY PRACTICE

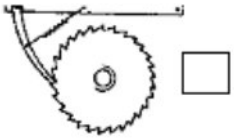
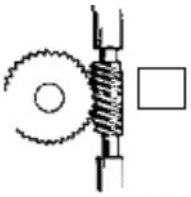
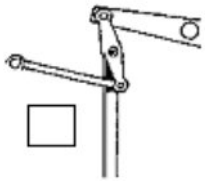
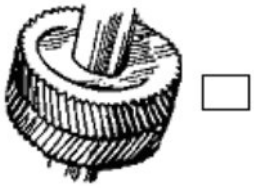
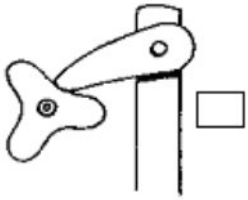
1. How does a ***mechanism*** differ from a machine?
2. What is studied in ***kinematics****?*
3. Describe a ***gear***.
4. What is ***axial motion****?*
5. How are the teeth cut in a ***spur gear****?*
6. What is a ***pinion****?*
7. How are the teeth cut in a ***helical gear****?*
8. Describe a ***herringbone gear***.
9. How are the teeth cut in a ***bevel gear****?*
10. What is a ***worm gear****?*
11. Describe a ***rack and pinion*** mechanism.
12. What is a ***cam****?*
13. What is a ***follower****?*
14. What is a ***linkage****?*
15. Describe a ***spring***.
16. How does a ***leaf spring*** differ from the usual type of spring?
17. What device works with a ***ratchet****?*

3.6.3.2 LEARNING WITH PICTURES

Identify each of the mechanism below. Try to label each part.

a) a worm gear. b) a rack and pinion. c) a spur gear. d) a linkage. e) a bevel gear.
f) a spiral coil spring. g) a leaf spring. h) a ratchet and pawl.
i) a herringbone helical gear. j) a heart-shaped cam with follower.
k) a cloverleaf-shaped cam with follower.



3.6.3.3 MATCHING

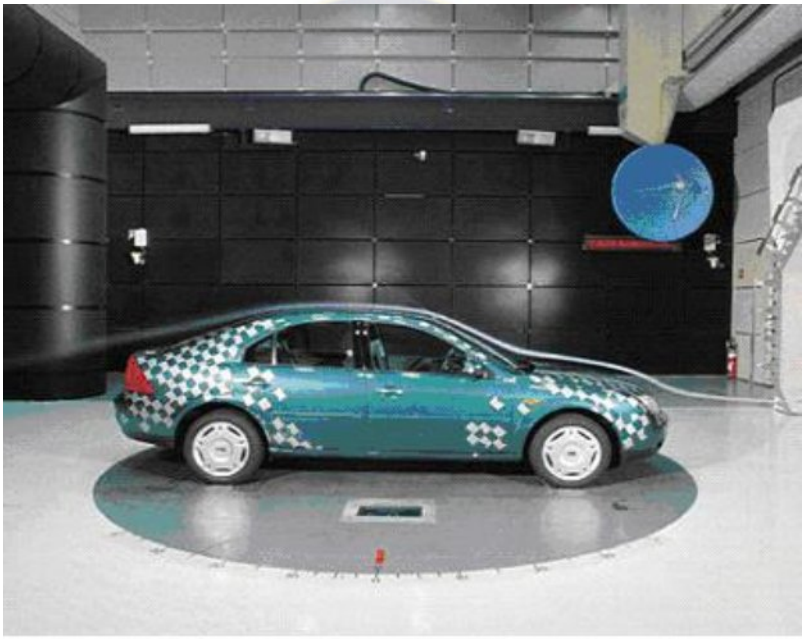
Match the terms on the left with the statements on the right.

1. Mechanism	__A spring made of strips rather than a spiral coil.
2. Kinematics	__A mechanism consisting of rods connected to each other by joints that permit motion.
3. Gear	__A device of elastic material, usually metal, that returns to its original shape after being distorted.
4. Axial Motion	__A branch of the science of mechanics that deals with aspects of motion apart from mass and force.
5. Pinion	__A gear with teeth slanted at an angle to the plane of the wheel itself.
6. Spur Gear	__A component of a machine that transmits or changes motion.
7. Helical Gear	__The part of a cam mechanism, usually a rod or shaft that is the output member of the pair.
8. Bevel Gear	__Motion in the line around which a wheel rotates.
9. Worm Gear	__A piece of metal that rotates or slides to transmit or change motion.
10. Rack and Pinion	__ A wheel with teeth cut at an angle to its axis; paired with a
11. Cam	pawl it governs or prevents motion.
12. Follower	__The smaller member of a pair of gears.
13. Linkage	__A wheel with teeth that can engage or mesh with another wheel with teeth.
14. Spring	__A gear with straight teeth and parallel to the axis.
15. Leaf Spring	__A gear that meshes with a screw-like cylinder that has teeth cut in helices.
16. Ratchet	__A gear with teeth cut in the shape of a helix.
	__ A gear mechanism in which a spur gear (pinion) meshes with teeth in a straight par (rack).

3.6.3.4 READING COMPREHENSION

1. What science has developed to study mechanisms?
2. How do gears work?
3. For what purposes are gears used?
4. What determines the four basic types of gears?
5. What is the simplest and most common kind of gear? How are its teeth arranged?
6. What is the difference between the gear and the pinion?
7. How are the teeth arranged in helical gears? What is a variation of the helical gear?
8. For what purpose are helical gears particularly useful?
9. How are the teeth arranged in a bevel gear?
10. What are bevel gears especially useful for?
11. What is a variation of the bevel gear?
12. Describe the worm gear and its uses.
13. What is the name for a gear mechanism with a straight bar and a small spur gear used as a pair?
14. In a cam mechanism, which is the input member and which is the output member?
15. Are all cams the same shape?
16. What are some of the things that cams do?
17. Name some machines which use cams.
18. What is a linkage and how does it work?
19. Name some different types of springs.
20. How does a ratchet and pawl mechanism work?

LESSON 4



3.7 AERODYNAMICS IN CAR DESIGN

Automobile designers are working on ways to build automobiles that get good gas mileage. One way to do this is to make cars more **streamlined** by **reducing** drag, or wind **resistance**. Scientists define drag as a **force** that retards or slows, an object that is moving through the air. All moving objects are subject to drag. Studies estimate that at 88 kilometers an hour, one-half of the car's **fuel** and more than 60 percent of the car's horsepower are used **to overcome** drag. So if car designers can reduce drag they can improve on the car's gas mileage, or fuel efficiency.

To find out more about drag, car designers use engineers who are specialists in aerodynamics. Aerodynamics is a science that **involves** the study of moving air and the forces that act on objects moving through the air.

The aerodynamic specialists measure air resistance in units **indicating** coefficient of drag (CD). The coefficient of drag is the ratio of the amount of wind resistance an object **encounters** to that of a flat plate of the same weight held vertically. As an example of CD, a 1.2- by 2.4- meter piece of plywood held vertically would have a CD of about 1.1. Other shapes would have a lower CD. A watermelon of the same weight as the plywood would have a lover CD. A falling parachute would have a CD of about 1.3. **In comparison**, the typical automobile would have a CD of about 0.45.

3.7.1 WIND TUNNEL

Engineers use wind tunnels to study the CD of automobiles. Wind tunnels are the basic tool of aerodynamic research. They are used to test design **models**, or smaller representations, of bridges, buildings, spacecraft, and most recently, automobiles. A wind tunnel can have a **width** of 12 to 24 meters and be as long as 275 meters. The tunnel has a special section where a test model is placed. The object tested can be a **full-size** car or a clay model of the real thing. A huge fan blows air into the test section at about 80 kilometers an hour. During this time the aerodynamic specialists **checks** the areas of the car where there may be turbulence, or irregular air movement. Some specialists use powerful lights to check turbulence. Other engineers use smoke, small pieces of paper, or other visible substances in the same way.

The wind tunnel studies have located several trouble spots where drag occurs around the car. One of the major problems is the underside of the car, where there are many exposed parts. This area **accounts for** about 20 percent of the drag. The rear section of the car also presents a problem. All the air that rushes from the front of the car collects in the back and creates a **vacuum**, which pulls the car backwards. Another trouble spot is the area around the window frames. Even license plates, windshield, and side mirrors are areas of drag.

3.7.2 DESIGN IMPROVEMENTS

The wind tunnel studies have helped make many aerodynamic improvements in automobiles. Today many cars have hoods that slope to act as wedges against the wind. Windshields are also better designed to **cut down on** wind resistance. Special dams are **installed** under the front section of the car to reduce the flow, or movement, of air under the car. Other improvements include **retractable** head lamps and smaller radiator grilles. Some designers have stopped using radiator grilles altogether. Others want to eliminate mud flaps, rain gutters, an even side trim to reduce air turbulence.

Aerodynamics will play a mayor role in the design of future automobiles because of the importance of improving gas mileage. And that means the consumer might see the automobile change drastically in size and shape from what it looks like today.

3.7.3 GRAMMAR FRAME

3.7.3.1 THE PRESENT PREFECT

From the reading selection

The wind tunnel **studies have** located several trouble spots.
Diesel engines **have gained** wide acceptance.

Use the present perfect to talk about an indefinite time in the past.
Use the simple pat tense to talk about a definite time in the past.

Present perfect	Simple past tense
I **have driven** a truck twice.	We **drove** a truck last year.
(We don't know when)	(we know when)

Form the present perfect with "has" or "have" and the past participle form of a verb.

Affirmative statements

I have met Maria.	(meet	met	met)		
You have seen a tool.	(see	saw	seen)		*singular
He has spoken English.	(speak	spoke	spoken)		
She has eaten fish.	(eat	ate	eaten)		
It has grown a lot.	(grow	grew	grown)		
We have had coffee.	(have	had	had)		
You have broken your leg.	(break	broke	broken)		*plural
They have written a book.	(write	wrote	written)		

Negative statements		Contractions
I have not met Maria.	=	I haven't met Maria.
He has not spoken English.	=	He hasn't spoken English.

Yes/no questions	Short answers	Information questions
Have you seen a tool?	Yes, I have/No, haven't.	What have you seen?
Has it grown a lot?	Yes, it has/No, it hasn't.	How has it grown?

For a complete list of irregular past participle forms, see Appendix.
The past participle form of regular verbs is the same as the simple past tense form.

cook	cooked		cooked
love	loved	loved	
want	wanted		wanted
visit	visited	visited	

3.7.3.2 SHORT ANSWERS

Complete the conversation with the present perfect.

1. A: Have you ____ that new van? (see) B: Yes, _____
2. A: Has he _____ Bolivia? (visit) B: No, _____
3. A: Have you and Tomas ____ chicken? (eat) B: Yes, _____
4. A: Has your brother ____ letters? (write) B: No, _____

3.7.3.3 FILL IN THE BLANKS

Use the present perfect or the simple past tense to complete the conversations.

1. A: Have you seen the Great Pyramids?
   B: Yes, I have. I ____ Egypt in 1999.(visit). They _____ wonderful.(be)
2. A: Has the new garage opened?
   B: No. It _____. Maybe tomorrow.
3. A: Have you eaten lunch?
   B: No, I haven't. But I ___ a big breakfast two hours ago.
4. A: Have you met the new professor?
   B: No. The class _____.

3.7.3.4 VERB TENSES REVIEW

The simple present tense is used for actions that occur now and that generally occur. It is used to state general truths. In science writing this tense is used often because of the frequent use of definitions and rules.

> Engineers **use** wind tunnels to study the CD of automobiles.
> At 88 kilometers an hour, more than 60 percent of the car's horsepower **is** used to overcome drag.

The present perfect tense is used to indicate actions that began in the past and are still occurring.

> She **has driven** that car since she bought it.

Sometimes the present perfect tense is used to indicate that something occurred in the very recent past.

> The wind tunnel studies **have located** several trouble spots.

This tense is common in science writing, where recent results of experiments are often reported.
The present progressive or continuous tense is used to indicate that something is occurring right now and to suggest that it probably did not occur in the past.

> Wind tunnels **are having** an effect on car design.

Note that the rules and examples above only cover some of the uses of these tenses.

3.7.3.5 MULTIPLE CHOICE

Choose the correct lettered response to explain each numbered statement

1. All moving objects are subject of drag.
   a. This is a general statement of fact.
   b. Moving objects were probably not subject to drag in the past.
2. The wind tunnels studies have located several trouble spots.
   a. This probably happened a long time ago.
   b. This happened in the past, and probably more trouble spots will be found.
3. The studies have helped scientists design better cars.
   a. The studies helped them one time only.
   b. The studies are helping them now but probably did not help them until recently.
4. Air is rushing from the front of the car and is collecting in the rear of the car.
   a. This is a general statement of fact.
   b. This is happening right now.
5. Some engineers have used special lights in the wind tunnels studies.
   a. They don't use them any more.
   b. They are probably still using them now.

3.7.3.6 SIMPLE NOUN COMPOUNDS

Often two or more nouns are used together so that one of them defines or limits the meaning of the other.

vocabulary list car designer win tunnel research

These noun compounds may be confusing unless you are already familiar with them as units. In understanding noun compounds you haven't seen before, it is helpful to remember that the last word in the pair or group is usually the most important. The words that come before it usually are modifiers.

When you reach a confusing pair or group of nouns, it is helpful to ask the question, "What kind of _____ ?" and try the last noun in the blank space.

3.7.3.7 SCANNING

The reading in this chapter contains twenty-seven different two-word compounds and one three-word compound. The first three are given. Complete the list.

1. gas mileage 2. wind resistance 3. car designers 4. _____

5. _____ 6. _____ 7. _____ 8. _____

9. _____ 10. _____ 11. _____ 12. _____

13. _____ 14. _____ 15. _____ 16. _____

17._____ 18. _____ 19. _____ 20. _____

21._____ 22. _____ 23. _____ 24. _____

25._____ 26. _____ 27. _____

3.7.3.8 WORD ORDER

gas mileage _____ What kind of mileage? ***gas mileage***

1. wind resistance _____
2. car designers _____
3. rear section _____
4. license plates _____
5. air turbulence _____
6. trouble spots _____

3.7.3.9 CONDITIONAL SENTENCES.

Conditional sentences express a result of an action. They usually have an "if" clause and a result clause.

(if clauses "the condition")	(result clause)
If I eat dinner at home,	I don't eat too much.
If they speak English to the taxi driver,	he won't understand.
If they had more money,	they would take a trip.

Use the present factual conditional to talk about general and scientific facts. Use the simple present tense or the present tense of "be" in both clauses.

If it rains, flights are delayed.	(general fact)
If you heat water to 100 degrees, it boils.	(scientific fact)

3.7.3.10 FILL IN THE BLANKS

Complete each present factual conditional sentence.

1. Water _____ (freeze) if you _____ (lower) its temperature below 0 degrees.
2. If I _____ (see) something on the floor, I ____ (return) it to the owner.
3. She ___ (go) on vacation every year if she ___ (get) a lot of money.
4. He ___ (run) in the park if the weather ____ (be) dry.

Use the future factual conditional to talk about what will happen in the future under certain conditions. Use the simple present tense in the "if" clause. Use the future with "will" or "be going to" in the result clause.

If I go to sleep too late tonight, I won't be able to get up on time.
If she comes home after 9:00, I'm not gong to make dinner.

Don't use a future form in the "if" clause.

If I see him, I'll tell him. NOT If I'll see him, I'll tell him.

3.7.3.11 WORD CHOICE

Choose the correct form to complete each future factual conditional sentence.

1. If they _____ (like/will like) the movie, they ____ (see/will see) it again.
2. I ____ ('m going to talk/talk) to her if she _____ (does/'s going to do) that again.
3. If you _____ (buy/ are going to buy) some eggs, I _____ (make/will make) you an omelette tonight.
4. If they _____ (see/will see) her tomorrow, they _____ (drive/'ll drive) her home.

Use the present unreal conditional to talk about unreal conditions and their results. Use the simple past tense in the "if" clause. For the verb "be", always use "were". Use "would" and a base form in the result clause.

If I had black shoes, I would wear them. (I don't have black shoes)
If I were a teacher, I would teach French. (I'm not a teacher)

Don't use "would" in the "if" clause.

If I knew his name, I would tell you.
NOT If I would know his name, I would tell you.

3.7.3.12 OPEN ANSWERS

Complete each present unreal conditional sentence. Use your "own" ideas.

1. My family would be angry if _____
2. If I didn't study English, _____
3. The English class would be better if _____
4. If I were child again, _____

3.7.3.13 FIGURATIVE CONDITIONAL

Ordinarily the construction ***would*** + verb implies the result of a condition that is not real or that is contrary to fact.

I would buy that car if it got better gas mileage.
(It does not get good mileage, so I will not buy it)

In science writing, in addition to the use in the example, this construction is used in a figurative sense. This often occurs when the writer states something that is theoretical, not literal.

A falling parachute would have a CD of about 1.3.

Notice that there is nothing unreal or contrary to fact about the example sentence. The author is implying that the statement is somewhat theoretical, but nonetheless true. The same author could have written the following sentence with no real change in meaning:

A falling parachute has a CD of about 1.3.

3.7.3.14 MULTIPLE CHOICE

Choose the correct lettered response to explain each numbered statement.

1. The CD of a 1.2- by 2.4 meter piece of plywood would be about 1.1.
    a. It has a CD of about 1.1.
    b. It does not always have a CD of about 1.1
2. Cars would get better gas mileage if aerodynamics specialists designed them.
    a. Aerodynamic specialists design cars.
    b. Aerodynamic specialists do not design cars.
3. The typical automobile would have four tires.
    a. The typical automobile has four tires
    b. The typical automobile has four tires only in certain circumstances.
4. If wind tunnels were big enough, they would be used to test full-size bridges.
    a. Wind tunnels are big enough to test full-size bridges.
    b. Wind tunnels are not big enough to test full-size bridges.
5. Turbulence would be an example of irregular air flow.
    a. Turbulence is not an example of irregular air flow
    b. Turbulence is an example of irregular air flow.
6. Two and two would equal four
    a. Two and two equal four.
    b. Two and two would equal four in certain circumstances.

3.7.4 SUBTECHNICAL VOCABULARY

3.7.4.1 VOCABULARY

Drag: resistance
Plywood: thin wood
Located: found
Consumer: buyer
Dams: collectors
Gutters: directors
Trim: decoration

Rear: back
Clay: formable substance
Trouble: problem
Collects: comes together
Slope: are placed diagonally
Mud flaps: mud protectors
Efficiency: effective use

Drastically: extremely
Tool: implement
Spots: places
Wedges: protectors
Altogether: entirely
Eliminate: stop using
Horsepower: a measure of the car's force.

Full-size (adjective): Standard-size; normally big.
Full-size cars use more gas than smaller cars.

Streamlined (adjective): Designed for speed and easy movement.
The new trucks are all **streamlined** and much faster than the older ones.

Retractable (adjective): Capable of being pulled in so that it can not be seen.
Many trailers have **retractable** axles.

Force (noun): Physical power, energy, strength.
Gravity is the **force** that holds us close to the earth

Resistance (noun): Opposition of one thing to another.
Windshields offer **resistance** to the wind.

Fuel (noun): Material that is burned to provide power or heat.
Wood, oil, coal, and gas are **fuels.**

Ratio (noun): Numerical relation between two related things.
The **ratio** of cars to trucks on this road is three to one.

Width (noun): Distance from one side to the other side of an object.
This automobile has a **width** of two meters.

Vacuum (noun): The empty space that occurs when all air is taken away; a completely
empty space.
When all the air is taken from a container a **vacuum** occurs.

Model (noun): A smaller representation of a full-size object.
Engineers make models of the cars they design.

To Check (verb): To look at; to investigate; to test; to measure.
The man **checked** the thermostat to see what the temperature was.

To install (verb): To put in a position for use.
An electrician **installs** new electrical wiring.

To overcome (verb): To win against.
Safety precautions help us to **overcome** accidents

To encounter (verb): To find.
We **encounter** new ideas whenever we fix a motorcycle.

To involve (verb): To require; to include.
Science involves the study of physics, chemistry, and biology.

To account for (phrasal verb): To explain; to cause.
Good care **accounts for** the smooth running of this engine.

To cut down on (phrasal verb): To reduce.
It is necessary **to cut down on** fuel in order to save money

In comparison (phrase): When measured against, when contrasted with.
A diesel engine is very hot **in comparison** to a gasoline one.

3.7.4.2 FILL IN THE BLANKS

Complete the following sentences with words from the list.

install reduces involves retractable resistance
radio indicate fuel streamlined

1. Many newer cars have_____ head lamps.
2. Cooking oil is not a good _____.
3. Using brakes_____ the speed of a car.
4. If one person in three can not read, the _____ of non-readers to readers is one two three.
5. The new mechanic promised to _____ lights on my van.
6. The results of the tune up _____ that coolant is beneficial.
7. Many bacteria have _____ to penicillin.
8. _____ cars use less fuel.
9. Driving _____ experience.

3.7.4.3 MULTIPLE CHOICE

Choose the correct lettered response to complete each numbered statement.

1. Frequent tune ups help us _____ engine overheating.
    a. account for
    b. overcome
2. Airplanes are _____ the forces of gravity.
    a. subject to

b. in comparison to

3. Those mechanics _____ a new use for a crankshaft.
    a. encountered
    b. accounted for
4. _____ auto-mechanics is easier than medicine.
    a. To overcome
    b. In comparison,
5. _____ expenses helps you save money.
    a. Cutting down on
    b. Involving
6. A tractor head has the _____ of hundred of horses
    a. fuel
    b. force

3.7.4.4 CROSSING OUT

Cross out the word that is wrong.

1. The distance from one side to the other side of the street is (length/width).
2. We look at the gas gauge (to reduce/ to check) the amount of fuel.
3. Toys are often (models/ vacuums) of larger objects.
4. A (full-size/ model) train can be examined at home.

3.7.4.5 READING COMPREHENSION

3.7.4.6 SKIMMING

Answer the following yes/no questions.

1. Does the reading selection have more than one paragraph?
_____
2. Does the chapter have one overall title?
_____
3. Are there footnotes at the end of the reading?
_____
4. Does the author use formulas?
_____
5. Is a bibliography included?
_____

3.7.4.7 TRUE OR FALSE STATEMENTS

Look at the reading again. Mark the following statements T if they are true or F if they are false.

1. _____ The article is about all kind of moving vehicles.
2. _____ The article covers the subject of aerodynamics in all its aspects.

3. _____ The concepts presented are too difficult or sophisticated for the average reader.
4. _____ You will learn something of value from the selection.

3.7.4.8 MULTIPLE CHOICE

Choose the correct lettered response to complete each numbered statement. Your answers should be based on the reading.

1. All moving objects _____
    c. overcome drag
    d. are subject to drag
    e. reduce drag
    f. are streamlined
2. One way to get good gas mileage is _____
    a. to increase wind resistance
    b. to design automobiles
    c. to reduce drag
    d. to measure air resistance
3. The science that involves the study of moving air is _____
    a. aerodynamics
    b. air resistance
    c. drag reduction
    d. engineering
4. Aerodynamics specialists measure air resistance _____
    a. in units indicating CD
    b. Vertically
    c. With watermelons
    d. To lower the flat plates
5. Of the following objects, __ has the lowest CD.
    a. an automobile
    b. 1.2- by 2.4- meter piece of plywood
    c. a falling parachute
    d. a flat plate
6. Engineers study the CD of cars by using _____
    e. flat plates
    f. bridges
    g. aerodynamic research
    h. wind tunnels
7. Wind tunnels are used to test _____
    a. spacecrafts
    b. bridges
    c. buildings
    d. all of the above
8. There are many exposed parts _____
    a. in the wind tunnels
    b. on the clay models

c. on the underside of the car
d. in the huge fans

9. Well-designed windshields _____
   a. reduce wind tunnels
   b. create a vacuum
   c. cut down on air flow under the car
   d. increase drag

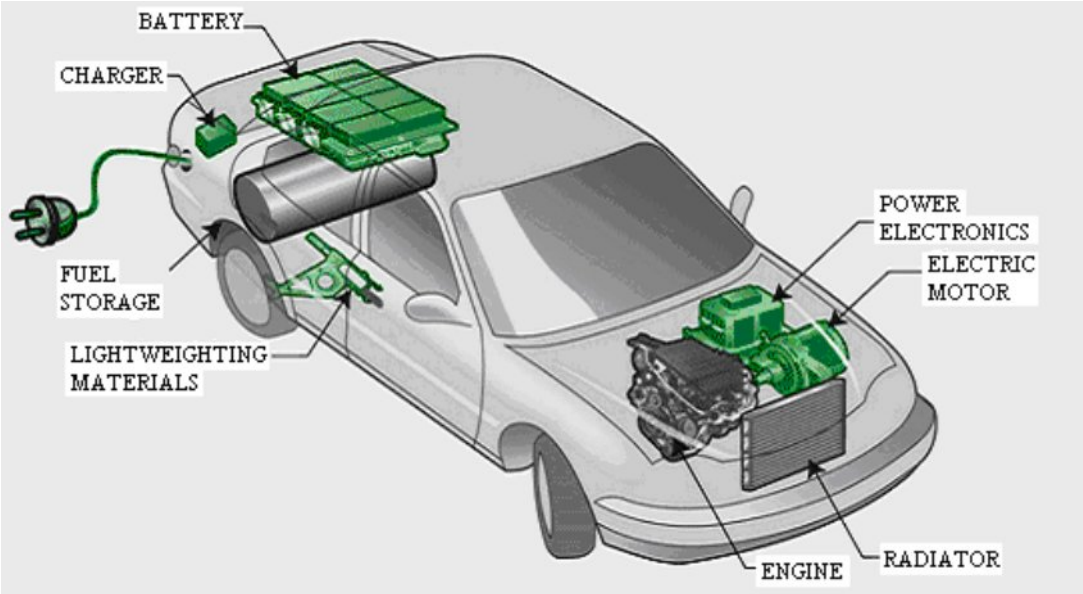
10. Some designers want to eliminate
   a. mud flaps, rain gutters, and air turbulence
   b. head lamps, smaller radiator grilles, and mud flaps
   c. mud flap, rain gutters, and side trim
   d. wedges, license plates, and side mirrors.

3.7.4.9 OPEN ANSWERS

Answer the following question either in English or in your own language about the chapter you just skimmed.

1. What is the general subject of the selection?
   _____
2. Does the author give the subject full coverage?
   _____
3. Could the general reader understand this chapter?
   _____
4. Do you think there is controversy, or disagreement, about the subject?
   ___

LESSON 5



3.8 POLYMERIC BATTERIES FOR ON-ROAD ELECTRIC VEHICLE DESIGN

The significant cost advantage in a fuel-short world, **coupled with** the potential for **materially** reducing air pollution, has led to renewed interest in electric car development. Even though trucks, vans, and **forklifts**, among other electrically powered off-road vehicles, have been available and in operation for some time, development of a commercially acceptable, **mass produced** electric passenger car **has not kept pace with** other technical developments in the auto industry. This is **in large measure** due to problems **inherent** in batteries as we now know them. It should be noted **at the outset** that electric cars are popularly regarded as anachronisms and museum pieces, **in spite of the fact that** at one time early in auto-motive history, they **outranked** gasoline-powered cars in widespread use. One day they may eventually recoup that position, and most drivers can expect to have driven an electric car before the century is up.

3.8.1 BATTERIES

Interest in the traditional lead-acid battery has in recent years **given way to** more innovative power sources, in large part because of the **marked** disadvantages of the lead-acid storage battery, which have been appreciated for some time. There is, in fact, no inherent reason why lead-acid batteries have to be used in electric vehicles. Some of the exciting new batteries include a zinc-nickel battery, a zinc-chloride battery, a sodium-sulfur battery, and a lithium battery. Inherent in some of these newer batteries, however, several of which are still in the experimental stage-are problems of exceptionally high heat production (particularly in the sodium-sulfur and the lithium types), size and weight, and the necessity of **guarding against** chlorine

gas **release** in the zinc-chloride battery. These batteries do, on the other hand, have the advantage of extremely high energy densities, ranging from 70 watt-hours per kilogram (which is double that of the lead-acid battery) to a **theoretical** 830-watt-hours-per-kilogram energy density. These high energy densities will enable electric cars to be driven much longer distances before needing a charge.

3.8.2 POLYMERIC BATTERIES

What may now be the first important step in the mass production of electric automobiles is the development of a conductive polymer battery made of a material that is structurally similar to plastic but which has a metallic appearance and the ability to conduct electricity as well as lead does. This new plastic battery delivers twice as much power as the ordinary car battery, weighs less than 5 kilograms, and is virtually **maintenance-free**. It has the capacity to be molded into any shape, enabling it to be placed anywhere in the car, including under the roof, behind the door panels, or even beneath the seat.

The conductive polymer battery is unlike the familiar lead-acid storage battery used in gasoline-powered automobiles. To review, the **latter** has two **electrodes** (one composed of lead [Pb], the other of lead dioxide [$Pb0_2$]) which are **immersed** in an electrolyte-in this case, a solution of **diluted** sulfuric acid (H_2S0_4). Electricity is produced from the chemical reaction of these materials. A current of electrons flows from the negative terminal (lead), passes through an external circuit, and returns to the positive terminal (lead dioxide). The reaction can be shown as $Pb0_2 + Pb + 2H_2S0_4$ -» $2PbS0_4 + 2H_20$. Simply stated, the chemical reaction of the battery creates an **abundant** supply of electrons at the negative terminal and a **scarcity** of electrons at the positive terminal. However, over a period of time, the materials in the battery are used up and the battery goes dead. The battery then has to be recharged by plugging it into a battery charger which is **subsequently** plugged into an electrical outlet. The battery charger forces electrons through the battery in the opposite direction, reversing the chemical action, which restores most of the metal in the battery to its original form. But every time a battery is recharged, it loses some of its ability to produce electric current, and in time will need to be replaced. Most engineers believe the lead-acid battery is too heavy, too costly, and too **short-lived** to play a major role in the development of electric vehicles.

Several types of conductive polymers are ready to be tested. One type is polyacelylene $(CH)_x$-(where x is sonic large but unknown number), a plastic made by linking acetylene molecules into long chains. Since polyacetylene is a natural insulator, it has no free electrons such as those in lead to move from atom to atom. The electrons in polyacetylene are all engaged in the bonding of atoms, leaving no free electrons to circulate about the molecule. To liberate the electrons, therefore, chemists dope the polyacetylene with chemicals such as iodine. Doping with iodine compound oxidizes the polyacetylene, **dislodging** an electron from one of its double bonds and causing it to attach itself to the iodine atom. Now the polymer becomes

positively charged where the electron used to be, and the iodine becomes negatively charged. One researcher has tested several battery cells, one of which includes a piece of polyacetylene as a positive electrode and lithium metal as a negative electrode, all immersed in an electrolyte solution. Other polymers to be tested include polypyrrole and polyphenylene. Engineers expect to have completed their basic research within the next few years.
Besides its capacity to be molded, the plastic battery has several other advantages. In the lab the plastic battery can go through the charge-discharge cycle hundreds of times without permanently changing the polymer or the electrolyte. The polymers they are made of are relatively inexpensive. In fact, the material is so adaptable that it is being studied as a potential component of photovoltaic cells, long-distance transmission lines, and storage batteries for power stations.

It is hoped that before long the product of this research will be a practical polymer conductive battery. Hurdles to overcome are the toxicity of dopants and the fact that many doped polymers lose their electrical characteristics upon exposure to air. It is widely accepted that the conductive polyacetylene must be kept in an **inert** atmosphere to prevent its immediate degradation. Polymer battery research is important enough to have been given **top priority** by engineers and designers. This is because many researchers agree that if energy per unit weight and volume is the key **criterion** in battery success, the conductive polymer battery may be an important first step in electric vehicle development.

3.8.3 GRAMMAR FRAME

3.8.3.1 GERUNDS AND INFINITIVES

Use a gerund (an “ing” form of a verb) after the following verbs: avoid, can’t stand, discuss, dislike, enjoy, feel like, (don’t) mind, practice, quit, suggest.

> He enjoys cooking.
> I suggest going to work.

Use an infinitive (“to” + the base form of a verb) after the following verbs: agree, be, sure, choose, decide, expect, hope, learn, need, plan, seem, want, wish, would like.

> We hope to learn Japanese.
> They want to study Chinese.

Use either a gerund or an infinitive after the following verbs: begin, continue, hate, like, love, prefer, start.

> She loves to drive a car.
> She loves driving a car.

You have to use some specific prepositions after adjectives and verbs.
Adjectives + prepositions: angry about, afraid of, excited about, happy about tired of, bored with.

I'm afraid of failing a test.
He is tired of studying every day.

Verbs + prepositions: complain about, talk about, worry about, apologize for, believe in, object to.

They believe in being honest.
We talk about reading a good book.

3.8.3.2 FILLING OUT A PARAGRAPH

Fill out the paragraph with the correct preposition.

Salomon is an extrovert. Like most extroverts, he's direct. And he's honest; he believes in telling (tell) the truth. At his job, he works with other people and he never complains _____ (work) long hours. He doesn't worry ____ (have to) work on weekends or holidays. He has a few fears, though. Most of all, he's afraid _____ (fly).

Complete each sentence with a gerund or an infinitive.

Let me tell you something about my father. He enjoys getting up (get up) early and_____ (run) in the park. He doesn't mind _____ (go), even when the weather is bad. In the mornings when he doesn't feel like _____ (exercise), he sleeps late. One day, would like _____ (join) him when he exercises.

I actually prefer _____ (go) to bed late, and I love _____ (read) until midnight. But now I plan _____ (stop) that habit. From tomorrow on, I want ____ (go) to sleep early, even though I hate _____ (do) that. We talked about it, and I agree _____ (change) my daily routine and _____ (go) running with him for one week.

3.8.3.3 DIRECT OBJECTS

The subject of a sentence performs the action of the verb, and a direct object receives the action of the verb.

(subject)	(verb)	(direct object)
A mechanic	repairs	cars.
They	drive	a nice van.

The direct object answers the question "What …..?"

What does a mechanic repair?	Cars
What do they drive?	A nice van.

3.8.3.4 UNDERLINING

Underline the subjects in the following sentences. Circle the direct objects.

1. They are visiting Mexico this week
2. Many people rent cars when they travel.
3. Ariel and Edgar never eat meat.
4. We can't enter school before ten o'clock.
5. Does she have the tickets?
6. Eva wants coffee with milk.

3.8.3.5 INDIRECT OBJECTS

When a sentence contains a direct object and prepositional phrase, you can use an indirect object to say the same thing.

	D.O	I.O.		I.O	D.O
He gives	a nice car	to Marina.	= He gives	Marina	a nice car.
She is mailing	letters	to Alberto.	= She is mailing	Alberto	letters
They buy	a book	for Carmen.	= They buy	Carmen	a book

The indirect object answers the question "To whom or for whom?"

D.O.	What does he give Marina?	A nice present.
I.O.	To whom?	To Marina.
D.O.	What do they buy?	A book.
I.O.	For whom?	For Carmen.

3.8.3.6 WORD ORDER

Rewrite each sentence as in the examples above.

1. She buys chairs for us. She buys us chairs_____
2. Esperanza sends a check to Tomas. _____
3. Once a week, we read stories to them. _____
4. They serve lunch to us in the kitchen. _____
5. They always give gifts to me. _____
6. He never gives me money.

_____

7. They give me a receipt. _____
8. I show him the phone message. _____

Add the direct or indirect object to each sentence. Don't add words.

1. They send it on Monday. (to me) _____
2. Do they give dinner on the tour. (you) _____
3. We always tell the truth. (her) _____
4. They make extra time. (for him) _____

3.8.3.7 THE PASSIVE VOICE

The active voice focuses on the "doer" of the action. Use the passive voice to focus on the "receiver" (object) of the action.

(active voice)	(passive voice)
Eva (doer) drinks milk (receiver).	Milk is drunk by Eva.

Many sentences can be written in both, active or passive voice. Form the passive voice with a form of "be" and the past participle of the verb.

	Active voice	Passive voice
Present tense	Rene buys trucks.	Trucks **are bought** by Rene.
Present continuous	Rene is buying a house.	A house is **being bought** by Rene.
Past tense	Rene bought a nice truck.	A nice truck **was bough**t by Rene.
Past continuous	Rene was buying bolts.	Bolts were **being bough**t by Rene.
Present perfect	Rene has bought screws.	Screws have **been bough**t by Rene.
Future with "will"	Rene will buy a clutch.	A clutch will **be bought** by Rene.
Future "be going to"	Ana is going to buy nuts.	Nuts are going to **be bought** by Ana.
Modal "can"	Rene can buy spanners.	Spanners can **be bought** by Rene.

Use the passive voice when the person or thing doing the action is not known or not important.

This car was made in Japan.
Screwdrivers are sold today.

Use the "by" phrase in passive voice sentences when it is important to know who is performing an action.

The Mona Lisa was painted by Leonardo da Vinchi.	(important)
Toyotas are made (by someone) in Japan.	(not important)

Intransitive verbs don't have objects. With intransitive verbs, there is no "receiver" of an action. For that reason, intransitive verbs are not used in the passive voice. Some common intransitive verbs are: die, seem, happen, stand, rain, come, sleep, go, arrive, live, fall, sit, laugh, stay, walk.

Luis arrives next week.
They came to the party.

3.8.3.8 WORD ORDER

Change the following sentences from active to the passive voice.

1. Leonardo da Vinci made this drawing.

   _____

2. Van Gogh painted The Starry Night in 1889.
   _____
3. Federico Fellini directed the film La Strada in 1954.
   _____
4. Pedro Almodovar is directing a new film.
   _____

3.8.3.9 VERB TENSES REVIEW

The simple (present active) infinitive, formed with to plus the simple form of the verb, is used in a variety of ways.

Review some common uses of the infinitive.

She wants **to identify** the cancer-inhibiting factor in shark blood.
There is nothing **to say**.
Is there something for me **to do**?
The goal of this program is **to reduce** air pollution.
Hypertension is too serious **to neglect**.
Amaranth is not yet predictable enough **to grow** commercially.

Some other uses of the infinitive can interfere with comprehension unless you are familiar with them. The passive infinitive, the perfect infinitive, and the perfect-passive infinitive are used often in scientific and technical writing because of the prevalence of reporting impersonally about recent developments. Sometimes the difficulty in under-standing these uses of the infinitive is caused by the fact that they are made up of so many separate parts. At other times the problem may be the fact that the performer of the action is unclear. Whatever the reason, focusing attention on these uses of the infinitive should help you become familiar with them.

Passive present infinitive

He didn't want **to be exposed** to radiation.

Perfect infinitive

The tremors appear **to have ended**.

Perfect-passive infinitive

It would have been impossible for sunspots **to have been discovered** until the invention of the telescope.

3.8.3.10 MULTIPLE CHOICE

Passive Infinitives, Perfect Infinitives, Perfect-Passive Infinitives
Demonstrate your understanding of the italicized infinitive forms. Choose the lettered response closer in meaning to each numbered statement taken from the reading.

1. Most drivers can expect to have driven an electric car before the century is up.

a. An electric car driven before the end of the century is most drivers' expectation.

b. Before the end of the century, electric cars will be in widespread use.

2. There is, in fact, no reason why lead-acid batteries have to be used in electric vehicles.

a. Use of the lead-acid battery is not a necessity in electric vehicles.

b. We don't have lead-acid batteries to be used in electric vehicles.

3. These high energy densities will enable electric cars to be driven much longer distances before needing a charge.

a. Before being driven, they will enable the high energy densities to be powered at no charge.

b. Electric cars using batteries with high energy densities will drive longer distances between charges.

4. It has the capacity to be molded into any shape, enabling it to be placed anywhere in the car, including under the roof, behind the door panels, or even beneath the seat.

a. Anywhere in the car can be molded.

b. Its capacity to be molded makes it possible for it to be placed anywhere in the car.

5. The battery then has to be recharged by plugging it into a battery charger which subsequently is plugged into an electrical outlet.

a. The electrical outlet is subsequently recharged by the battery plugged into the battery charger.

b. First the battery is plugged into a battery charger, then the charger is plugged into an electrical outlet.

7. But every time a battery is recharged, it loses some of its ability to produce electric current, and in time will need to be replaced.

a. The frequently recharged battery will wear out, and we will have to replace it.

b. Every time a battery is replaced, it loses some of its electric-current producing ability.

8. Several types of conductive polymers are ready to be tested.

a. Several types of conductive polymers have already been tested.

b. Testing is ready to begin on several types of conductive polymers.

9. Engineers expect to have completed their basic research within the next few years.

a. After having completed their basic research, engineers are expected within the next few years.

b. Within the next few years, the basic research will be completed.

10. Polymer battery research is important enough to have been given top priority by engineers and designers.

a. Engineers and designers have been given top priority in polymer battery research.
b. Engineers and designers consider polymer battery research to be extremely important.

3.8.4 SUBTECHNICAL VOCABULARY

3.8.4.1 VOCABULARY

Forklifts: Factory machines for lifting heavy objects.
Release: Emission.
Latter: Last one mentioned, lead-acid battery.
Diluted: Made weaker, usually by adding water.
Subsequently: next; later.
Top priority: The most important place

Mass produced (adjective): Manufactured in large numbers.
The assembly line is the most widely used method in the manufacture of **mass produced** items.

Marked (adjective): Significant; considerable; clearly defined.
Acid rain has had a **marked** effect on the aquatic ecosystem.

Theoretical (adjective): Lacking verification; based on speculation; unproved
The idea that sunspots have determined major world events is largely **theoretical.**

Abundant (adjective): Numerous; plentiful; more than sufficient
It is hoped that photovoltaic cells will provide an **abundant** supply of energy in the near future.

Inherent (adjective): Involved in the essential nature of something.
Many problems are **inherent** in deep-sea diving.

Short-lived (adjective): Of little duration; transient.
Sunspots are relatively **short-lived** phenomena; most last only a day.

Inert (adjective): Chemically or physically unreactive; exhibiting no chemical activity.
Adding an **inert** substance does not affect the outcome of most chemical experiments.

Electrode (noun): Collector or emitter of an electric charge; a device through which an electric current enters or leaves a medium.
Batteries have positive and negative **electrodes**.

Circuit (noun): Pathway through which electric current travels.

Circuits are sometimes connected directly to a battery or other power source.

Scarcity (noun): Relative lack; insufficient amount.

There is a **scarcity** of natural resources in many areas of the world.

Criterion (noun): Test on which a decision can be based or a judgment may be formed.

The main **criteria** in determining the economic success of amaranth as a food crop are its hardiness and the predictability of its harvest time.

To outrank (verb): To surpass in status or ability.

The earthquake that occurred here last year **outranks** all others in the century in the amount of damage it caused.

To guard against (phrasal verb): To work to prevent.

Treating hypertension is one way **to guard against** strokes and coronary artery disease.

To immerse (verb): To put under water; to cover with a liquid; to submerge.

Certain metals can be cleaned by **immersing** them in acid.

To dislodge (verb): To remove from a previous attachment

The one-person submersibles are dexterous, yet they are strong enough **to dislodge** samples of mineral deposits on the ocean floor.

Materially (adverb): Substantially; considerably; to a significant degree

The course of aquatic fish evolution could be **materially** altered by the acid rain problem.

To keep pace with (phrasal verb): To keep up with; to compete with successfully; to remain at the same level.

The development of alternative energy technology **has not kept pace with** the growing scarcity of fossil fuels.

To give way to (phrasal verb): To permit the other to win; to lose by choice or by passivity.

In recent years traditional eye surgery for retina reattachment **has given way** to laser repair of this disorder.

Coupled with: In addition to; joined with.

High salt consumption **coupled with** untreated hypertension can lead to very serious consequences.

In large measure (in large part) (expression): Mainly; principally; largely; chiefly.

Many doctors believe that arterial plaque build up is **in large part (in large measure**) due to a diet high in saturated fats coupled with a genetic predisposition to atherosclerosis.

At the outset: At the beginning.

This professor admitted **at the outset** that even though he believed there was a cancer inhibiting factor in shark blood, he didn't know if it would ever be identified.

In spite of the fact that: Even though.

In spite of the fact that we know what causes acid rain, we have done almost nothing to prevent it.

Free (compound adjective-forming suffix): Without

In many respects, robots are more trouble **free** than human workers.

3.8.4.2 TRUE OR FALSE

Mark the following statements T if they use the italicized word or expression correctly, or F if they use it incorrectly.

___ 1. If you keep pace with other members of your class, you are a markedly better student than the others.
___ 2. Eating a varied diet helps guard against nutritional deficiencies.
___ 3. Objects in an art museum usually have been mass produced.
___ 4. An electrode is a collector of electric current.
___ 5. A scarcity is more than what is needed.
___ 6. A short-lived phenomenon has a considerable life span.
___ 7. A criterion is one factor used in a test or in helping form a judgment.
___ 8. An inert substance is very chemically reactive.
___ 9. The etiology of essential hypertension is in large part poorly understood.
10. A car that is maintenance-free is a gift from the mechanic.

3.8.4.3 MULTIPLE CHOICE

Choose the correct lettered response to complete each numbered statement.

1. When you put something in a liquid you _____it.

a. dislodge b. immerse c. guard against d. keep pace with

2. Amaranth is a (n) _____weed that needs hybridization in order to be exploited as a food crop.

a. marked b. inherent c. abundant d. inert

3. It seems that the invasive diagnostic procedures are_____ the new scanners.

a. giving way to
b. keeping pace with
c. guarding against
d. in large measure

4. Electricity travels along a (an) _____
a. criterion b. scarcity c. electrode d. circuit

5. There is a _____ _difference between electric trains and the maglev.
a. marked b. short-lived c. dislodged d. mass-produced

6. Although many scientists believe arterial plaque build up is largely caused by diet, this link is still _____.
a. theoretical b. short-lived c. marked d. inherent

7. Dizziness_____ headache is a major symptom of the bends.
a. given way to b. abundant c. guarded against d. coupled with

8. Untreated hypertension can _____shorten life.
a. at the outset
b. materially
c. theoretically
d. in spite of the fact

9. Currently, gasoline-powered cars greatly_____ electric cars in number.
a. outrank b. keep pace with c. guard against d. immerse

10._____sharks are not all ferocious, most people think they are.
a. Inert
b. Mass-produced
c. Short-lived
d. In spite of the fact that

11. It is difficult to _____a piece of steel from a magnet.
a. keep pace with b. guard against c. dislodge d. immerse

12. _____ hypertension has no symptoms; but later it becomes apparent from a whole group of complications.
a. In spite of the fact that
b. At the outset
c. Theoretical
d. Inert

13.____in any X-ray diagnosis is the danger of excessive radiation exposure.
a. Inherent b. Theoretical c. Dislodged d. Immersed

3.8.4.4 READING COMPREHENSION

Insert one word taken from the reading in each of the following statements.

1. Two factors have contributed to the current renewed interest in _____ vehicles.
2. These two factors are air _____reduction and fuel economy.
3. Some trucks, vans, and forklifts are non-gasoline-powered _____ road vehicles.

4. There has not been as much progress in electric passenger car development as there has been in the _____industry as a whole.
5. _____ have many inherent problems which probably have been the cause of the relatively low level of interest in electric car development.
6. Even though electric cars were once in widespread use, they are now _____by gasoline-powered cars.
7. Before the end of this ____, electric cars will be far more prevalent than they are today.
8. Most people think electric cars can only be seen in a _____
9. There has been less _____in lead-acid batteries recently.
10. We have known about the _____of traditional car batteries for some time.
11. Some of the newer batteries, on the other hand, have _____ of their own.
12. Some of these experimental batteries generate too much _____
13. The zinc-chloride battery may emit _____gas into the air.
14. As in the lead-acid battery, _____and large size need to be overcome.
15. One of the good things about the newer batteries is their high energy _____
16. Energy density is measured in watt-_____per kilogram.
17. Because their energy densities are so high, it is possible to drive long _____ without recharging them.
18. The most exciting of the experimental batteries is the _____polymer battery.
19. The material used in this battery looks _____but is structurally like plastic.
20. The polymer battery delivers double the _____ of the lead-acid battery.
21. This new battery requires almost no _____.
22. Its "moldability" gives designers the option of installing it _____
23. The _____in the lead-acid battery are immersed in diluted sulfuric acid.
24. The chemical reaction within the battery produces _____.
25. The electrons flow from the _____ terminal to the lead dioxide terminal.
26. After a while the battery wears down and goes _____.
27. A battery charger reverses the _____ flow, restoring the metal to its original form.
28. Three of the problems inherent in the lead-acid battery are weight, cost, and duration of use, making it impractical for use in

_____ cars.

29. Three polymers undergoing experimentation are polyacetylene, _____, and polyphenylene.
30. Polyacetylene's electrons, unlike those in lead, do not move from atom to atom, but rather are engaged in the _____process.
31. The doping causes _____of the electrons.
32. This is done by separating an _____from its bond.
33. Soon the research will probably be _____
34. _____are poisonous.
35. Unless polyacetylene is kept in an _____ atmosphere, it breaks down.
36. The key criterion in battery success is _____ _per unit weight.

3.8.4.5 WORD CHOICE

Choose the correct lettered response to explain each numbered word or expression.

1. Regarded as	a. considered to be	b. looked at carefully
2. Anachronisms	a. very new items b. Items out of their proper time	
3. Recoup	a. recover or regain	b. lose
4. Charge	a. renewal	b. change
5. Delivers	a. needs	b. provides
6. Molded	a. shaped	b. deteriorated
7. Plugging into	a. striking	b. connecting to
8. Restores	a. buys	b. replaces
9. Insulator	a. something that does not permit passage of electricity b. electrolyte	
10. Practical	a. prototype	b. feasible

UNIT 4

4.1 CONCLUSIONS AND RECOMMENDATIONS

Language learning strategies are a valuable addition to the challenging tasks of learning and teaching a second language. Students can benefit from this material and strategies developed in this project, but it can not be assumed that merely presenting them as lists will make them a permanent part of successful learning. Instructors need to help students see how they can develop and transfer such knowledge into "rules for action", that is, into successful procedures for undertaking a specific task. Metacognitive strategy training fulfils this objective by helping learners incorporate the strategies in a meaningful way that transforms students' declarative knowledge of reading strategies into procedural knowledge. This is especially important for ESP courses because reading efficiently is a critical skill that is directly related to many students' career paths. Although this text of strategy training was for reading comprehension, practitioners will find the all the units applicable to the writing skill.

This project has made use of a wide-angle approach to course design, relying as heavily as possible on existing linguistic research and commercially available didactic materials of ESP. Another characteristic of equal importance has been the attempt to match and reconcile the older with the newer methods of ESP teaching.

Though in general there is reason to be al least moderately satisfied with the general results obtained so far, it is equally true that still much remains to be done. Areas of priority attention haven't been touched because of time factor. It is hoped that by approaching new automobile systems, new grammar frames and vocabulary have to be introduced for a better understanding of auto-mechanics. I strongly recommend instructors follow the same approach to introduce new material. Since I have taught technical English for about ten years, I'm sure students learn well when properly presented meaningful material.

UNIVERSITAS MAJOR PACENSIS DIVI ANDREÆ