AN HISTORICAL STUDY OF THE DEVELOPMENT
OF A COMMUNICATIVE APPROACH TO ENGLISH LANGUAGE TEACHING
IN POST-REVOLUTIONARY CUBA

Volume II

Appendices B - E

Adrienne Hunter

PhD Thesis
University of Edinburgh
1988
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APPENDIX B

DOCUMENTS RELATED TO PHASE II (1975-1977)
A. Programme

Thursday, 17 March
Arrive from Toronto

Friday, 18 March
Discussions with Adrienne Hunter, CUSO Technical Advisor.

Saturday, 19 March
Lecture at CENIC (National Scientific Research Centre) on 'New directions in English language teaching'. Lecture and discussion attended by 90 English language teachers from various institutes of research and higher education. Lunch with postgraduate English teachers from CUJAE (Faculty of Engineering).

Sunday, 20 March
Talk and discussion on ELT methodology with 21 teachers from CENIC, CUJAE, Faculty of Medicine, Pedagogical Institute, Ministry of Public Health and Institute of Fisheries. Lunch with participants.

Monday, 21 March
Free day.

Tuesday, 22 March
Visit to Faculty of Medicine. Workshop session with Marjorie Moore, Head of English Department, and staff. Lunch at CENIC. Workshop session at CENIC with Madeline Touza, Head of English Department, and staff. Discussion with Ana Maria Hermosilla, Head of French Department at CENIC.

Wednesday, 23 March
Visit to CUJAE. Policy meeting with Professor Alarcon, Professor Ochoa, Mr. Lo Kim (Head of Language Department) and Professor Delgado. Lunch with Mr. Lo Kim and postgraduate English teachers (CUJAE). Workshop session with Mr. Lo Kim and postgraduate English teachers (CUJAE).

Thursday, 24 March
Final round-up discussion with Adrienne Hunter. Depart for Toronto.
B. General Comments

The purpose of the visit was to inspect the teaching of English to students of science and technology at a representative selection of University level institutions in Havana, and to advise on the development of specialised syllabuses and materials. The following notes are based on my visits to CENIC, CUJAE and the Faculty of Medicine.

(Throughout this report, ELT = English language teaching; EST = English for science and technology.)

English is taught to 1500 students in the undergraduate programme at the Faculty of Medicine, and to 2000 students in the undergraduate programme at CUJAE. Both these institutes have, in addition, a smaller postgraduate programme in ELT. The postgraduate English classes at CENIC draw students from a variety of academic backgrounds.

On their arrival at University the students have some knowledge of general English deriving from their secondary school training, but they still need to develop the ability to use English as a tool in pursuit of their specialist studies. In addition, their knowledge of general English may be defective, so there is a need for a remedial course which should be designed in such a way that it reveals the relevance of English to the study of such specialisations as medicine or physical science. The three University-level ELT programmes which I visited aim to help the student to attain the highest possible level of proficiency in reading comprehension, aural comprehension, speaking and writing, with the emphasis on the first two abilities. The purpose of these programmes is to provide students with the ability to handle written English materials in their research, and to communicate orally with English-speaking colleagues when travelling abroad.

Since there is no ELT textbook available which meets all the needs of Cuban students of science and technology, teachers in Havana are in the process of developing their own syllabuses, partly by writing their own materials, and partly by utilising extracts from a variety of published sources. Such syllabuses are necessarily of an improvised nature, and the need to write materials as well as carrying out normal classroom duties places a heavy strain on the teaching staff. Some members of staff have been very active in producing experimental teaching materials; this is particularly the case at the Faculty of Medicine and at CUJAE. Books in use at CUJAE include English on the Tip of Your Tongue (Hunter and Kainola) published by CUSO and Technical English, written by a team of Cuban teachers led by Mercedes Zorzano, Cesar Alazabal and Jose Lo Kim.
The teaching techniques being used are interesting and varied, and include selected pattern practice, note-taking and the comprehension of ideas expressed in lectures, the preparation and presentation of oral dissertations, reading comprehension practice and written composition. Although some of the materials reflect the continuing influence of formal structural techniques of grading and behaviourist habit-formation theories of learning, there is a general awareness among the teachers that teaching English to students of science and technology requires the development of new types of exercises based on the characteristic communicative properties of technical and scientific discourse.

C. An EST syllabus for Cuba

There is clearly a growing need in Cuba for specialised syllabuses and materials for the teaching of English to students of science and technology at the tertiary level of education. The immediate need is for a one-year course at immediate post-secondary level which will serve both to rectify the student's defective knowledge of basic English, where necessary, and to provide a transition to technical English in the later stages. Eventually this one-year course might be expanded into an integrated two or three-year programme for use in those institutions which continue the period of formal English instruction up to and including the postgraduate level. In the early stages, such a syllabus should not make too many assumptions about the amount of English already known; however, in order to retain the interest of students it is important that the lesson material should be as varied and interesting as possible, and that the language used should be directly relevant to the student's specific communicative needs.

On the basis of current research into techniques of teaching English to students of science and technology, I believe that an ESP syllabus for Cuba should have the following general characteristics:

1. The syllabus should emphasise the communicative rather than the grammatical properties of language. Part of the task in a remedial syllabus is to rectify the student's defective knowledge of English grammar, but at this stage a formal knowledge of grammar is not an end in itself. Rather, the aim should be to show the student how his formal grammatical knowledge can be put to use in performing various acts of communication appropriate to his particular field of study. A student of engineering, for example, should be made aware of the various ways in which English is used to explain, to classify, to express cause and effect relationships, or to write a description, a report or a set of instructions.
far as possible, all the exercises should be directed
towards the meaningful use of language in a vocational
context; the manipulation of grammatical patterns 'in
vacuo' should be avoided. In this way we can revise the
basic grammar, and at the same time give it practical
point. Moreover, by studying the communicative context
it is possible to devise a wide range of useful and
interesting exercises which are outside the scope of
conventional, inward-looking English courses. In addition
the student's interest is maintained because he can readily
appreciate the relationship which is established between
the English class and what goes on in the engineering
workshop or science laboratory.

2. In the early stages, at the point where we are effecting a
transition between the elementary secondary school syllabus
and the advanced EST materials, appropriate attention should
be paid to the four skills of reading, writing, speaking and
understanding speech. In situations where English is to be
used mainly as a research language, i.e. as a tool for
facilitating the student's studies in his specialist field,
the emphasis of the English syllabus should pass fairly
quickly to reading comprehension, backed up by writing
practice as a related skill. However, there will be some
specialist subjects, such as clinical medicine, where a
strong emphasis on oral communication must be retained
throughout the course. An important requirement is to develop
a wider variety of reading comprehension questions. In
addition to simple comprehension questions which serve to
check the propositional content of isolated sentences, we
need exercises which draw the reader's attention to the way
a piece of language is interpreted as continuous discourse.
A number of exercises of this type can be found in the volumes
of the 'English in Focus' EST series published by Oxford
University Press.

3. In teaching English to students of science or engineering
we want to concentrate primarily not on the subject-matter,
but on the ways in which
language and subject-matter interrelate. We want to show the
student how the subject-matter is given linguistic expression,
how the language is used to express various scientific facts
and processes. Essentially, then, the aim is interdisciplinary;
we want to bring the teaching of English into the closest
possible contact with what goes on in the science classroom or
laboratory. One way of promoting this relationship is to
exploit the wide range of non-verbal devices - maps, charts,
tables, graphs, line-drawings and conventional diagrams - that
the student constantly makes use of in his technical work.

The close relationship which exists in many scientific
texts between verbal and non-verbal ways of conveying the same
message can be utilised in the form of 'information transfer'
exercises. Such exercises require students to transfer in-
formation from one mode into another. For example, if we ask

* for doctors who go to work in other Third World countries where the
language of communication is English.
the student to read a short passage describing an instrument or a machine and then get him to complete or label a diagram with reference to the information in the passage, we have an exercise in comprehension. If we ask him to convey in words the information contained in a graph or diagram, we have an exercise in composition. Such exercises, which are capable of being developed to a high level of sophistication, can act as a natural link not only between the science class and the English class, but between receptive and productive abilities in handling language.

4. In an EST course specifically designed for Spanish-speaking students, there will be a natural role for English-Spanish translation. The type of translation exercise I propose is quite different from the literary translation which was often met with in the days of the grammar-translation method. Literary translation is an immensely difficult task for the simple reason that the meaning of a literary passage tends to be highly ambiguous and elusive. This is not normally the case when we are dealing with a passage of scientific writing. Typically, a scientific writer aims to convey a meaning which is completely clear and unambiguous. Moreover, the basic cognitive processes of science can be thought of as universals which are often realised in the form of non-verbal devices such as scientific formulae, graphs and diagrams of various kinds. In other words, given a clear and unambiguous scientific meaning, we have a point of reference for verbal realisation in the student's own language and in English. This makes the task of translation much more concrete and controllable than it is in the case of a literary passage, and enables us to incorporate useful translation exercises into EST teaching even at a fairly elementary level.

5. Although the general approach will emphasise the communicative rather than the formal properties of language, some attention must be given to revising the basic grammar. However, this must be done in a manner appropriate to the type of students we have in mind. It will not serve the needs of sophisticated, adult students if we simply repeat the structurally-based, linearly-graded exercises of the elementary English course. We must ensure that pattern practice does not become an end in itself, but that it is subordinated to the over-all aims of the syllabus, which is concerned with learning to communicate rather than acquiring more and more facility in practising formal grammatical patterns out of context. It follows that, in our EST syllabus, we should group the patterns, not according to their formal structural properties, but according to the way in which they are to be used, for example, in writing a report of an experiment, or in performing such communicative acts as defining, classifying, summarising or hypothesising. Rather than attempt to revise the whole of the grammar in the EST syllabus, we should concentrate on those points, such as locative and
time expressions, if and because clauses and impersonal passives, which have a high frequency of occurrence and a clearly identifiable use in scientific writing. Furthermore, we should pay close attention to those points of grammar which are peculiar to scientific writing and which are not likely to be dealt with in a general English syllabus. Examples are the use of unattached participles, which are often considered a fault of style but which are an accepted convention in scientific contexts, systematic variation in the use of attributive past participles (the emitted light, the curve shown), and phrases like in a given experiment, at a given temperature, where 'a given', used for exemplification or generalisation, can be regarded as an extra determiner which occurs only in scientific registers. All this serves to emphasise the fact that the construction of an EST syllabus is a specialised task which has to be performed with great care. The job cannot be done simply by adapting a general course which was originally designed for an entirely different purpose.

6. In devising an EST syllabus for use with adult students we should take a broadly cognitive view of language learning, and select our materials accordingly. The various types of situational and audiolingual methods, with their emphasis on acquiring correct pronunciation and automatic patterns of agreement, give good results at the elementary level but quickly become tedious and counter-productive if prolonged for months or even years without modification. Teaching methods which were originally designed to promote oral fluency in simple conversational exchanges bear little relation to the needs of students who are concentrating on acquiring the skills necessary for reading advanced scientific texts. Adult students (particularly, one might suppose, adult science students) tend to demand rational explanations for what they are doing, and there is no point in denying them this useful aid to efficient learning, so long as the points can be expressed simply and clearly, and we do not spend too much time on theoretical exposition. In writing an English course for students of science and technology, then, we will look for opportunities to control the learning process by simple explanations in English or Spanish. These would be given at suitable points in the learning sequence and formulated in a manner appropriate to the learner's level of linguistic sophistication. The aim would not be to 'talk about grammar' for its own sake, but to ensure that the student understands the underlying concepts that govern grammatical choices. As a further aid to efficient learning, a simple grammatical terminology should be provided so that the teacher can deal quickly with students' questions. Furthermore, the textbook should contain a synopsis of the semantico-grammatical systems being taught, so that the student can 'fix' what he happens to be learning at any particular time, and relate it to the main points of the syllabus as a whole.
Some provision for in-service teacher training should be built into any proposal to create a new EST syllabus for Cuba. It would be as well to admit that in setting out to devise EST materials which are relevant to the student's needs, we are making extra demands on the English teacher. This seems unavoidable; it is related to the fact that language teaching at an advanced level is qualitatively different from teaching at an elementary level. It does not simply require more and more of the same elementary teaching material; it requires materials and techniques which are specifically designed for the advanced student. However, a teacher who is already proficient in general English should not find it too difficult to acquire enough knowledge of scientific English to function effectively as a teacher of EST. Again it would be as well to admit that we may be faced with a considerable task of changing teachers' attitudes; but I believe that it is mainly a matter of changing attitudes, rather than making an entirely new set of inherently difficult demands. It might help to remind ourselves that at this level the teacher is not being asked primarily to teach the language system, which the students are assumed to know already, though their knowledge may well be imperfect. Nor is he being asked to teach the entire discipline of, say, chemistry or engineering. What he is being asked to do is to explore the ways in which English is used to express certain concepts and reasoning processes which are fundamental to the study of a particular science. We can go a long way to help the teacher by providing a good key, a guide to the pronunciation of difficult words, and reading passages which are as far as possible self-explanatory. If further factual knowledge about the discipline is required, it is, I hope, not too idealistic to suggest that the students themselves should be expected to provide this. In other words, our aim should be to make an EST class at University level a co-operative enterprise in which we combine the specialised scientific knowledge of the students with the specialised linguistic knowledge of the teacher.

D. Recommendations

1. Materials development

(a) My visits to CUJAE, CENIC and the Faculty of Medicine made it clear to me that many teachers at these centres have recognised the need to develop specialised EST materials, and that the types of material needed are very similar in all three cases. A number of writers are already producing materials, largely on an ad hoc basis. In the present situation there is a serious danger of a great deal of un-co-ordinated work being done, with considerable duplication of effort. This would not be too serious if a good EST course eventually materialised. However, it should be recognised that an enormous amount of work is involved in developing
and testing material of this kind, and if the writers are spread across a number of different institutions, it is only too likely that much of this work might be done in a fragmentary way with little to show for it in the end. I would, then, argue strongly for some centralisation of the effort.

(b) There is a strong case for establishing an EST Research and Development Unit at a relatively high level in Havana, which could design materials and feed them into the various institutions for testing and modification to meet specific needs. Such a unit should be set up on at least a three-year basis, and should be provided with a director and staff who are experienced teachers but who can be released from their regular duties so that they have time to concentrate on materials development. The work of such a unit would include making a survey of EST needs in Cuba, reviewing the development of EST research in other countries, developing an integrated series of EST teaching materials, testing the materials in various institutions in Havana, and supervising the publication of EST textbooks for Cuba.

(c) It should also be the responsibility of the R & D Unit to establish a local forum for discussion. This might take the form of a study group, meeting at regular intervals, and including representatives from all the institutions in Havana currently engaged in EST teaching or research. It should also be the aim of the R & D Unit to establish a reference library of EST materials, both published and unpublished. Priority would be given to locally produced materials, or to materials which are particularly relevant to local needs.

(d) I have emphasised the need to establish a single co-ordinated effort in the field of EST materials production in Havana. However, the principle of centralisation applies more widely. Those institutions in Havana which are concerned with teaching English for science and technology have similar needs; such institutions in Cuba as a whole, or in Spanish-speaking Latin America as a whole, also have similar needs. Indeed, while developing EST materials in Edinburgh it has been brought home to us very strongly that there are technical institutes and universities in many parts of the world where there is a need for a one or two-year course in English for students of science and technology, and in all these cases the type of course required is much the same. It would appear, then, that whereas a centralised textbook writing project in Havana would be producing materials for use in Cuban institutes of higher education in the first instance, there would eventually be scope for adapting these materials for use in other Spanish-speaking countries, thus providing educational leadership on an international scale.
2. Teacher training

Because teaching English to students of science and technology at the University level involves highly specialised skills and a wide range of background knowledge in psychology, linguistics, sociolinguistics and methodology, it will be necessary to provide specific vocational training for teachers working at this level. A long-term goal might be to establish a Centre for Applied Linguistics in Havana, where language teachers could receive appropriate training. In the short term, it should be possible to provide an annual in-service training course for language teachers at University level, which could be run partly by local staff and partly by specialists brought in from overseas.

3. Contacts with overseas Universities.

Any textbook writing or teacher training project in Cuba concerned with EST should establish the closest possible links with the international community of research workers, preferably by establishing a 'special relationship' with an appropriate University Department in Canada or Britain. A precedent for such a relationship can be found in the 'plan for collaboration' which currently links the National University Language Centre in Mexico City with the Department of Linguistics at Edinburgh University. Other University Departments in Britain which would be suitable for association with a Cuban EST Project include the centres for applied language studies at Birmingham, Lancaster and Reading, and the University of London Institute of Education. Canadian institutions which would be qualified to fulfil such a role include the Modern Language Centre at the Ontario Institute for Studies in Education, Toronto, and the TESL Centre at Concordia University, Montreal.

The purpose of establishing a link between the proposed Cuban English Studies Project (CESP) and an Associated Overseas University (AOU) would be to establish a two-way relationship as follows:

(a) The training of CESP staff, or teachers selected by CESP, for a formal qualification in education or applied linguistics, specialising in the teaching of English as a foreign language, at AOU.

(b) The establishment of a Cuba-related EST research and development project at AOU, which would provide scope for sub-contracting appropriate parts of the materials development being done at CESP. This would have to be done in the context of an overall programme of research, and on terms acceptable to both institutions. However, given a suitable degree of advanced planning, there should be considerable opportunity here for fruitful co-operation.
(c) Short consultative visits by AOU staff to CESP, and by CESP staff to AOU.

(d) The secondment of an EST specialist to help with in-service teacher training and to assist in the development of an EST course.

(e) An important advantage in setting up a link with an overseas University Department specialising in English language teaching research would be to obtain access to the network of relationships which already links British and Canadian Universities, both to one another, and to numerous EST development projects around the world.

E. Acknowledgements

I would like to conclude by expressing my thanks to CIDA for sponsoring my visit, and to all those people who gave freely of their time and hospitality while I was in Cuba. I would particularly like to thank the English language teaching staffs at CUJAE, CENIC and the Faculty of Medicine for their interest and help. I feel particularly indebted to Adrienne Hunter for initiating and organising the programme. Without the enthusiastic help of all these friends my leisure time would have been considerably less enjoyable and my work considerably less effective.

[Signature]

22 April 1977.
From: Adrienne Hunter  
Canadian Technical Advisor in English at ISPJAE

To: Ambassador James Hyndman  
Canadian Embassy, Havana, Cuba

cc: CUSO  
ISPJAE (Higher Polytechnic Institute José Antonio Echeverría)  
Dr. Patrick Allen

Re: Report on Dr. J.P.B. Allen's Visit to Cuba, March 17-24, 1977

Dr. Allen's report on his visit to Cuba is, I believe, very complete. Consequently, there is very little that I can add to what he has already said about the language teaching needs for students of science and technology in Cuba.

I would, however, like to 1) add some information about what has been done as a follow-up to his visit, and 2) make two recommendations for the immediate future which reflect the concern of the language teachers who participated in the sessions with him.

I FOLLOw-UP TO DR. ALLEN'S VISIT

A Distribution of Materials

1. Dr. Allen's lecture of March 19 and the workshop session of March 20

   a) Transcripts of these have been made and typed up in English, with 200 copies of each run off. These are being distributed in the various institutes of research and higher education in Cuba concerned with teaching English for Science and Technology.

   b) A Spanish translation of the March 19th lecture has been made and will also be distributed among non-English speaking members of the language teaching community.

2. Dr. Allen's Report

   Copies in English have been sent to CUSO as well as to the Canadian Embassy in Havana.

   Copies, translated into Spanish, are also being sent to: ISPJAE, the Higher Institute of Medical Sciences, CENIC, the Pedagogical Institutes of Havana and of Pinar del Río, the Faculty of Philology (University of Havana), MINJAP, the Institute of Fisheries, and the Ministry of Higher Education (Postgraduate Section).

B Teacher Training course in English for science and technology (EST):

New Trends in Language Teaching

A 54-hour course in the basic concepts and rhetorical functions of EST is being given at ISPJAE, June 6 - July 15, under the direction and supervision of Adrienne Hunter.

This course constitutes part of the teacher training program which I have been carrying out at ISPJAE as one aspect of my role as technical advisor.
The course has two objectives:
1) to teach the undergraduate teachers in the English program at IJPJAE the linguistic concepts of EST and the basic rhetorical functions of scientific language.
2) to train the postgraduate teachers in the English program (who have already received training in the above) to be teacher trainers in EST.
To this latter end, the course is being designed, written and presented by the teachers in the postgraduate program under my supervision.
This course will involve 22 persons.

C EST courses for university students

1. IJPJAE
The postgraduate program which has incorporated the communicative language teaching approach since 1975, continues to be further developed. As there has not yet been time, the coming academic year will not see significant changes in the undergraduate program which presently emphasizes grammar and technical vocabulary. The entire undergraduate staff, however, is taking a course in the new EST approach (see B).

2. The Higher Institute of Medical Sciences
The communicative language teaching approach and materials are being introduced for the first time in two of the courses at this institute, namely in the first year undergraduate course and in the third-fourth year undergraduate course. The postgraduate program, which has been devised along these lines for two years now, continues to be developed and refined. There also continues to be close collaboration and exchange of materials and ideas between this program and the IJPJAE postgraduate program.

3. CENIC (National Scientific Research Centre)
Since Dr. Allen's visit, two of the English teachers who took the course in EST which I gave in 1975, have held an introductory 9-hour seminar on EST for all their language teachers (12 persons): English (8), French (2) and Russian (2).
The long range plan at CENIC is to introduce communicative language teaching approach into all their language programs at all levels. In the English program, the approach and EST materials were introduced into the second level program two years ago. Work on this is ongoing and developmental. In addition, the first level program is now being analyzed and revised and the new approach incorporated. In the French program, changes have been introduced into the second level, and an analysis of the Russian program is beginning.

4. MINSAP (Ministry of Public Health)
A CIDA-sponsored course for medical technicians going to Canada to study in the summer of 1977, has been considerably revised and rewritten as a result of Dr. Allen's week of lectures and workshops. This program had already incorporated a large number of EST materials.
5. Other Institutions

Before Dr. Allen's visit, the following institutes, whose teachers participated in my 1975 EST course and seminars, had begun using the approach and materials in some of their programs:

1. Faculty of Philology, University of Havana
2. Pedagogical Institute of Pinar del Río
3. Institute of Fisheries

Since Dr. Allen's visit, it has not been possible to maintain contact with all these institutions, so I cannot report on their recent activities. However, a meeting with all these people is being planned for the end of June. (See I E)

D Presentation of Project to the Ministry of Higher Education (MEH) by the Head of the Language Dept. of the Higher Institute of Medical Sciences

This project was drawn up as a result of discussions, which were held during and following Dr. Allen's visit, concerning the needs in the field of university-level language teaching.

The project outlines the need for the creation of a postgraduate school in Applied Linguistics for language teachers in Cuba. The program of such a school would include teacher training in the new communicative language teaching approach which emphasizes the communicative -- rather than the grammatical -- properties of language. The project suggests that some teachers be trained abroad, in Canada and/or Great Britain, who would then form the nucleus of professors for this postgraduate school. It also suggests that professors from abroad be brought to Cuba for consultation and to give short courses.

In my opinion, the creation of such a school constitutes one of the most pressing needs in language teaching in Cuba at the present time. Firstly, there is a need for a large body of highly trained language teachers for all the newly-created universities and research centres. Secondly, the teachers in these universities and centres require a postgraduate course in order to progress from one teaching category to another. Thirdly, there is a great need in Cuba for research in all fields and language teaching is no exception. Without training in research methods and procedures, which would form part of a postgraduate course in Applied Linguistics, research on a coordinated and significant scale cannot be effectively carried out. Fourthly, Cuba's primary need with respect to English is in specialized areas of science and technology, foreign trade, diplomacy. Training in a new approach which is based on the interrelationship between language and subject matter would seem not only relevant but essential. Teaching English in specialized areas, however, requires highly specialized skills and, as Dr. Allen has pointed out, a wide range of background knowledge in psychology, linguistics, sociolinguistics, and methodology, which only a formally-organized postgraduate course could provide.

For all of these reasons, the establishment of a postgraduate course in Applied Linguistics would seem to be all-important.
E Proposed Seminar

Arrangements are now being made for a meeting with the English teachers from all the institutions who participated in Dr. Allen's workshop. This meeting will essentially have two objectives:

1) to bring each of us up to date on what we have done since Dr. Allen's visit, and to exchange any new materials (for example, the course outline and lessons from the EST Teachers' Course at ISPJAE)

2) to plan for a seminar in late December or early January 1978 at which each institution would make a full report on work done and future plans. This seminar could also deal with topics that are of interest and concern to all, such as testing and evaluation.

F Adrienne Hunter's Future Participation in Cuban EST Language Programs (1977-1978)

For some time now, I have been planning to go to Scotland during the coming academic year to take the M.Sc course in Applied Linguistics at the University of Edinburgh. Recently, I learned that I have been awarded a Canadian IDRC grant (International Development Research Centre) for one year of study and research abroad. This will now make it possible for me to not only study at Edinburgh, but to visit all the centres of applied linguistic studies and universities in Great Britain where research and materials development work is being carried out: London, Reading, Birmingham, Colchester, and Lancaster. I plan to visit these centres in September prior to starting the M.Sc course in Edinburgh on October 1st.

The IDRC grant will also enable me to return to Cuba during the winter break (mid-Dec. to mid-Jan.), and it is during this period that I propose we hold our EST seminar. At that time, I will be able to report on the latest EST research in Great Britain and bring with me all the latest materials, published and unpublished.

II RECOMMENDATIONS FOR THE IMMEDIATE FUTURE

A. Follow-up visit by Dr. Allen,

As an interim step in meeting some of the needs outlined in both Dr. Allen's and my reports, there has been an expressed interest in having Dr. Allen return to Cuba during the academic year 1977-78 to provide continuity to the work underway here in various institutions. As Dr. Allen will be teaching at OISE in Toronto again next year, travel arrangements for a follow-up visit could be easily arranged as part of a Canadian tourist plan such as was done for his visit in March 1977.

I would recommend that Dr. Allen's visit coincide with my own return visit from Edinburgh and the proposed EST seminar in late December or early January.
b. Reference Library

I would like to suggest that a library of reference materials as complete and up-to-date as possible be established at one of the centres where E3T courses are being developed, on the understanding that these materials be available to everyone concerned. The centre chosen should be the one which has the best library facilities.

CONCLUSION

In conclusion, I would like to express my thanks to a number of people involved with the project of bringing Dr. Allen to Cuba: first of all to Ambassador Hyndman for his encouragement and support in backing the project; to CIDA for making it financially possible; to International Relations and the teachers of the Language Dept. at ISPJAE for all their help and attention prior to, during, and subsequent to Dr. Allen’s visit.

Without all these people’s help, Dr. Allen’s visit would not have been the enormous success that it was.

Adrienne Hunter
June 1, 1977.
1. Objectives

This course included two sets of objectives depending on the level of linguistic competence of the students entering the course. For those with little or no base in the language, the objectives were confined to:

i) read rapidly and with complete understanding materials in the student's field of speciality

ii) fully understand conversations about and lectures in the student's field of speciality

For those who entered the course with a good basis in the language (who, for example, achieved 70+ on the placement test), there were the two added objectives of:

iii) speak well about matters in the student's field of speciality

iv) write with limitations in the area of the student's speciality

All students, however, studied the same materials (including oral and listening practice) up to the middle of the course at which time it was decided who could and who could not achieve the four objectives.

2. Structure of the Course

The course was divided into three stages of 60, 140 and 40 hours each.

Stage I was concerned with a review of the basic structures of the language taught through the medium of dialogues, songs and stories. The emphasis was on speaking and listening.

Stage II (140 hours) was mainly concerned with teaching the rhetorical functions of scientific language, and emphasized reading and writing although the students continued to do oral and listening practice. The materials of this stage were of a general scientific nature.

Stage III (40 hours) was concerned with readings in the areas of the students' specialties. For this stage, the students were grouped according to their specialties, rather than according to the level of their linguistic competence as they have been in Stages I and II.

3. Number of Students

Number who registered for the course and took the placement test

131

Number who were required to take course because they met the four objectives

14

Total number of students who registered in the course who were to take it

117

Number who never came to class

20

Number who began the course

97

Number who dropped out during the course

32

Total number of students who finished the course

65

NOTE: The reason for drop-out was due largely to the pressure of work because of the restructuring at the administrative level in Cuba.
I. Number of Groups

In Stages I and II, there were 6 groups formed according to the level of their linguistic competence.

In Stage III, there were 7 groups according to the specialties. Thus, each group in Stage III had a mixture of linguistic competence.

II. Results

a) Promotion: 64/65 passed the course = 98% promotion. 1/65 did not take the final exam because he was mobilized a few days before the end of the course.

b) Objectives achieved:

- Total who were able to meet 4 objectives: 52
- Total who were able to meet 2 objectives: 12

(The person who did not take the final exam would have achieved the 2 objectives).

c) Distribution of Marks

For those who achieved 4 objectives, the distribution of marks was the following:

<table>
<thead>
<tr>
<th>Placement Test</th>
<th># of Students</th>
<th>5+</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>Final Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>91</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>80 - 89</td>
<td>17</td>
<td>1</td>
<td>11</td>
<td>4</td>
<td>1</td>
<td>27</td>
</tr>
<tr>
<td>70 - 79</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60 - 69</td>
<td>14</td>
<td>2</td>
<td>9</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 - 59</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41 - 49</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>1</td>
<td>1</td>
<td>19</td>
<td>26</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>52</td>
<td>1</td>
<td>19</td>
<td>26</td>
<td>6</td>
<td>52</td>
</tr>
</tbody>
</table>

For those who achieved only 2 objectives, the distribution of marks was as follows:

<table>
<thead>
<tr>
<th>Placement Test</th>
<th># of Students</th>
<th>4</th>
<th>1</th>
<th>2</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>33 - 37</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>40 - 47</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Length of Course

The course was designed to be 240 hours long, but no class received that many hours. The most that any class received was 234 hours and the least that any class received was 204 hours. The reasons for this discrepancy were the following:

1) The two best groups lost 10 hours at the beginning of the course because only 20 students, or two groups, had been anticipated in the postgraduate program and when it came time to begin the course, we had neither sufficient number of teachers, nor classrooms, and so, two groups had to wait a week until these problems were solved.
11) The CDT group lost 20 hours at the end of the course as their "especialista" course began in mid-April, 3 weeks before the final exams in English.

11i) All groups lost a total of 6 hours because of a rally in the Plaza and rain which prevented people from getting to school on time.

11v) The students using the room in "Construcción de Maquinaria" often lost time because the classroom was frequently flooded and unusable.

v) Certain groups also lost time (a maximum of 4 hours per group) because of illness on the part of the teacher.

7. Evaluation by the Students

We asked the students to make two types of evaluation:

a) a self-evaluation of their progress in the four aspects of the language (regardless of the objectives of the particular student) at five different points in the course:
- before classes began
- after 50 hours
- after 120 hours
- after 200 hours
- after 240 hours (at the end of the course)

The results, shown on graphs, are attached, first of all by the groups A-F, and last, according to the total number who finished the course as a group. In general, all students felt they had improved considerably in all aspects.

b) an evaluation of the activities of the course (29 activities)

The results of this survey were analyzed according to each group and then according to the student body as a whole.

The survey shows that the activities related to oral practice were considered to be the most useful of all.

Under the reading and writing activities, the following were rated highest:
- true-false questions
- practice in the use of the article
- writing oral presentations

Under listening:
- listening comprehension exercises for dialogues, songs & stories
- science reports
- listening exercises on phonology and grammar
- listening to other students' oral presentations

Under oral practice:
- practicing oral presentations
- pronunciation practice
- giving oral presentations
- question and answer practice based on reading
- reading out loud

No activity of the 29 listed was rated as not useful by more than 2 students of the 62 who answered the questionnaire.

In general, the students felt that the course should be longer and should include more materials related to their specialized studies.
6. Conclusions and Recommendations:

a) Placement test and Objectives

In our original outline of the course, it was anticipated that only those who achieved more than 70 on the placement test would be able to achieve all four objectives in the time allowed for the course, 240 hours. However, as the results show, it would seem that those getting above 50 on the placement test are capable of handling the productive skills as well as the receptive skills, and some with less than 50 are also capable.

b) Length of course

In general, the students felt that the course should be longer, and this coincides with the feelings of the teaching staff. It is possible that the very best students require only 240 hours, but the others need about 300 hours to achieve results that will be lasting. Also, with more hours, it would be possible to have more students achieve four objectives.

c) Attendance

The case of the person who had 47 on the placement test and who achieved a final mark of 5 in all aspects (4 objectives) is the case of someone who attended class regularly, who always did her homework and who diligently applied herself to the task at hand, taking full advantage of all the activities and extra oral practice offered. With these same attitudes, more students could have undoubtedly achieved the same results.

The case of the person who had 91 on the placement test but only achieved 3 on the final exam is an example of someone who could have achieved 5+ had he come to class regularly. Unfortunately work and health problems prevented him from attending more than approximately 50% of the classes.

Our policy was to demand a 90% attendance and once the student had been absent 10% of the total number of class hours (i.e., 24 hours out of 240), that person would normally have been asked to drop the course. Each case was, of course, given special analysis and there a number of cases where we did not apply the rule, although in general we did. Given the results achieved, we feel that this policy was valid and should be continued in future courses.

d) Course Content

In general, we feel that we are on the right track as far as course activities are concerned. We are achieving good (in some cases, excellent) communicative competence in a reduced length of time.

It is clear, however, that we must move in the direction of a course that incorporates more and more specialised materials - it is what the students need and it is what they themselves want and find most stimulating. In the 76-77 course, only 40 hours (16%) of the course were devoted to specialised materials. This is clearly very little, but the use of specialised materials poses very real problems as they must be specially prepared. This requires not only a great deal of training and experience, but also an enormous amount of time for research and writing on the part of the teacher. This aspect, and other recommendations about the future of the department, will be dealt with in a separate report.

Adrienne Hunter
This report covers the following topics:

1. A brief history of the ISPJAE English language project
2. International recognition of the ISPJAE English language project
3. Adrienne Hunter and the IDBC Award
4. Perspectives of the ISPJAE English language project
5. What has to be done

1. A Brief History of the ISPJAE English Language Project

The present English for Science and Technology (EST) program at ISPJAE has grown out of the original postgraduate English program begun in 1972 by a team of Canadian University Service Overseas (CUSO) teachers. The original program was set up to complement the CIDA-CUSO-sponsored master's program involving Canadian engineering professors. Over the years since 1972, the postgraduate program has evolved smoothly from one stage to the next:

1972-1974: the overall design of the program; the writing, by Canadians, of the introductory oral materials leading to the publication of English on the Tip of Your Tongue (Hunter and Kainola) by CUSO in 1974.

1975: the training of ISPJAE postgraduate teachers -- and teachers from other Cuban institutions -- in oral methodology and the use of the materials in English on the Tip of Your Tongue.

1975-1976: the introduction of the new functional approach to language teaching and the basic concepts of English for Science and Technology (EST); a 50-hour course for teachers in the functional approach given by Adrienne Hunter; the preparation of advanced EST reading and listening materials.

1976-1977: training the ISPJAE teachers in the postgraduate program to write their own materials and to train other teachers.

1977: the introduction of the functional approach into the ISPJAE undergraduate program through a teacher training course, designed and supervised by Adrienne Hunter, and prepared and given by Gisela Hernandez and Mercedes Zorzano, teachers in the postgraduate program.

(See the appended General Report on the Postgraduate English Program at ISPJAE for a more complete history of the development of the language program at ISPJAE from 1972-1977.)

The final objective of the Canadian technical advisor, Adrienne Hunter, is to phase herself out of the program at ISPJAE, leaving the Cubans completely prepared and ready to carry on by themselves in the areas of materials development and teacher training. However, this objective will only be achieved after several more years of intensive and systematic work.
2. International recognition of the ISPJAE English language program

The program at ISPJAE in the functional approach to the teaching of EST has attracted the attention of advanced educational institutions, both in the United States and Great Britain. Dr. Patrick Allen of the University of Edinburgh, who made a professional visit to Cuba in March 1977, was highly impressed with the program. Professor Louis Trimble of the University of Washington, also an expert in the field, considers it one of the most important projects in the international arena.

Why have these international experts in the field of applied linguistics, and specifically in EST, come to recognize the importance of the ISPJAE EST program?

There are basically two reasons:

For one thing, the work done at ISPJAE (and now applied to other Cuban institutions), although recent in origin, has developed many original approaches and materials. This has been done, however, with the full utilization of advanced developments in the EST field on an international level.

Secondly, the project at ISPJAE, which includes materials development and teacher training, has been recognized as one of the largest and best organized projects for the EST functional approach.

3. Adrienne Hunter and the IDRC Award

The project at ISPJAE and its influence and application in other Cuban institutions has been given concrete international recognition through a grant awarded by the International Development Research Centre (IDRC) of Canada to Adrienne Hunter. This grant is given to only ten Canadian professionals every year.

The IDRC award is almost always given for advanced work in the fields of science, technology, and agriculture. It is the first time in the history of the award that a grant has been made to further the study and application of EST.

The award was granted in recognition of the outstanding contribution of the ISPJAE project in EST and specifically to the Canadian, Adrienne Hunter, the founder and coordinator of the project.

The IDRC award will allow for one year of study and research by Adrienne Hunter at the University of Edinburgh’s School of Applied Linguistics, as well as research in other centres of applied linguistics in Great Britain and Canada.

These individual contacts will be of great help in establishing ISPJAE’s own international contacts for the future.

According to the prospectus, Adrienne Hunter will coordinate her work in Scotland with ISPJAE during the 1977-78 academic year, returning to Cuba in October 1978 to complete the final preparation of advanced EST materials and the training of Cuban teacher trainers.
4. Perspectives of the ISPJAE English language project

ISPJAE is a "centro rector" in the field of engineering and technology in Cuba.
ISPJAE should also become the "centro rector" for the specialized methodology, programs, textbook materials and teacher training in EST as applied specifically to engineering and technological studies.

The idea is not to compete with the training of teachers at the Pedagogical Institutes. This latter must continue for the mass training of English teachers.
ISPJAE should, however, be prepared to train graduate English teachers in the functional approach for EST with direct reference to engineering and technology. These teachers would be prepared to teach at any of the engineering and technological schools in Cuba.

Specialized textbooks for EST which take into account the needs of the different specialties in engineering and technology must be written by the teachers at ISPJAE for use in all the engineering and technological schools in Cuba.

ISPJAE must be prepared to coordinate the EST programs at all engineering and technological schools in Cuba. Organic ties should be established with the English departments of these institutions and a system of consultation and inspection should be set up.

The ISPJAE program should also be prepared to organize and coordinate research in the field of the functional approach to EST in order to perfect its methods and materials with each school year. In order to do this, international ties with advanced centres should be expanded and developed: the universities of Edinburgh, London, Birmingham, Lancaster and Reading in Great Britain; Concordia University and the Ontario Institute for Studies in Education in Canada; and if the political situation makes such a tie possible, with the University of Washington in Seattle in the United States.

The basis for these ties can be established by Adrienne Hunter during the visits she will make in 1977-1978.

5. What has to be done?

A. Teacher Training

Adrienne Hunter will make two visits to Cuba during the 1977-78 academic year. During these visits (in Dec. and in April), she will give seminars on specific aspects of the functional approach to EST and report on the most up-to-date research being done in Great Britain.

On her return to Cuba, during the year 1978-79, she will give a full teacher training course to all the ISPJAE English teachers including such things as error analysis and research methods. In this course, she will be able to bring information on the latest developments in the field of EST.
One of her future tasks should be that of training a core of teachers to be teacher trainers, a job she has only just begun with Gisela Hernandez and Mercedes Zorzano. The core of teacher trainers would train teachers from other engineering and technological institutes throughout Cuba under A. Hunter's supervision.

All the activities mentioned above might include teachers from other scientific scientific institutions such as "Ciencias Médicas" and CEZIC -- teachers who have participated in other courses and seminars offered at CUJAE by Adrienne Hunter.

3. The Postgraduate Program

As a result of five years of solid work and constant improvement, the postgraduate program in its present form is a tightly-organized highly efficient program which achieves the same objectives in 240 hours as were originally achieved in some 360-400 hours. The materials and methods used are extremely varied, and, in many cases, have been especially written for our students. They have been evaluated by the students as very useful and interesting. Dr. Allen and Professor Trimble consider the course excellent and one of the best organized anywhere.

There are aspects of the postgraduate course, however, that need further development, for example, aspects of scientific listening and reading exercises.

I believe, however, that we should be careful about making any changes that would affect the continuity or slow down the program. It would be best to leave the teachers who have already been trained in the program, to continue working on these aspects during my absence. In fact, work has already begun under my guidance. During my visits in Dec. and April there will be further consultations on this work. Upon my return in Oct. 1978, changes in teaching personnel can be made in accordance with the teacher training program.

C. A Future Three Year 720-hour Course

It is speculated that the present postgraduate course will be replaced by a three-year 720-hour course offered by a Language Centre. This new program would be geared in part to graduates who have never studied the language previously.

If the language centre is formed, I see the development of this ambitious program as one of my major tasks. Prior to my departure for Scotland in July, the overall design of the course must be mapped out, and initial work on the first year program can begin in my absence with consultations on my visits. Upon my return, we will be able to incorporate the very latest methods, and possibly materials, into the course and complete it under my supervision. Participation in this will be excellent teacher training.

D. The Undergraduate Program

This is a two-year, four-semester, 192-hour program. Two textbooks now exist that are based on a grammar-vocabulary approach and that have played an important role in teaching reading to the undergraduate engineering students.
These books need to incorporate the new functional approach and so should be revised to include exercises in the rhetorical functions of scientific language for use in the first year of the program. I would suggest that these books, which contain readings from all fields, be used only in the first year.

This preparatory work should begin in September 1977, under the direction of Mercedes Zorzano. I recommend that Mercedes be moved from the postgraduate program to carry out this work, but I do not recommend moving any of the other teachers.

Before leaving for Scotland, Adrienne Hunter should meet with Mercedes and Lo Kim to work out an overall plan of action. By the time Adrienne Hunter visits Cuba in December 1977 for 2 weeks, work on the revised first year textbook should be well underway. The revision work should be near completion by the time of Adrienne's second visit in April. On each of these visits, Adrienne could bring new materials which could supplement the work under way.

Between May and September, the materials should be put into final form for use in the 1978-79 year.

Upon Adrienne Hunter's return to Cuba in Oct. 1978, work on the second year materials should begin. These materials should be specialized according to the engineering groups which each class is made up of.

Adrienne Hunter

June 24, 1977,
Havana.
I Phase I of the "Especialistas" Course (The Canadian Phase), 1972-1975.

II Phase II of the "Especialistas" Course, 1975-1977

III Changing Conditions

IV Future Perspectives

I Phase I (The Canadian Phase), 1972-1975

1. The First Course: Jan. 1972-June 1972

When the CUSO English language group of five teachers (David Gallagher, Charles Carrington, Adrienne Hunter, May Ann Kainola and Judy Ransom) arrived in Cuba at the end of Jan., 1972, we were given the responsibility of teaching English to the first group of postgraduate engineering students who would be taking a master's degree program in engineering in 1972-1973. This master's program was a CUSO-CIDA project which drew heavily on Canadian engineering professors who spoke English. This explained the importance of the English program.

The needs of the students were to: read texts in their fields of specialty, understand lectures and discussions about the subjects that they would be studying in the master's program, communicate with the Canadian professors about their fields and also in social situations, write examinations and a thesis in English.

We found the following situation at CUJAE as regards the postgraduate English program: There were 2 Cuban English teachers, Gilda Aragón and Gisela Hernández, who were not trained in the methods which the Canadian English teachers brought with them. There was no program for the course. There were no textbooks that suited the needs of the students. At other centres, such as CENIC, the Alexander books were being used, but we felt that it was contextually inappropriate and unsuitable for students who were not absolute beginners. We had only four months to prepare the students so that they could take classes in English when the Canadian engineering professors arrived. (This included writing a course and giving it.)

The five Canadian English teachers designed and conducted the first course (Feb. 1 - May 31, 1972) Gilda Aragón and Gisela Hernández sat in on the classes but did not undergo any formal training in either methodology or materials writing.

The course was an intensive course: 4 hours a day, 5 days a week, with a total of some 300 hours. The students, on the whole, had a good level of linguistic competence when they entered the course.

A teaching program was worked out. The basis of it was a series of 30 structurally-graded dialogues set in the context of CUJAE and concerned
3 engineering students (2 men and 1 woman). The dialogues were accompanied by drills to practise structures and pronunciation. All these materials were written by Adrienne Hunter, May Ann Kainola and Judy Ransom and were recorded at Radio Havana Cuba for use in future courses. As well as the drill exercises, there was a detailed course outline from which each teacher was expected to develop additional teaching materials.

In addition to oral practice with dialogues, we had the students write and present oral compositions about general topics of interest having to do with Cuba and/or their work: the Ceiba Plan, work-study programs, productive work, coffee-picking, sugar processing, etc.


This was also an intensive course (20 hours/week) with a total of some 480 hours, although the students from Production had fewer hours as they did not enter the course until December.

The two Cuban teachers were incorporated into the course along with three of the original Canadian teachers (David Gallagher, Adrienne Hunter, May Ann Kainola). All five teachers carried the same teaching load.

The BBC-British Council film series, "The Scientist Speaks" was integrated into program as second-level teaching material, leaving the dialogues and exercises to form the first-level where a review of the basic structures of the language was necessary. Vocabulary lists and special grammatical exercises for oral practice were prepared by A. Hunter and M.A. Kainola to accompany this series which dealt with general scientific topics such as Bridges, Plastics, Telecommunications.

In addition to "The Scientist Speaks", 'technical classes' were begun as part of the second level. Once a week, the students were grouped according to their specialties. The students in each group selected topics from the outline of the course they were to take with the Canadian engineering professors. They then researched the topics in the library on their own and made oral presentations to their classmates. David Gallagher, a graduate engineer, handled all the technical classes.

By the end of the 72-73 course, it was clear that a course outline for the first level was not sufficient and that more detailed teaching materials were required to accompany the dialogues. Therefore AH and MK began writing such detailed materials in March 1973 for use in the third course.

3. The Third Course: June 1973-March 1974

The third course began in June 1973 and continued with breaks for holidays until March 1974. The total number of hours was in the vicinity of 480 (20 hours/week).

In September, 1973, David Gallagher left the CUNJAL English program and Adrienne Hunter replaced him as coordinator. Another Canadian, Sheila Ketz, filled the vacancy, making the same total of 5 teachers, all of
whom continued to have the same teaching load.

During the third course, Adrienne Hunter and May Ann Kainola finished working out detailed materials for the first level of the course. These were dittoed and used in all the classes.

It was decided to publish a book which would contain not only the dialogues and the detailed exercises, but also notes on methodology and hundreds of drawings.


4. The Fourth and Last Course: Sept. 1974-June 1975

This was the fourth and last course given to students who would be studying with Canadians. All future "especialista" programs would be given by Cuban (Spanish-speaking) engineering professors.

The course continued to be intensive: 20 hours/week, and the total number of hours varied according to the linguistic level of the students when they enrolled: from approximately 320 - 480.

The teachers giving the course were 5 Canadians and 2 Cubans. There were three new Canadians, Suzanne Daoust, Helga Stefannson, Frances Gorbet. Suzanne and Helga began teaching in Sept., Frances in January.

The course continued to have a 'general' English first-level component (English on the Tip of Your Tongue) and a scientific second-level component: The Scientist Speaks and the technical classes.

The technical classes were handled by Adrienne Hunter and May Ann Kainola and considerable work was done to give more shape and content to them. In addition to the oral presentations, we began to use scientific readings and worked out a strategy to include grammatical correction and reinforcement, dictation, and English-Spanish-English translation. We began working in closer collaboration with the students themselves in choosing reading passages which were appropriate to the students' field, and up-to-date in content.

It was clear that in future courses, the students would need more work with scientific materials related to their fields and that this was the most difficult aspect of the course for the teachers to handle.

Up to this point, there had never been time to carry out any kind of teacher training program. All the teachers had been teaching 20 hours a week and the Canadians had spent the remainder of the time developing materials for classroom use. There had simply not been time to visit classes, train teachers in methodology or materials writing.

In January, 1975 the number of teaching hours/week was reduced to 10 and this allowed 4 of the Canadian teachers to design and prepare a course in methodology. The overall supervision of the course was carried out by Adrienne Hunter and the teaching and workshop sessions were divided
among Adrienne Hunter, May Ann Kainola, Suzanne Daoust and Frances Gorbet. This course was 50 hours long and concentrated on teaching oral skills: the stages in a lesson (presentation, repetition, practice and evaluation, contextualization); and ways of developing oral fluency (games, debates, role playing, etc.)

Teachers from the following centres also attended this course and received certificates: MINCEX, Philology (Ramos Latour), CENIC, Ciencias Médicas, Pablo Lafarge, Gorki.

II- Phase II of the "Especialistas" Course; 1975-1977

1. Transition to Communicative Language Teaching.

As stated previously, the students in the 1974-75 course were the last group of students with Canadian engineering professors coming to Havana to give courses. In the future, such courses, as long as they were to be given, would be taught by Cuban professors. This meant certain changes in future courses:

- there would be fewer hours available for the English course. Therefore the teaching had to be even more effective.
- less emphasis would be placed on speaking and more on reading. Reading and writing were aspects we had not really developed up to this point as our concern had been for the students to be able to speak with the Canadians.
- the English teachers would be all Cubans with Adrienne Hunter acting as technical advisor. Therefore, more emphasis would have to be placed on teacher training not only in the area of methodology (e.g. how to handle the technical classes) but also on materials writing.

In the Spring of 1975, Adrienne Hunter and Gisela Hernández of CUJAE, Marjorie Moore of Medical Sciences and Madeleine Monte of CENIC met a number of times to discuss common problems in the English courses at those centres and to try and outline a course that would contain elements which could be used in common by all 3 centres.

We had many problems in common:
- the need to meet the same objectives with emphasis on the reading of specialized scientific texts
- the need to reduce the number of hours without changing the objectives
- our students had similar linguistic backgrounds requiring remedial work rather than teaching from zero. Some were false beginners.
- our students generally had a good grammatical basis but could not 'communicate' in the language.

There was consensus that we needed a course that not only reviewed and reinforced the basic grammatical structures of the language giving the student linguistic competence, but that contained elements which could lead the student to communicative competence. We felt that there was a need, particularly in the second level of the course, to move towards something other than purely grammatical structures and vocabulary.

At all three centres, we had used oral presentations where the student had to define, describe, and report on things directed related to his work and we had found this extremely useful. We all thought that the solution lay along those lines.
In the summer of 1975, Adrienne Hunter, with the backing of CUJAE and the financing of CUSO, attended the first five-week Summer Institute on the Teaching of English for Science and Technology at the University of Washington in Seattle, Wash., USA.

This institute was based on a new approach to language teaching, sometimes called communicative language teaching, or functional language teaching, or teaching English for Special Purposes (ESP). Teaching English for Science and Technology (EST) is one such special purpose; EST uses a communicative language teaching approach. The institute showed that we in Cuba were on the right track in tackling the problem of communicative competence.

EST emphasizes the communicative functions of language rather than the grammatical and lexical aspects. It is an approach which shows the student the interrelationship between language and subject matter. The student learns to recognize that language is used to express scientific facts and processes and it is these processes that the student practices rather than grammatical exercises which have no special purpose as far as communicating ideas is concerned.

2. Courses and Seminars in EST for Teachers

Upon her return to Cuba in Sept. 1975, Adrienne Hunter organized, designed, prepared and gave a 48-hour course in EST. The 25 university-level teachers who participated in this course came from the following institutions: CENIC Medical Sciences (both undergraduate and postgraduate programs), CUJAE (both undergraduate and postgraduate programs) Philology (Ramos Latour).

Most of the programs which the participants worked in, later incorporated, to a greater or lesser extent, some of the EST ideas and/or materials from the textbook series, English in Focus, co-edited by J.P.B. Allen and H. Widdowson of the University of Edinburgh and published by Oxford University Press.

During the 1975-1976 academic year, Adrienne Hunter was invited to give lectures on EST at MINCEX and the Pedagogical Institute of Havana. In Sept. 1976 she gave a special lecture at CENIC to some 90 language teachers in Havana.

Adrienne Hunter maintained very close contact with the people at the University of Washington, sending them copies of her lectures and the course materials which she used for the teachers' course and materials used in the teaching programs during the year. In exchange, Professor Louis Trimbine at the University of Washington sent to Cuba his most up-to-date research findings and was extremely encouraging in his views of what was being done here. He characterized the work as unique, of very high calibre, and of international interest.

Collaboration between CUJAE, Medical Sciences and CENIC continued with full cooperation in the exchange of materials and ideas.

3. Courses for "Especialistas" at CUJAE 1975-1976

During the academic year, 1975-1976, three different courses were given:
A 130-hour reading and writing course using the English in Focus materials. This course was given from Jan. - May 1976 to three groups of students who, according to linguistic level, ranged from poor to advanced.

A 600-hour course in the 4 aspects of the language (reading, writing, speaking, listening). This course was given to a group of students who had almost no basis in the language and had tremendous learning problems. The course emphasized structural drills.

A 240-hour course in the 4 aspects, given to a group of students of medium and advanced levels, using a variety of experimental materials and techniques. These included special recorded listening exercises of all types; oral presentations selected according to functions (definition, description, report) rather than topic; the analysis of scientific readings from a functional as well as a grammatical and lexical point of view; the students working with tape recorders in class and on their own time. Adrienne Hunter prepared and taught this course.

To summarize the results of the various courses:
- those in the reading course were almost unanimous in their desire for an oral component in the course. They felt dissatisfied with the limited objectives of reading and writing, although they liked the approach to reading and writing.
- although the linguistic levels of the other two groups were different, the results seemed to show that an approach which used more communicative functions and fewer structural drills yielded better results.
- the 240-hour course had shown that it was possible to achieve the same kind of results that we had achieved in previous courses with fewer hours using a different kind of approach and more work in listening exercises and oral presentations.

June, July and part of August were devoted to designing a new course and preparing new materials to be integrated with the best from previous years.


The course designed consisted of three stages:
- Stage I was the old first-level of previous courses, but reduced to 70 hours of intensive review of grammatical structures through the dialogues and stories in English on the Tip of Your Tongue. In addition, songs for the teaching of English were added to the curriculum, and a series of listening exercises for dialogues, stories and songs were written and recorded on tape.
- Stage II was 120 hours long and concentrated on the communicative function: of scientific language: definition, classification, and description. Materials from English in Focus were used for this stage, as well as originally-written listening exercises called Science Reports. There was a variety of activities to practice the oral aspect of the language including oral presentations, question and answer practice, reading aloud, songs.
- Stage III was 50 hours long and was devoted to specialized materials found in journals and textbooks of the students' fields of specialty. This required very original and exhaustive work on the part of the teachers. The films from The Scientist Speaks were incorporated into this stage as part of specialized materials. We also had guest speakers and lecturers.
For the first time since 1972, Adrienne Hunter was released from teaching any classes, in order to devote full time to the preparation of materials and teacher training.

It was particularly necessary for Adrienne Hunter to be free of classroom responsibilities as three new teachers were working with the program who needed special attention: Olga Larraz, Osvaldo Montesgudo and Carmen Sam. The fourth new teacher, Mercedes Sorzano had taken Adrienne Hunter's course in EST in 1975. In addition, she's a teacher with considerable experience and knowledge. These two things made it possible for her to work with Gisela Hernández and Gilda Aragón in helping the new teachers prepare their classes. Mercedes, Gilda and Gisela became Adrienne Hunter's counterparts.

Not only did the new teachers require extensive preparation in the techniques of handling the variety of materials and activities, but they also required preparation in the content of the lessons - in understanding what the scientific readings were saying - and in preparing effective exercises for the students.

The course was 10 hours a week, and all the teachers spent more than 3 hours per class hour on preparation in Stages 1 and 2.

In Stages 1 and 2, Mercedes Sorzano, Gisela Hernández and Gilda Aragón gave guidance to the other teachers, but in Stage 3, I had to work with each teacher individually, advising on the selection of the reading passages and then checking and revising all the exercises based on these reading passages. This took hours of work on everyone's part, but was well worth the time and effort expended in terms of the teachers' growth and development.

The results of the course were extremely gratifying and exceeded our expectations. They are dealt with in: Report on Especialistas' Course 1976-77, June 1, 1977, by Adrienne Hunter.

III- Changing Conditions

1. The Present State of the Postgraduate Program

As I have tried to show in this report, the development of the postgraduate English course, which was characterized by Dr. Allen as one of the best he had ever seen anywhere, is the product of many years' work and of a great deal of experimentation and original creative thinking. It can be seen that the course has developed from one year to the next improving each step of the way. The course we have now is, we consider, highly effective and good, but it needs perfection and the teachers need to work with the course more, in order to feel comfortable with the concepts and the techniques.

2. Integration of the Undergraduate and Postgraduate Programs

Since Sept. 1976, the two programs have worked under the same head of the department. Before this, the programs were separated, not only in content, but also physically. We had no contact with each other. It is very positive that we are now one department.

It is clear that the two programs need to be integrated so that one
leads into the other and the first step in that direction is being taken at this very moment; the teachers in the undergraduate program are taking a course in the basic concepts of EST, and minor changes are planned for the undergraduate program next year, with much more sweeping changes for the year after.

3. Training the Teachers of the Undergraduate Program in the Concepts of EST.

This is a 54-hour course, offered from June 7-July 14, 1977 (a 6-week period) to familiarize the undergraduate teachers with the basic concepts and rhetorical functions of EST.

The course also has two added objectives. One is that of training Gisela Hernández and Mercedes Sorzano to be teacher trainers in EST. Gisela and Mercedes have prepared and are giving the lessons under the supervision of Adrienne Hunter who first planned and designed the course.

The third objective is to train Olga Lantz and Carmen San to be assistant teacher trainers and workshop leaders. The course includes five 3-hour workshop sessions in which the students' homework assignments are analyzed and discussed and the new teaching items are practiced. Carmen, Olga, Gisela and Mercedes each conduct one workshop group of 3 students.

IV- Future Perspectives

At the end of July, Adrienne Hunter will be leaving ISPJAE for 14 months of study and research abroad related to the work in EST at ISPJAE. She will make 2 visits during the 1977-78 academic year and then return to ISPJAE in October, 1978 to complete her present two-year contract.

Much remains to be done at ISPJAE. As ISPJAE is a centro rector, the language programs must also be models to be used throughout engineering and technological institutions in Cuba. Bearing this in mind, the following must be undertaken and completed in the next 2 or 3 years:

* The undergraduate program must be revised and updated in accordance with the new concepts and principles: materials written, teachers trained
* A 3-year 770-hour program for a new Language Centre must be designed and executed: materials written, teachers trained
* A small core of teachers must be trained to be teacher trainers in other centres and teaching institutes
* Research must be initiated and carried out in the areas of language learning most relevant to our work here at ISPJAE.

Adrienne Hunter
APPENDIX C

SURVEYS

PROFICIENCY TEST

RAW SCORES
SURVEY OF STUDENTS' OPINIONS

(This is an example of the type of questionnaire that was given to postgraduate English students at ISPJAE beginning in the 1975-76 academic year, following an agreement between the teachers at ISPJAE, CNIC, and ISCM-H that all courses should be evaluated not only by the teachers but by the students.)

Part A: (to be administered at the beginning and end of the course, and at various points in between.)

Please evaluate your present knowledge of English in the following areas:
(E=excellent; VG=very good; G=good; F=fair; P=poor)

<table>
<thead>
<tr>
<th>Ability</th>
<th>Evaluation</th>
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<tbody>
<tr>
<td>ability to speak on everyday topics</td>
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<tr>
<td>ability to speak on scientific topics</td>
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<tr>
<td>ability to understand normal conversation</td>
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<td>ability to understand lectures</td>
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<td>ability to read scientific texts</td>
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<td>Ability to write on topics related to your work</td>
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</table>

Part B: (to be answered only at the end of the course)

Please evaluate the following aspects of the course you have just taken, on a scale of 1 - 5. (1 is the lowest rating and 5 is the highest.)

Aspect/Activity

<table>
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<th>Question and answer practice</th>
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<td>Oral presentations</td>
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<td>Grammatical correction</td>
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</table>

etc.
STUDENT SURVEY RELATED TO 1980-82 FIELD STUDY

Administered at the end of Semester I (in Dec.) to three consecutive groups of first-year engineering students in the academic years of 1979-80, 1980-81, and 1981-82)

Ingles I

INSTRUCCIONES: No firme ni ponga su nombre en esta planilla. En las selecciones haga una cruz al lado derecho. Expresé su opinion abiertamente para que sirva de ayuda en la investigación.

1. Fecha de nacimiento: -----------------------------

2. De que nivel de enseñanza procede? ---------------
   Nombre y lugar del centro: --------------------------
   ---------------------------------------------------

3. Diga si considera que el curso de inglés del Primer Semestre, comparado con el que usted recibió en el nivel previo, fue en calidad y metodología: inferior -------- igual -------- superior --------

4. Cual de los dos sistemas o métodos de enseñanza de idiomas considera mejor?
   en el que no se traduce -----------------------------
   en el que se traduce -------------------------------

5. Diga si en el semestre pasado, en cuanto al curso de inglés se refiere, aprendió:
   muy poco -------- un poco -------- mucho más de lo que sabía --------

6. Diga si considera que las clases recibidas fueron:
   malas -------- regulares -------- buenas --------

7. Cuántas horas semanales le dedica al estudio individual del inglés en este semestre?
   menos de 1 ---- de 1 a 2 ---- más de 2 ----

8. Como considera su atención a las clases de inglés?
   ninguna ---- poca ---- regular ---- mucha ----

9. Es importante el inglés en su carrera?
   si -------- no -------- sin criterio --------
Proficiency Test for 1981-82 Field Study

Nombre ______________________

SECCION A

En esta sección seleccione la oración que expresa la misma idea que la oración original y encierre la letra correspondiente.

1. University students must study hard.
   a. University students will probably study hard.
   b. It is necessary for university students to study hard.
   c. It is possible for university students to study hard.
   d. University students don't study hard.

2. Mary is able to drive.
   a. Mary is driving.
   b. Mary might drive.
   c. Mary likes to drive.
   d. Mary can drive.

3. George wasn't able to finish the project.
   a. George can't finish the project.
   b. George won't be able to finish the project.
   c. George couldn't finish the project.
   d. George finished the project with difficulty.

4. It may rain on Saturday.
   a. We always have rain on Saturdays.
   b. We will have rain on Saturday.
   c. It is necessary to have rain on Saturday.
   d. It is possible that we will have rain on Saturday.

5. We may use our dictionaries in the exam.
   a. We have permission to use our dictionaries in the exam.
   b. It was possible to use our dictionaries in the exam.
   c. Dictionaries will be used in the exam.
   d. Dictionaries must be used in the exam.
6. A house can be made of different materials.
   a. We can use different materials to make a house.
   b. There are different materials in this house.
   c. We can make a different house from these materials.
   d. Different materials make a house.

7. Bill is 5 feet tall. Peter is 5 feet 6 inches tall.
   a. Bill and Peter are equally tall.
   b. Bill isn't as tall as Peter.
   c. Peter is shorter than Peter.
   d. Bill is taller than Peter.

8. Their apartment consists of three rooms.
   a. The three-room apartment is there.
   b. Apartments consistently have three rooms.
   c. There are three rooms in their apartment.
   d. Three rooms constitute an apartment.

9. The FAO meeting was officially opened by Fidel at the Convention Palace and many delegates attended.
   a. The Convention Palace opened the FAO meeting.
   b. Fidel officially opened the FAO meeting.
   c. Many delegates officially opened the FAO meeting.
   d. The FAO meeting opened without Fidel.

10. The classroom is 6 metres long and 5 metres wide; the laboratory is 10 metres long and 3 metres wide.
    a. The area of the two rooms is the same.
    b. The classroom is as wide as the laboratory.
    c. The laboratory is larger than the classroom.
    d. The classroom is longer than the laboratory.
SECCION B
En esta seccion lea cada parrafo y seleccione la terminacion correcta de cada oracion. Encierre la letra correspondiente. (Hay 3 parrafos.)

1er Parrafo

A man has a serious problem and decides to consult his doctor. When he arrives at the office, he explains his problem. "Doctor", he says, "I am very nervous and every time I sing, I begin to cry. What can I do?" The doctor replies, "Put your fingers in your ears."

11. The man goes to
   a. the man's office
   b. the doctor's office
   c. my office
   d. their office

12. The patient consults his doctor because
   a. he cries all the time
   b. he is extremely nervous
   c. he has something in his ear
   d. he isn't able to sing

13. The patient begins to cry
   a. when he arrives at the office
   b. when he consults a doctor
   c. when he puts his fingers in his ears
   d. when he sings

14. The patient asks the doctor
   a. to tell him what to do
   b. to give him some medicine
   c. to explain the origin of his problem
   d. to put his fingers in his ears

15. The doctor recommends that the man
   a. not sing
   b. not listen to himself
   c. not consult a doctor
   d. not be nervous
16. The man considers that his problem is serious but

a. the doctor isn't
b. the doctor does too
c. the doctor will
d. the doctor doesn't
The heart is one of the most important vital organs of the human body. Without it, we cannot breathe. The heart consists of four compartments with doors, known as valves, between them. It pumps blood in and out through these doors by changing the size of the compartments so that the doors open and close. It can do this because the heart is made of muscle.

17. The topic of this paragraph is
   a. important vital organs
   b. the heart
   c. the valves of the heart
   d. muscles

18. The heart is essential for
   a. opening and closing doors
   b. breathing
   c. changing our size
   d. donating blood

19. The principal function of the heart is to
   a. change the blood
   b. be a vital organ
   c. pump blood
   d. open and close doors

20. The doors between the compartments are called
   a. muscles
   b. organs
   c. valves
   d. pumps

21. The compartments change in size with the result that
   a. the heart stops pumping
   b. the heart is a vital organ
   c. the heart is made of muscle
   d. the doors open and close

22. The size of the compartments can be changed because
   a. the heart is made of muscle
   b. the compartments have doors
   c. the blood goes through the door
   d. the doors are known as valves
23. one of the most important vital organs means in Spanish
   a. uno de los organos vitales mas importantes
   b. un importante organo vital
   c. una importancia vital de los organos
   d. un organo vital muy importante
More than two thousand years ago, the people of India learned how to make sugar from sugar cane. However, it was much later, at the time of the Crusades, that sugar was introduced to Europe by the Arabs. The term "sugar" is now used for more than 100 sweet-tasting substances composed of carbon, hydrogen and oxygen. The carbon may be in different proportions, but there is always twice as much hydrogen as oxygen.

24. An appropriate title for this paragraph is
   a. "The discovery of sugar"
   b. "Sugar"
   c. "The composition of sugar"
   d. "The people of India"

25. Sugar was discovered
   a. after the Crusades
   b. two thousand years ago
   c. before the Crusades
   d. at the time of the Crusades

26. The first people to learn about sugar were
   a. the Crusaders
   b. the Arabs
   c. the Europeans
   d. the Indians

27. Europeans
   a. learned about sugar from the Arabs
   b. discovered sugar in India
   c. introduced sugar to the Arabs
   d. used sugar before the Indians

28. All sugars contain
   a. sweet-tasting substances
   b. as much hydrogen as oxygen
   c. carbon, hydrogen and oxygen
   d. more oxygen than hydrogen

29. The proportion of hydrogen to oxygen in a sugar
   a. is sometimes the same
   b. will always be the same
   c. might be different
   d. will always vary
30. **more than 100 sweet-tasting substances** means in Spanish

a. mas de cien dulces sabrosos sustanciosos
b. mas de cien sustancias de sabor dulce
c. mas de cien sabores dulces y sustanciosos
d. mas de cien dulces de sabores sustanciosos
(Section C-1 of the proficiency test is found on pages 398 and 399 which are placed facing each other so that the student may easily select the words on page 399 that correspond to the blanks on page 398.)
SECCIÓN C-1

El siguiente reportaje periodístico apareció en la prensa mundial el día 2 de agosto de 1981, 10 días después de que el presidente Fidel Castro había visitado la Isla de la Juventud para ver la extraordinaria vaca, Ubre Blanca.

Como vera, hay espacios en blanco en el reportaje. Cada espacio responde a un número (31, 32, etc.). En la página opuesta, encontrará una lista de grupos de palabras enumerados del 31 al 50. En cada grupo, subraye la palabra correcta correspondiente a cada espacio enumerado.

Veanse los dos ejemplos (i) y (ii):

Yesterday, August 1, a new world record in milk production was (i) in Cuba. A Cuban cow, which is one part Cebu and three (ii) Holstein, produced 107.3 litres of milk in a 24-hour period.

Ejemplos:
(i) established establishes establish establishing
(ii) Cubans cows part parts

Ten 31 ago, Cuban president, Fidel Castro, 32 the extraordinary cow, Ubre Blanca, 33 she had produced 82.8 litres in one day. President Castro said that 34 believed that 82.2 litres in 35 day was a world record in milk 36.

During his visit, 37 president suggested that Ubre Blanca 38 produce even greater quantities of milk 39 her nutritional intake (alimentacion) was improved. 40 suggestion was implemented (realizada) and since 41 the cow has responded by 42 her own record five times.

Fidel Castro 43 on a sugar and cattle farm as a 44 and has taken a personal 45 in the development of the Cuban 46 program. The objective of this program is to 47 a 'tropicalized holstein' that will produce 48 much milk as a 49 cow in a country like Canada 50 has a temperate climate.
SECCION C-2

Palabras para llenar los espacios del reportaje

En cada grupo, subraye la palabra correcta correspondiente a cada espacio enumerado.

| 31. | months | days | hours | weeks |
| 32. | visited | visiting | visit | visits |
| 33. | before | until | while | after |
| 34. | she | it | I | he |
| 35. | that | one | ten | this |
| 36. | production | productive | products | produced |
| 37. | a | this | one | the |
| 38. | must | will | might | can |
| 39. | how | if | that | where |
| 40. | its | her | his | my |
| 41. | then | there | yesterday | when |
| 42. | break | broken | breaks | breaking |
| 43. | lives | lived | live | living |
| 44. | boy | children | student | girl |
| 45. | interested | interesting | interest | interests |
| 46. | gene | geneticist | genetically | genetic |
| 47. | develops | develop | development | developing |
| 48. | as | very | little | too |
| 49. | Cuban | Cebu | holstein | Canadian |
| 50. | that | when | why | who |
RAW SCORES ON PROFICIENCY TESTS  
(For 1981-82 Controlled Matched-Group Experiment)

GROUP I

The sets of scores in Group I show how six groups of students from the Central University of Las Villas in the city of Santa Clara were matched with six groups of students from the Higher Polytechnical Institute Jose Antonio Echeverria in Havana on the basis of mean and standard deviation. (See Chapter V, Section 5.2)

ARCHITECTURE GROUPS

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24.56 25.18 25.25 27.64
8.25 7.39 5.45 8.84
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- **Average:** 21.72, 16.66, 22.4, 18.83, 21.53, 22.88, 21.17, 20.61
- **Standard Deviation:** 6.55, 5.82, 5.98, 6.04, 6.85, 5.33, 6.61, 5.99
### CHEMICAL ENGINEERING GROUPS

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GROUP 2

The sets of scores in Group 2 are those of the matched groups obtained on the proficiency test administered first in Sept. 1981 (before the course began) and then again in June 1982 (when the course was over).

Note that there are results for only four -- rather than six -- pairs of matched groups. (This discrepancy is discussed in Chapter VI.)

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TEACHERS' EVALUATION OF 1981-82 STUDY

This survey deals with two things: a) aspects of the first year course and b) the 1st year research project.

I FIRST YEAR COURSE

1. Tick (✓) the academic course(s) in which you have taught 1st year English at ISPJAR:

<table>
<thead>
<tr>
<th>1981-82</th>
<th>1980-81</th>
<th>1979-80</th>
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<tbody>
<tr>
<td>Courses prior to 1979 - 80</td>
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2. Please evaluate the following aspects of the course(s) you have taught as G (Good); F (Fair); P (Poor). If any aspect does not apply to any particular course, please leave the space blank.

<table>
<thead>
<tr>
<th>Aspect</th>
<th>81-82</th>
<th>80-81</th>
<th>79-80</th>
<th>prior 79</th>
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<tbody>
<tr>
<td>lesson plans for the teacher</td>
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<td>theoretical background and explanations of teaching</td>
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<td>items for the teacher</td>
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<tr>
<td>presentation of grammatical items</td>
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<td>grammatical explanation to students</td>
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<td>linking exercises between chapters</td>
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<td>exercises for comprehension of readings</td>
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<tr>
<td>logical sequence and progression of teaching items and exercises</td>
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<td>reinforcement of reading skills</td>
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<tr>
<td>study notes for the students</td>
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<tr>
<td>student participation and interest</td>
<td></td>
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<tr>
<td>student achievement in terms of ability to:</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- infer meaning of words</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- extract the essential information</td>
<td></td>
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<tr>
<td>- make a summary (in Spanish)</td>
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<tr>
<td>- skim and scan</td>
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<tr>
<td>expansion of the student's vocabulary</td>
<td></td>
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<tr>
<td>- understand relationships between ideas</td>
<td></td>
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</table>
3. (a) Do you feel that your knowledge of language or of language teaching has in any way improved or increased as a result of working with the experimental materials (1980-81 or 1981-82)?

Yes ______ No ______

(b) If 'yes', in what way? ________________________________

II RESEARCH PROJECT

4. Please evaluate the following aspects of the research as G F P or N/O (No opinion).

<table>
<thead>
<tr>
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<tr>
<td>explanation of the design of the</td>
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<tr>
<td>experiment</td>
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<tr>
<td>organization and assignment of</td>
<td></td>
</tr>
<tr>
<td>tasks &amp; activities</td>
<td></td>
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<tr>
<td>control of assigned work</td>
<td></td>
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<tr>
<td>usefulness of research</td>
<td></td>
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</tbody>
</table>

5. (a) Do you feel that you have learned as a result of being a member of the research project/team?

Yes _____ No _____

(b) If 'yes', in which of the following aspects? (Mark with X)

- the design of the experiment ______
- the matching of subjects ______
- the use of statistical analyses ______
- the interpretation of results ______
- the organization of tasks ______
- other(s) ________________________________
III GENERAL COMMENTS

(Please make any comments about the first-year course -- in this or any previous years -- and/or the research project.)
Example of Teachers' Evaluations of Individual Classes

Evaluation of Class I
prof: Roberto Ciba
# of students: 182

General Evaluation: 5

Length of class: The length of the class was appropriate for the time it required.

Content of items: The contents of the different items the class dealt with were developed in the best way that was needed. The students liked the content of the class as a whole in the same way as it was developed.

Form of presentation: The presentation was ok.

Specific Problem: To my opinion, ex. 5 in the student's materials could have been used in a better way.

In that exercise we may not only search for adjectives but for cognates, false cognates, noun endings and prepositions as well. This could be used as a conclusion. Besides, other questions could be asked concerning those items at the time we check the exercise, and thus, we can have a better conclusion.
Evaluation of Class II

prof: Roberto Cubo

# of students: 182

General Evaluation: 4

Length of class: The class was too long to be developed perfectly in just 120 minutes. The point of the class (items) that influenced us was 2.2 and 2.3.4

Content of items: The contents were selected correctly, but their development wasn't.

If the chapter dealt with The Present Tense Simple and Progressive why don't we include some little grammatical teaching points on those aspects to make the students remember them.

Form of presentation: see next point.

Specific Problems: Point 2.2. Reference. This point is always very difficult to the students. I think that if an example is given in Spanish to make them see that reference really exists in all languages and that it is very important to know how to determine it, the comprehension of the item would be better.

Developing it...
Evaluation of Class

prof: Roberto Caba

# of student: 

General Evaluation: 

Length of class: It was ok.

Content of Item: 2.6. Chart 7

Could it be better to add some questions or at least one, with What, Where, etc. to make them see the relation of the form of the verb and the use of the auxiliary in the past and the past tense of the verb in the answer. What about the list Progressing tense? This should be dealt with if it is taken into consideration the chapter. Form of presentation: It was ok.

Specific Notes:
Evaluation of Class II

prof: Robert Ciba

# of students

General Evaluation: 4

Length of class: ok.

Content of items: ok.

Form of presentation: 4, 7, none

Specific Problems: 2, 4, 3, 1

This is very difficult. I've been thinking of other forms of developing it, but haven't found an appropriate one.

2, 4, 4

This is somewhat complicated for them. It would have been better to give them a little bit more, and if necessary in Spanish in some instances.
Evaluation of Class II

prof: Roberts A6a

# of students

General Evaluation: 4

Length of class: too long (due to the exercises)

mainly ex. 5, 6 and 7.

Content of items: ok.

Form of presentation: ok


This was easier than other exercises of the same type because the numbers were very easy to find. Nevertheless, it was yet complicated.
Evaluation of Class III

prof. Roberto Caba

General Evaluation: 4

Length of class: OK (although we had not plenty of
time to develop it.)

Content of text: What about the Simple and
Progressive
future tense or Active voice? It would have
been good to give them at least the main
cues for their grammatical formation; if a
in your class at least in the next.

Form of presentation: ok

Specific Problems: Ex. 1 students materials
question 2

The reference in some instances is a
what difficult to notice as in sentence e.g.
the last in sentence 4 that could be of two;
back and forward.
APPENDIX D

READING EXERCISES 1981-82 FIELD STUDY
(FOR READING PASSAGES IN TECHNICAL ENGLISH)

- TRADITIONAL APPROACH
  (pages 429-472)
  - Electronics ....... 429
  - Galileo ............ 435
  - Gravitation ....... 442
  - Glass ............... 447
  - Plastics ............ 453
  - Density ............. 458
  - Large Numbers ...... 463
  - Energy ............. 468

- EXPERIMENTAL APPROACH
  (pages 473-526)
  - Electronics ....... 473
  - Galileo ............ 479
  - Gravitation ....... 487
  - Glass ............... 494
  - Plastics ............ 502
  - Density ............. 511
  - Large Numbers ...... 516
  - Energy ............. 523
Primera edición, 1979
Cubierta: Emilio Llenín

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EDITORIAL PUEBLO Y EDUCACIÓN
Calle 15 No. 604, entre B y C,
Plaza de la Revolución, Ciudad de La Habana.
PRESENTACIÓN

Este texto ha sido redactado para los estudiantes de Ingeniería que requieren el Inglés Técnico. Esta forma especializada del Idoma se imparte en este nivel de enseñanza para formar en el estudiante capacidades y habilidades lingüísticas que le permitan leer e interpretar textos técnicos escritos en lengua inglesa; es por esto que el objetivo principal de este material docente es enseñar las estructuras gramaticales principales en el Idoma, así como un vocabulario científico-técnico general que permita al alumno, posteriormente, leer escritos de su especialidad, en los que generalizará y aplicará integralmente los conocimientos aquí adquiridos.

Al preparar este libro se parte de la premisa de que los estudiantes tienen un conocimiento previo de la asignatura adquirido en el nivel medio superior, pero también se tiene en cuenta que el nivel de ellos es heterogéneo, debido principalmente a la diversidad de vías de ingreso a la universidad. Por este motivo se estimó oportuno adecuar este material, que responde plenamente a la metodología para impartir las clases, a las características objetivas de nuestro alumnado.

Este trabajo se basa en la experiencia adquirida en varios cursos de labor en las Facultades de Tecnología de la Univ. de La Habana y Oriente, por lo que constituye un esfuerzo conjunto del Dpto. de Idoma de la Escuela de Ciencias Básicas y la Sección de Idoma de la Facultad de Tecnología de las respectivas universidades.

CIUDAD UNIVERSITARIA "JOSE ANTONIO ECHEVERRIA"
Julio de 1975
"AÑO DEL PRIMER CONGRESO DEL PARTIDO"
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READING SELECTION

ELECTRONICS

Electronics is a subject that is developing into a field of many subdivisions. The application of electronics to everyday life and industry is increasing now.

Scientists are very ingenious and devise many ways of utilizing electronics. Some electronic machines have mechanical senses. They are able to see, hear, touch and smell; they combine these senses in their mechanical brains to remember, measure, count and talk. They do all these things with great accuracy. The electron makes possible these actions and these machines. We cannot tell exactly what an electron is or what it is like because it is too small to see, even with a powerful microscope. It is one of the smallest particles in the universe and it has negative electricity.

When we observe the effect that the electron produces under certain conditions, we can learn its general properties.

Electrons can see things that the eyes of men do not see. They can detect things of the past that we do not know.

Electrons can smell smoke and help prevent fires. Electrons can determine the thickness of the paint on an automobile. They can feel the temperature and control the operation of a furnace in a factory.

They record everything and remember details for a long time with great preciseness.

Another important quality of electrons is their use as high speed calculators. They perform mathematical operations instantly.

Three hundred billions of billions of electrons weigh 0.28 grams.

In what way is it possible that these small particles do all these wonderful things?

Electrons are infinitesimal particles with a negative charge that whirl at high speed around the cores of atoms.
To work they have to be set free from various substances in one of three ways: by heat, by the action of light and by bombardment or collision with other electrons.

VOCABULARY

subject = theme; one of the branches or disciplines of learning.
Ex. Mathematics is a subject.
develop = to become bigger and better; to grow.
field = area; sphere of activity.
increase = augment; get bigger; to get greater in dimension or quantity.
develop = to invent; plan.
way = manner;
sense = perception. Any special faculty of sensation (see fig. 1).
brain = mass of nerve tissue inside the head (fig. 2).
remember = to keep in the memory; to think of again.
measure = to determine the dimension, distance, quantity; etc.
accuracy = exactitude, preciseness.
cannot = auxiliary verb that denotes impossibility.
like = similar.
too = in excess; extremely.
even = Sp. aun
powerful = strong; having great force.
smoke = mixture of carbon and gases that results from fire (see fig. 3).
help = co-operate; be of use.
fire = combustion (fig. 3).
thickness = fig. 4.
paint = colored film that covers an object (fig. 6).
feel = to perceive through physical sensation.
You feel through the senses.
furnace = place where metals change to liquid state.
to record = to register; to keep note of things that occur.
detail = a small part or piece.
a long time = much time.
high speed = very rapid.
perform = do, make; put into effect.
weigh = to use a balance to weigh objects (fig. 7).
charged = full of electricity.
whirl = rotate, revolve; circular movement (fig. 5).
speed = velocity. The act or state of moving rapidly.
core = center, nucleus.
around = fig. 8.
heat = high temperature. In physics, a form of energy.

OPPOSITES
increase ≠ decrease
remember ≠ forget
small ≠ large
cannot ≠ can
high ≠ low

SYNONYMS
help = aid, assist
wonderful = extraordinary
small = little
large = big, great
charged = loaded
EXERCISE VII

Answer the following questions about the reading selection.

1. What is developing now?

2. What do scientists invent?

3. Do all electronic machines have mechanical senses? Give a complete answer.

4. What actions can they do when they combine these senses in their mechanical brains?

5. What makes these actions possible?

6. Can we see an electron? Why?

7. In what way can we learn the characteristics of the electron?

8. In what other way can we use another important quality of electrons?

9. Around what do electrons whirl?

10. What is necessary for an electron to have power?

EXERCISES VIII

Fill the blanks with words from the following list:
prevent - core - perform - whirl - smell - talk - measure - fire - forget - accurate - increase - help - tell - remember

1. The central part of an atom is the ______________.

2. Electrons ______________ at high speed.

3. Smoke is the result of ______________.
4. Electronic machines are ____________
5. They ____________ fires.
6. ____________ and ____________ are opposite actions.

EXERCISE IX
Match the sentences in column "A" with their corresponding endings in Column "B". Use numerals.

"A"                      "B"
1. Electrons are also necessary  __ calculations with great accuracy.
2. It is impossible to see an electron  __ even with a strong microscope.
3. The core is the  __ prevent fires.
4. Electrons help to  __ from various substances.
5. Heat sets free electrons  __ increases every day.
6. The application of electronics to different fields  __ the furnace in a factory.
7. Electrons can control  __ synonym of to rotate.
8. To whirl around is  __ In their mechanical brains.
9. Electronic machines perform  __ central part of the atom.
10. Electronic machines combine their mechanical senses  __ as high speed calculators.
     __ is an important subject.
     __ are developing a new device.

EXERCISE X
Match the words in column "A" with their corresponding synonyms in column "B". Use numerals.

"A"                      "B"
1. accuracy  __ Invent
2. powerful  __ make
3. devise  __ velocity
4. perform  __ precision
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<tr>
<td>10</td>
<td>way</td>
<td>certain</td>
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Galileo Galilei discovered the principles of the pendulum around the year 1583. He was watching the motion of the candelabra in the Cathedral of Pisa. The candelabra swung from side to side. The consecutive swings were becoming smaller and smaller as the candelabra was slowly coming to rest.

Did the time of each swing become smaller? He did not know the answer and decided to measure the time by counting his own pulse. To his surprise he discovered that although the swings were becoming shorter and shorter, their duration in time did not change; they remained exactly the same.

He repeated the experiment with a stone tied to the end of a string and found the same result. He also discovered that for a specific length of the string the oscillation period remained the same, no matter how heavy or how light the stone in his experiment was. This was the origin of the familiar device that we call pendulum.

It is possible to repeat the measurements that Galileo made by using the apparatus known as the simple pendulum. This consists of a small heavy object, such as a sphere of lead (Pb), the bob, which hangs from a stationary point by a length of strong, but thin, thread. A convenient method of suspending the pendulum is to clamp the thread firmly between a pair of glass prisms. In this way it is possible to alter the length of the thread and investigate the effect on the time of swing.

We can measure the time for several sequences of ten complete pendulum swings, for example, by using a stop-watch. You can see that when the length of the pendulum (i.e., the distance between the centre of the bob and the point of suspension) remains...
the same, then the periodic time, or time for one to-and-fro swing of the pendulum remains constant. Besides, the amplitude of the swing (half the distance through which the bob moves) does not affect the periodic time of the pendulum, when this amplitude is small compared with the length of the pendulum.

When the lead bob is hanging freely under the influence of gravity and we move it to one side of this equilibrium position, there is a displacement to the side and also a rise of the bob.

Consequently, the kinetic energy we use to move the bob from the mid-point of its path when it is swinging, changes into potential energy. When you release the bob from this position, it falls under the influence of the Earth's gravity, losing potential energy, but gaining kinetic energy. As the bob passes through its equilibrium position, all the potential energy becomes kinetic energy again, and the bob is travelling at its maximum speed.

This kinetic energy is sufficient to produce the oscillation of the pendulum.

VOCABULARY

watch - observe.
motion - movement; the act or process of moving.
candelabra - a hanging lamp with several candles. (See fig. 1)
swing - v. oscillate n. oscillation. (See fig. 2)
become - verb that implies transformation or change of state; come to be.
rest - absence of motion, immobility.
each - everyone of two or more considered separately. Ex.: Each student has a book.

own - used to emphasize possession.
although - a word that introduces an unexpected result.
remain - stay.
stone = rock.
tie - to connect with a band, rope, or cord.
string = cord.
no matter how... = not considering; without taking into consideration.

device = (n) a mechanical invention or apparatus used for a special purpose.

bob = sphere or similar object that hangs from a cord or string. (See fig. 2)

length = (from long) in this lesson, a specific portion of cord.

thin = with little space from one side to the opposite side. (See fig. 3)

thread = fine cord. (See fig. 4)

clamp = (figuratively) hold firmly as with a clamp. (See fig. 5)

pair = a group of two.

stop-watch = a watch that we can stop in order to measure seconds.

I. e. = that is (See fig. 6)

to-and-fro = first in one direction and then in the opposite one, repeatedly.

Ex. A pendulum moves to-and-fro.

hang = suspend.

displacement = act of moving from its usual or original position.

rise = (n) ascent. (See fig. 8)

path = route, course.

release = liberate.

fall = drop or come down from a higher place.

lose = not to have any more. (See fig. 7)

gain = acquire; obtain.

again = another time (indicates repetition).

travel = move; proceed; pass Ex. Light and sound travel in waves.
EXERCISE VI

Answer the following questions according to the reading.

1. When did Galileo discover the principles of the pendulum?

2. What was Galileo doing in the Cathedral of Pisa?

3. What did Galileo use to measure the time of the consecutive swings?

4. What was surprising about the motion of the candelabra?

5. What did Galileo use in his second experiment?

6. What did he find this time?

7. What are the principal parts of the simple pendulum?

8. Is the weight of the bob determinant for the oscillation period?

9. Does time vary with the length of the string?

10. When is the bob travelling at its maximum speed?

EXERCISE VII

Fill the blanks with words from the following list.

loses - swing - measured - light - fall - law - tied - remained -
thread - pair - rise - thin - bob - hangs - to and fro - path -
passes - heavy

1. At the end of its _______ the speed of a pendulum is moment-
arily zero.

2. Galileo _______ a stone to a string.

3. The oscillation period _______ the same.
4. A pendulum moves ___________.

5. No matter how _________ or how _________ the stone is, the oscillation is the same.

6. The _________ is a lead sphere.

7. The pendulum _________ freely under the influence of gravity.

8. The bob moves along a definite ___________.

9. When the bob _________ potential energy, it gains kinetic energy.

10. When the pendulum _________ through its equilibrium position, it is travelling at its maximum speed.

EXERCISE VIII

Select the correct definition of the words.

1. stop watch
   a watch with a pendulum
   a very accurate watch
   a watch that you can interrupt
   to stop
   to hold firmly
   to lose
   the act of changing the position of an object.

2. clamp

3. displacement
   the act of going to an opposite position
   the act of changing the direction

4. travel
   to gain velocity
   to move
   to continue in the opposite direction

5. rest
   to be moving
   to be immobile
   to be hanging
EXERCISE IX
Match the words in column "A" with their corresponding opposites in column "B".

"A"  "B"
1. Immobility  ___ larger
2. smaller  ___ gain
3. rapidly  ___ thick
4. thin  ___ motion
5. lose  ___ slowly
     ___ pair
     ___ thick

EXERCISE X
Match the words in column "A" with their corresponding synonyms in column "B".

"A"  "B"
1. observe  ___ motion
2. oscillate  ___ device
3. stay  ___ remain
4. string  ___ swing
5. movement  ___ watch
     ___ cord

EXERCISE XI
Fill the blanks with the past form of the verb in parenthesis.

1. The wind ___________ (be) strong. The candelabra ___________ (swing) to and fro.
2. Galileo ___________ (make) a simple pendulum. He ___________ (use) it in his experiments.
3. Last year we ___________ (decide) to have a new laboratory. We finally ___________ (install) the laboratory last December.
4. We _________ (watch) the objects: one was heavy, the other was light; but they _________ (fall) on the ground at the same time.

5. Thomas _________ (choose) the long telescope. I _________ (prefer) the short one.

6. The experimenter _________ (stop) the watch. It _________ (indicate) ten seconds.

7. Isaac _________ (find) the solution to the problem, but it _________ (take) him a lot of time.

8. We _________ (hang) the pendulum. We _________ (hold) its thread firmly between two prisms.
When you take a pencil in your hand and let it drop, it falls to the floor. In the same way, when you observe the falling leaves of a tree as they fall to the ground you will see that they drop to the ground, they fall downward.

Water runs downhill; a ball will roll downhill. An automobile will run downhill with its engine disconnected, but you need the power of the engine to take the car uphill. You will go down a hill without pedaling your bicycle, but it requires your human effort to pedal the bicycle uphill.

Everything on Earth obeys this attraction toward the Earth. This force that attracts all things is gravitation. Through this force the Earth is attracting all things that are on it, and all things that are on it are attracting the Earth. Not only this, but, every object on Earth attracts every other object, no matter how small it is or how apart they are. The masses of the Sun and the Earth are very big and even at a distance of 93 million miles they attract each other with a force of 4 trillion tons.

Greater bodies have greater attracting force than smaller bodies.

Gravitation is, to be sure, only one of the forces of the Universe, but it is a very powerful one. It is acting all the time and we find sufficient and constant demonstration of its constancy in the work that is necessary when we want to perform or stop any movement against the line of its action.

Gravitation is the force responsible for the balance of the Universe. It acts according to a law Isaac Newton discovered in the 17th century. We can state the law in this way: Every body of matter in the Universe attracts every other body along a straight line between them.

This law states that every single particle of matter in the Universe attracts every other particle with a certain force. The entire body of the Sun, consequently, is pulling on every individual atom that composes the Earth and vice versa.

The force of attraction varies directly according to the product of their masses, and inversely according to the square of the distance between them. In other words, the force is greater between large,
heavy objects; it is greater between near objects. Greater objects have a greater attracting force.

When a thing starts to fall, it falls faster and faster as it approaches the Earth. For example, when you stand on top of a building that is 1248 feet high and drop a rock, it will travel at a rate of 16 feet the first second. This rate is going to increase considerably for each further second, and will be 48 feet in the next second, 80 feet in the third second, 112 feet in the fourth, and so on.

Finally during the tenth second, the approaching rock will hit the ground at a rate of 804 ft/sec. As the rock approaches the Earth, the Earth's pull on it increases.

VOCABULARY

let = permit
drop = fall down (see fig 1)
floor = ground; where you stand.
leaves = plants have leaves (see fig. 1)
run = (in this lesson) to move, (see fig. 2).
roll = movement proper of round objects (see fig. 3).
hill = an elevation of the ground (fig. 4).
power = capacity for action; force or energy applicable to work.
engine = motor.
require = necessitate, need.
obey = to act with obedience.
each other = expresses reciprocal action.
building = edifice. (see fig. 5).
law = statement of a relation or sequence of phenomena invariable under the same conditions; law of gravitation.
state = (in this lesson) express.
straight = direct; not curved (see fig. 7).
single = one, singular.
next = the one that comes after.
further = additional, subsequent.
certain = specific.
pull = force of attraction. (see fig. 6)
to pull = to exert force upon as to cause
motion in the direction of the force.
square = number multiplied by itself.
hit = strike
heavy = Iron (Fe) and Lead (Pb) are heavy.
near = that is not distant. (see fig. 8)
start = begin, commence.
fast = rapid, quickly.
approach = to come near; approximate.
top = upper part. (see fig. 9)
rate = proportion between 2 magnitudes.
and so on = etc...

SYNONYMS

entire = complete, total
way = manner, form
large = great, big

OPPOSITE

near ≠ distant, far apart
heavy ≠ light
large ≠ small
top ≠ bottom
downward ≠ upward
downhill ≠ uphill
connected ≠ disconnected
attract ≠ repel

EXERCISE VI

Answer these questions in reference to the reading:

1. What will happen to any object that you drop?
2. What does gravitation do?

3. What is necessary for a person to go up to the second floor?

4. Which things does gravitation affect?

5. What bodies have greater attraction?

6. What determines the equilibrium of the Universe?

7. What does the law of Gravity express?

8. What varies in Newton's law?

9. When is the force of attraction greater between 2 objects?

10. When does the rate of fall of an object increase?

EXERCISE VII

Fill the blanks with words from the following list:

PULLS - ROLL - FALLING - SINGLE - PUSHES - EACH OTHER
DROP - APPROACH - DOWNWARD - UPWARD - TOWARD -
REQUIRE - FURTHER - OBEY - ATTRACTING - VARYING - RUNNING

1. When you _______ a pencil it falls downward.

2. The force of gravity ______ objects ________ the Earth.

3. Two large, heavy objects attract ________.

4. All round things ________.

5. Every ________ particle of matter attracts every other particle in the Universe.

6. The speed of a ________ object increases gradually.

7. Objects fall faster as they ________ ________ the Earth.

8. The rate of fall increases with each ________ second.
9. Magnetism is an _________ force.

10. _________ water from rivers is fresh and clear.

EXERCISE VIII

Underline the correct form of the verb in parenthesis according to the time expression or to the reading selection.

1. The students (observe - are observing - will observe) the fall of objects to demonstrate gravitation in class tomorrow.

2. They (need - are needing - will need) several examples to calculate the rate of fall in the next class.

3. The professor (demonstrate - demonstrated - is demonstrating - is going to demonstrate) the formula according to Newton's law last class.

4. Gravitation (affects - affected - will affect) all bodies that exist.

5. Newton's law (states - will state - is stating) the facts about gravitation.

6. A thing (falls - is falling - will fall) faster as it approaches the ground.

7. The rock (travels - will travel - travelled) at a specific rate of velocity each further second.

8. The rate of velocity (increases - is going to increase - increased) until the object hits the ground.

EXERCISE IX

Fill the blanks with the correct preposition from the following list:

Along - Against - With - Of

1. A car ______ its engine disconnected will run downhill.

2. The force ______ gravity is very strong.

3. Electrons move ______ a wire made ______ copper.

4. Upward movements go ______ gravitation.

5. When gravity attracts an object it moves ______ the line of attraction.
Ordinary sand appropriately blended with other substances is the principal ingredient for making glass. Windowpanes and mirrors are made of glass; so are bottles, fruit jars, drinking glasses and many dishes. Glass tubes and lamps form an essential part of radio and television sets. Glass is used for the lenses of still and motion-picture cameras. Faraway stars are made visible by the big lenses of the telescope, and extremely small organisms are brought into view by the delicately adjusted lenses of the microscope. Glass insulators are widely employed in the electrical industry; glass blocks are needed in building construction.

In brief, glass is a basic material of modern life.

Nature was the first glassmaker. Glass was first formed out of sand (silicon and oxygen), soda (alkaline compounds) and lime (a compound of calcium and oxygen) in a natural process. Obsidian, for example, is a natural glass. This process was then imitated by man: soda and lime or other substances were added to sand; the mixture was fused under intense heat and finally the molten mass was shaped. Romans were remarkable in the art of making glass. By the end of the eleventh century all the fundamental glass forming processes were known. Until the late 1700's, advances in the glass industry were limited to the discovery of a few new raw materials and to the development of artisan's skills. Then machinery was introduced.

Today the industry is almost completely mechanized, though hand operations are still used in some small-volume specialized fields. Modern glass technology provides new ingredients and modifies the heat treatment to bring about a variety of desired properties.

Some steps are commonly followed in the process of making glass:

1) Sand and other materials are assembled to form what is called the glass batch.

2) These materials are melted in a furnace at a very high temperature and produce molten glass.

3) While the glass is molten, it is shaped and made to cool. A rigid piece is formed.

4) The glass article is annealed; that is, it is reheated and then
gradually cooled. By this process we obtain different kinds of glasses. They differ according to the properties they exhibit. To produce these different properties, the composition of glass, the heat treatment, and the process of formation are varied in many different ways.

Mirrors. When plate glass is coated on one side, it becomes a mirror. Two chemical solutions are made to react at the glass surface, causing metallic silver (Ag) to be deposited upon it. The silver surface is usually protected from scratching by a coat of paint.

Optical glass. Certain kinds of glasses, used for lenses and prisms, require specific light-transmitting properties. They are called optical lenses. Optical glass is manufactured from chemicals of the highest purity, and exceptional care is taken in weighing and mixing the materials.

Color filter glasses form a special group of optical glasses. By means of a special glass or combination of glasses, it is possible to filter out any color represented in the light spectrum.

These are only two of the many kinds of glass produced today. Surely new ingredients will be discovered and new varieties of glass will be obtained.

VOCABULARY

ordinary = common, usual.
sand = the product of desintegrated rocks, as in: the sands of the desert. (see fig. 1)
blend = combine, fuse, mix. The combining of particles, parts or elements.
in brief = in short. (See fig. 2)
set = In this reading: device, apparatus.
still = without motion, quiet.
insulator = material that does not permit the passage of electricity or heat.
mixture = a product formed by the combination of two or more things.
melt = change from solid to liquid state. by heat. (melted p. melted, molten pp.) (See fig. 3) widely = extensively. bring about = cause, effect. raw = in the natural state; not manufactured, treated or prepared, as in: raw material. provide = supply, satisfy a need. (See fig. 4) treatment = from the verb treat, that is, to submit to a process. batch = a mixture of materials ready for fusion into glass. anneal = to make resistant by heating and then cooling. plate = a thin, flat piece of any material. coat = in this reading, cover with a finishing or protecting film. scratch = break, mark or cut slightly with something sharp or rough.

SYNONYMS

blend = mix
fuse = melt
shape = form
assemble = gather
bring into view = make visible
motion = movement, moving
development = advance
kind = type, sort

EXERCISE VI

Answer these questions in reference to the reading:

1. What is the fundamental component of glass?

2. Is it possible to consider nature as the first glassmaker? Explain your answer.

OPPOSITES

Insulator / conductor
moving / still
faraway / near
3. In what way did man learn to make glass?

4. What form of energy is indispensable in glass making?

5. What increased the production of glass?

6. On what do the properties of glass depend?

7. When does a piece of glass become a mirror?

8. What characterizes optical glasses?

9. Mention some kinds of glasses widely used today?

10. Why is glass a basic material of modern life?

EXERCISE VII
Tell whether the following sentences are True or False.

1. Glass is a good conductor of electricity. _______

2. Furnaces are commonly used to melt ingredients. _______

3. The basic material in the glass industry is lime. _______

4. Lenses constitute a special kind of glass. _______

5. The glass is first shaped, and then molten. _______

6. Optical glass is manufactured from chemicals of great impurity. _______

7. Microscopes, telescopes and cameras use optical glass. _______

8. At present, machinery is used in the production of glass. _______
EXERCISE VIII

Match column "A" with column "B".

A
1. Common sand
2. A T.V. tube
3. Microscopes
4. We vary the composition of glass
5. The process of production
6. Glass industries
7. Glass blocks
8. The existence of glass
9. Silicon and oxygen
10. A compound of calcium and oxygen

B
   __ is called lime.
   __ helps the advance of science.
   __ are necessary in glass making.
   __ help the laboratorist in his investigations.
   __ to obtain different properties.
   __ is the principal ingredient of glass.
   __ are almost entirely mechanized.
   __ are used by architects.
   __ is different for different types of glass.
   __ is made of glass.

EXERCISE IX

Fill the blanks with the correct word from the list.

furnace  heat  set  tubes  glass  insulator
sand  mixture  raw  mirrors  lenses

1. ________ reflect the light, _________ transmit it.
2. In the electrical industry _________ is used as an _________
3. A combination of substances is a _________.
4. The _________ in the _________ melts the materials.
5. Sand is the basic _________ material for making glass.
EXERCISE X

Rewrite these sentences using a synonym in place of each underlined word.

1. Sand is mixed with other substances to make glass.

2. In the furnace the mixture is fused at high temperatures.

3. Glass may be formed in different ways.

4. The advance of this industry depends on new discoveries.

5. Unicellular animals are made visible by the microscope.

6. Many sorts of glasses are produced today.

EXERCISE XI

Select the correct word in parenthesis.

1. Nature (provides - breaks - permits) us with materials and examples.

2. The heat (treatment - product - batch) is varied to obtain different properties.

3. We (exhibit - react - anneal) the glass to make it strong.

4. (Near - faraway - infinitesimal) objects are seen with telescopes.

5. We (blend - scratch - shape) sand and other substances to make glass.

6. (Bad - still - motion) pictures are presented in very rapid succession.
The development of synthetic plastic materials represents one of the great triumphs of the organic chemist. The term "plastics" used by the modern plastic industry, refers to certain substances manufactured from organic compounds, that is, from combinations of carbon with hydrogen, oxygen, nitrogen and other elements. The term does not include inorganic molding materials, such as concrete, cements, and ceramics, nor the organic substance we call rubber.

The four principal types of organic plastics (not including rubber) are synthetic resins, natural resins, cellulose derivatives and protein substances.

We use synthetic resin plastics to make nylon clothes, unbreakable phonograph records, the plug of electrical appliances and many other everyday products. The chemist is able to produce resinous materials that are as hard as stone, as transparent as glass, as elastic as rubber. When these materials are combined in the proper way, they can be molded into products that are strong and lightweight, and that resist moisture, moderate heat, sunlight, hard wear and acids.

Natural resins are generally known by their common names, such as shellac, resin, asphalt and pitch. Natural resins are widely used in industry for the production of the fusible type of molded product. These hot-molding compositions are prepared by mixing shellac, rosin and asphalt with suitable fillers. Compositions containing shellac are used in electrical insulators for high-voltage equipment, in telephone parts and in phonograph records. The term resin and rosin are often confused. Rosin is a natural resin recovered as a solid residue after distillation of turpentine from pine tree extracts.

Cellulose derivatives. This type of organic plastic is probably the most widely used. The celluloid plastic used for making toys, pens, pencils, etc.; the cellulose acetate; the familiar cellophane and the common type of rayon, all belong to this group of plastics. The basic raw material, cellulose, is obtained from ordinary cotton or pulped wood. Treatment with chemicals converts cellulose into
compounds that take any desirable shape. These plastics conduct heat slowly and can be tasteless, odorless and transparent. Their uses include photographic film, safety glass, lacquers, etc.

**Protein plastics**: These plastics are obtained from different sources, such as milk and soybean. These proteins are processed into a colloidal mass and finally formed into sheets, rods or tubes. The resulting product is used to make small articles such as buttons, beads, buckles, and other accessories.

**VOCABULARY**

- **triumph** = victory.
- **rubber** = an elastic substance obtained from (see fig. 1) the juice of various tropical plants.
- **plug** = a piece used to fill a hole. Device to make an electrical connection (fig. 2).
- **common** = ordinary.
- **lightweight** = having little weight / heavy weight. (see fig. 3)
- **moisture** = humidity.
- **hard wear** = much wear. (see fig. 4)
- **shellac** = Sp. goma laca.
- **pitch** = Sp. betún, brea, alquitrán.
- **suitable** = adequate, proper, correct.
- **belongs to** = is a part of, is the property of.
- **toy** = play thing for children. (see fig. 5)
- **rosin** = Sp. pez rubia.
- **filler** = a substance added to another one to increase its volume, weight, viscosity etc.
- **recovered** = got back, regained. (see fig. 6)
- **turpentine** = aguarrás, trementina. (Sp.)

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sheet = a thin piece of paper or any other material. (see fig. 7)
rod = a thin, straight bar of metal or wood. (see fig. 8)
beads = small balls or disks of glass, metal, etc. (see fig. 9)
buckles = Sp. hebillas.
desirable = that is desired.
cotton = Sp. algodón.
source = place of origin, from which... anything is obtained.
appliances = devices, instruments, etc.
term = word.
chemicals = substances used for producing a chemical effect.

EXERCISE V
Answer the questions based on the reading.

1. What are plastics made from?

2. Is cement an organic or an inorganic molding material?

3. What is one of the principal qualities of the synthetic resin products?

4. What are electrical insulators made from?

5. How is rosin obtained?

6. What is ordinary cotton used for in the plastic industry?

7. Name a very common cellulose derivative plastic used in everyday life.

8. Which compounds take any desirable shape?
9. Which plastics have no taste?

10. Which are the basic raw materials for the production of protein plastics?

EXERCISE VI

A) Find an adequate single-word modifier for each of the following words:

plastic
chemist
industry
materials
substances
clothes
record
plastic
resin
derivative
products
heat
insulators
type
wood

B) Find an adequate phrase modifier for each of the following verbs

industry
combinations
type
insulators
distillation
treatment

EXERCISE VII

Fill the blanks with words from the list:

moisture - plugs - fillers - appliances - shapes -
suitable - sheets - triumphs.

1. One of the great ____________ of the organic chemist is the development of synthetic plastics.

2. Substances added to other substances to increase their volume are called ____________.
3. Cellulose derivatives can be molded into products of different ___

4. Plastics are also produced in thin, light and transparent ___

5. The _____ of some electrical __________ are made of plastics.

EXERCISE VIII

Find, copy and translate:

1. a sentence in the passive voice.

2. a modifier that is a noun and the word it modifies.

3. an -ING modifier and the word it modifies.

4. a past participle or -ED modifier and the word it modifies.

5. An adjective and the noun it modifies.

6. a phrase modifier and the noun it modifies.
DENSITY

Every time you turn on the water in your kitchen or your bathroom, certain powerful forces in liquids and gases are working for you. Engineers have to calculate these forces with great accuracy when they build tunnels under rivers and mountains or construct airplanes that apparently defy the law of gravity.

Liquids and gases are made up of constantly moving particles called molecules. The forces in both liquids and gases are transmitted by these molecules as they strike one another and collide with the objects in their path. Liquids have some of the same properties as gases; they both flow freely from a container and have no definite shape. Liquids are different from gases in some aspects. The molecules of a liquid are held together much more tightly than those of a gas. A liquid will fill a container up to a certain level and the upper surface of the liquid will be horizontal.

A gas, however, will fill uniformly the whole of the container into which it is put. It diffuses or spreads out into the open air if released from the container.

In order to measure accurately the forces within a liquid, we have to know its density; that is, the mass (amount of material) packed into a given quantity of the liquid. We express density in terms of weight per unit volume; thus, we say of a given substance that it has a density of so many pounds per cubic foot (lb./ft.³).

The density of pure water is 62.4 lb./ft.³ when its temperature is 4° C. Alcohol is less dense than water and one cubic foot of it weighs only 50 lbs. Mercury, however, is the densest and therefore the heaviest of the three, because it weighs nearly 850 lbs./ft.³.

We can know the density of any liquid or of any solid by finding out how much a cubic foot or a cubic centimeter of it weighs. If we compare the density of the liquid or solid with that of the same volume of water, we will know what is called its specific gravity. Water is usually the basis of this type of comparisons; and so, we say that the specific gravity of water is 1. A substance half as dense as water has the specific gravity of 0.5. When we say that the specific gravity of mercury is 13.6, we mean that it is 13.6 times as dense as water.
A liquid exerts force on any surface with which it is in contact; and, the denser the liquid, the greater the force it will exert. We measure a force exerted by a liquid in terms of pounds per square foot or square inch and we speak of it as pressure.

**VOCABULARY**

fill = put into until no more can be received

occupy.

kitchen = room where you prepare and cook the food.

turn on the water = open the water faucet.  

(see fig. 1)

defy = (desafiar)

container = box, can, jar used to hold or contain something.

are made up of = consist of.

exert = apply, make an effort.  (see fig. 2)

strike = hit, beat.  (see fig. 3)

collide = to strike together with force, come into conflict: clash.

bathroom = room where you take a bath.

both = the two.

are held together = maintain united, keep integrally.

packed = contained.

tightly = firmly, securely.  (see fig. 4)

whole = complete, entire.

thus = in this way, therefore.

therefore = consequently.

so many pounds = a certain amount of pounds.

however = but.

nearly = almost, approximately.

to flow = to move in a current or stream.

spread out = expand, extend.

specific gravity = (peso específico)
EXERCISE VII

1. What happens every time you open the water faucet in your kitchen?

2. What do engineers calculate when they design a tunnel?

3. What do liquids and gases have in common?

4. Mention a difference between them.

5. What is density?

6. How is density established or stated?

7. Why is it important to know the weight of a liquid?

8. What liquid is used to make density comparisons?

9. What law can you state about the density of liquids?

10. What is pressure?

EXERCISE VIII

Answer the questions based on the reading.
Select the correct ending:

1. Water
   - is as dense as alcohol.
   - is denser than alcohol.
   - is less dense than alcohol.

2. A liquid
   - will fill a container to a certain level.
3. A gas will spread out into the open air.  will fill uniformly the whole container.

4. Density fills a container to a certain level. flows freely from a container. has a horizontal upper level.

5. Mercury is less dense than alcohol is denser than water. is as dense as water.

EXERCISE IX

Fill the blanks with words from the following list:

SOURCE - DEFY - MADE UP - FILL - RELEASE - HOWEVER

SHAPE - WHOLE - STRIKE - THEREFORE

1. All substances are ________ of molecules.
2. All liquids ________ freely from a container.
3. Gases will ________ up all the space.
4. When molecules collide, they ________ each other.
5. If you ________ a gas, it will diffuse rapidly.
6. The density of water is 62.4 lb/ft.³ ________ it is denser than alcohol.
7. Gases have no definite ________.
8. Some modern building apparently ______ the law of gravity.
9. A river is a ______ of water.

EXERCISE X
Match the words in column "A" with their synonyms or definitions in column "B". Use numerals.

"A"
1. kitchen
2. path
3. both
4. tightly
5. spread-out
6. to flow
7. nearly
8. whole
9. exert
10. source

"B"
____ almost
____ complete
____ apply
____ way
____ room where you cook the food
____ the two
____ diffuse
____ to move in a current
____ defy
____ firmly
____ origin

the pieces form a whole

to collide

to release

container
"LARGE NUMBERS"

To express the difference in size between ordinary objects and very small objects such as atoms and their nuclei, we use numbers like million and trillion. The number of atoms in the human body is about 1,000,000,000,000,000,000,000,000; the name for this number is octillion and the usual symbol for it is $10^{27}$. Since this number $10$ raised to the power of 27 (or 10 with the exponent 27) is the same as the number 1 followed by 27 zeros, this exponential notation is more convenient than writing out 27 zeros or using a name like "octillion". You will use the exponential notation almost exclusively and it is important for you to learn it.

Maybe you already know how to write and read these numbers. Even though you write the number 1 followed by 27 zeros, can you really appreciate the magnitude of this number? One way to grasp such size is to visualize a collection of a large number of familiar objects.

Let's start with a few smaller numbers. For example, suppose we have a million ($10^6$) dollars in one-dollar bills. Stack these on top of one another and they make a pile about 185 meters high. Lay this stack horizontally and it is twice the length of a football field. Now we ask what a billion ($10^9$) dollars would look like. Place them horizontally and the stack will be 160 kms. long, from Havana to Varadero. So we see that while a million reaches twice the length of a football field, a billion reaches 160 kms. This shows us how greatly we increase the numbers of things when we jump from a million to a billion by just adding three ciphers, going from $10^6$ to $10^9$.

Next, suppose that we have a trillion ($10^{12}$) dollar bills. This stack of dollar bills would be one hundred and sixty thousand Km. long (160,000) enough to go round the world four times. So we see that as we go beyond the trillions, we deal with distances just as difficult to visualize as the numbers themselves. Therefore, let us try another approach.

Let's take a collection of beans as the next example. Count out a hundred ($10^2$) average-sized beans and you will find that they occupy approximately the volume of a cubic inch.
A million \((10^6)\) beans are just about enough to fill an ordinary refrigerator, and a billion \((10^9)\) will fill a whole two-storied house; thus, a trillion \((10^{12})\) will fill a thousand houses, the number of houses of a medium-sized town, and a quadrillion \((10^{15})\) beans will fill all the buildings in a large city.

Let us try a larger number. Imagine that it is raining beans all over the entire land area of the globe, North America, South America, Europe, Australia, Asia and Africa, so that all the continents are covered with beans four feet deep. This global layer will contain sextillion \((10^{21})\) beans. Then imagine that the oceans are frozen over and the layer of beans covers the entire area of the Earth. Go out among the planets and stars and collect two hundred and fifty planets, each the size of the Earth, and cover each with a similar layer of beans four feet deep. Then you have septillion \((10^{24})\) beans. Finally go out into the remote Milky Way and collect two hundred and fifty thousand \((250,000)\) planets, each the size of the Earth; cover each in exactly the same way four feet deep; and then, at last, you have octillion \((10^{27})\) beans, the number of atoms in your body. So you see what an extraordinarily small object an atom is and how complicated you are.

VOCABULARY

- **size** = dimension.
- **raised** = elevated.
- **power** = (in this lesson) mathematical term that indicates that a number is multiplied by itself the number of times expressed in the exponent, a small number written above and at the right. Ex. \(10\) raised to the 3rd. power \((10^3) = 1000\).
- **even though** = expression that indicates a contrast. Synonym of though and although.
- **grasp** = to understand.
- **visualize** = imagine.
- **bill** = paper money. (see fig. 1)
- **stack** = make a pile. Put one on top of the other. (see fig. 2)
lay = place; put carefully.
twice = two times; double.
foot-ball field = place where the game of foot-ball is played; sport field.
reach = get to,
show = demonstrate.
jump = abrupt upward movement.
just = only
world = planet where we live; Earth. (see fig. 3)
deal = to have to do with; to be in relation with.
try = make an effort or interest.
approach = (in the lesson) manner of studying.
bean = vegetable.
average-size = of a standard or average dimension.
just-about = approximately.
two-storied house = house that has 2 floors or stories.
medium-sized town = town that is not large; that is not small.
   Ex. Trinidad is a town.
city = place where a great concentration of population and buildings are found.
   Ex. Havana is a city.
rain = natural phenomenon; water falling in drops from the clouds. (see fig. 6)
cover = put something over.
layer = film, stratum. (see fig. 7)
deep = profound.
frozen = past participle of the verb "to freeze".
star = luminous body.
milky way = Sp. Vía Láctea,
at last = finally.
SYNONYMS
state = express
small = little
enough = sufficient

OPPOSITES
top / bottom
start / finish, end
ask = answer

EXERCISE VI
Answer the following questions according to the reading.

1. Why do we use large numbers?

2. How many atoms do we have in our body?

3. Why are exponential notations easy to rise?

4. In what way can you understand the size of large numbers?

5. What happens when we go from a million to a billion?

6. What is a pile?

7. What is as difficult to visualize as numbers?

8. How many beans will fill a cubic meter?

9. How deep is the layer in the example?

10. Why do we say that our body is a complicated organism?
EXERCISE VII

Fill the blanks with words from the following list:

GRASP - LAYER - TWICE - JUMP - START - STACK - RAISE
POWER - SHOW - FILL - DEEP - TRY - DEAL

1. The _______ is expressed by the exponent.
2. The examples help you to _______ the ideas.
3. A hundred books will make a big ________.
4. The examples in the lesson _______ the size of an atom.
5. The North Pole is covered with a _______ of snow.
6. The _______ from a million to a trillion is a large one.
7. Mathematicians _______ with numbers.
8. Problems _______ when we use very large numbers.
9. Mathematicians ________ to explain numerical problems.

EXERCISE VIII

Match column "A" with column "B", according to the reading.

1. A quadrillion beans will fill _______ in the human body.
2. The number of things increases _______ a layer 4 ft. deep.
   greatly. _______ is more convenient.
3. A pile is made _______ by stacking objects on top of one another.
4. The exponential notation _______ twice the length.
5. There are octillion atoms _______ twice the length of a football field.
6. A million dollar stack laid horizontally is _______ when we jump from $10^6$ to
   $10^9$. _______ as the numbers themselves.
7. Trillions imply distances as _______ all the buildings in a large city.
   hard to visualize _______ the magnitude of an octillion.
THE NATURE OF ENERGY

What is energy? We are all familiar with some of the forms of energy. Suppose you have a pingpong ball and a baseball. You throw both balls at a window each with a speed of 100 cm/sec. The pingpong ball bounces off harmlessly, but the baseball shatters the glass. Why? Because the baseball has more energy. It is the energy in the motion of the baseball that at the moment of impact breaks into the window pane and tears apart the chemical bonds that held the glass together.

The form of energy associated with motion of this sort is called kinetic energy, and it will be denoted by the symbol $E_k$. It is related to the mass ($m$) and velocity ($v$) of a moving object by the equation,

$$E_k = \frac{1}{2} mv^2$$

In words, this states that the kinetic energy is equal to one-half the product of the mass and the square of the velocity.

Let's consider our example of the two balls that are thrown with the same velocity; the baseball weighs one hundred times as much as the pingpong ball, so it has one hundred times more energy. It is not the ball, but the energy of the ball, that breaks the window; it is not the gasoline, but the energy released by the combination of the atoms of carbon and hydrogen with oxygen in the engine-cylinder, that makes your car go; it is not the food, but the energy of the food, that keeps you alive. This is why the study of chemistry is essentially the study of energy.

Since the things that happen when atoms combine depend largely on how much energy is released, we need to have a measure for energy in order to discuss chemical reactions, just as we need the yard or the meter to discuss distances. The formula for the kinetic form of energy involves mass and velocity, so, in order to arrive at a measure for energy, we take a look first at these two quantities on which energy depends.

Mass and Weight. In defining a unit for matter, it is necessary to distinguish between mass and weight. Mass is the amount of substance; weight involves the downward pull on that substance exerted by the force of gravity, the attraction between the substance and the mass of the earth. One gram of mass is the same
amount of substance anywhere on earth; but the weight of this one gram of substance depends on where it is placed. At sea level in Havana it will have one value, at Moscow it will have another; on top of Mt. Everest it will have a smaller value because it is farther away from the center of mass of the earth and the pull of gravity on it is less.

In practice we can determine the mass of an amount of substance by comparing it with pieces of metal of known mass on a balance. Such reference masses are called weights.

**Speed and Velocity.** We will make clear the concepts of speed and velocity by referring to the example of the ping pong ball. The ball has a speed of one hundred centimeters per second as it is thrown toward the window, for speed is the time-rate of motion, the distance covered in unit of time.

Velocity is defined both in terms of rate of distance covered in unit of time and direction of motion. After the collision with the window, the ball is travelling in the opposite direction, so, the value of the returning velocity is minus one hundred centimeters per second (-100 cm/sec).

Quantities like speed and mass that bear no relation to any direction are known as scalar quantities, while quantities like velocity are known as vector quantities because they refer to a property with a definite direction; the algebraic sign of a vector quantity is plus or minus depending on the direction.

**VOCABULARY**

**bounce off** = to return back after striking an object.

**harm** = to injure, to hurt, to damage.

**harmlessly** = without harm, injure, hurt, damage.

**shatter** = to break into small pieces. (see fig. 2)

**break into** = penetrate violently.

**bond** = anything that binds, ties or unites.

**sort** = kind, type, class.

**One-half** = 1/2
since = because, as.
involve = imply.
balance = scales. See Fig. 5.
cover = in this lesson, to pass over
(a distance) as: The train covered
ten miles.
collision = violent encounter.
Idiomatic Expressions:
tear apart: separate, to pull apart by force.
take a look: see, consider.
make clear: clarify, explain.
SYNONYMS
1. amount = quantity
2. bond = link
3. release = liberate
OPPOSITES
apart / together
moving / still
plus / minus
EXERCISE V
Answer the following questions according to the reading.
1. At what speed do the balls travel?
2. Why does the baseball have more energy?
3. How is the energy of motion called?
4. Why is necessary to determine mass and velocity?
5. How can we determine the mass of an amount of substance?
6. What device is used with weights?
7. On what does weight depend?
8. How is speed defined?

9. What is the difference between velocity and speed?

10. How is the direction of a vector indicated?

EXERCISE VI
Tell whether the following sentences are true or false.

1. Weight implies the attraction of the force of gravity.
2. One gram of mass is not the same amount of substance anywhere on earth.
3. The balance is a device to measure speed.
4. Speed is defined in time-rate and direction of motion.
5. The heavier an object is, the more energy it has.
6. The breaking of the window is a physical phenomenon.
7. Kinetic energy involves weight and speed.
8. The pull of gravity is not the same in Cuba as in the North Pole.
9. Scalar quantities have to do with direction.
10. The study of chemistry implies the study of energy.

EXERCISE VII
Fill the blanks with the proper word from the following list.

ENERGY - THROW - BOUNCES OFF - SHATTERS - TEARS APART
RELEASED - WEIGHT - DENOTED - PRODUCT - SQUARE - SPEED

1. A pingpong ball ________ when it strikes a plane surface.
2. The energy ________ by \( E_K \) is related to the mass and velocity of a moving body.
3. A pingpong ball and a baseball have different ________
4. One half the ________ of the mass and the ________ of velocity is the equation for \( E_K \).
5. When you ________ a baseball against a window pane it ________ the glass.
6. The baseball has more ________ ________ than the pingpong ball.
EXERCISE VIII
Give the opposites of the following words:
before ___________ different ___________
upward ___________ nearer ___________
push ___________ less ___________
dead ___________ lost ___________

EXERCISE IX
Give the synonyms of the following words:
average ___________ movement ___________
kind ___________ greatly ___________
located ___________ imply ___________
the same ___________ quantity ___________
link ___________ liberate ___________

balance and weights

three kinds of geometrical figures

plus and minus

a covalent bond
CHAPTER I

READING I: ELECTRONICS

1. Electronics is a subject that is developing into a field of many subdivisions. The application of electronics to everyday life and industry is increasing now.

3. Scientists are very ingenious and devise many ways of utilizing electronics. Some electronic machines have mechanical senses. They are able to see, hear, touch and smell; they combine these senses in their mechanical brains to remember, measure, count and talk. They do all these things with great accuracy. The electron makes possible these actions and these machines. We cannot tell exactly what an electron is or what it is like because it is too small to see even with a powerful microscope. It is one of the smallest particles in the universe and it has negative electricity.

10. When we observe the effect that the electron produces under certain conditions, we learn its general properties.

11. Electrons can see things that the eyes of men do not see. They can detect things of the past that we do not know.

13. Electrons can smell smoke and help prevent fires. Electrons can determine the thickness of the paint on an automobile. They can feel the temperature and control the operation of a furnace in a factory.

16. They record everything and remember details for a long time with great preciseness.

17. Another important quality of electrons is their use as high speed calculators. They perform mathematical operations instantly. Three hundred billions of billions of electrons weigh 0.28 grams.

20. In what way is it possible that these small particles do all these wonderful things?

21. Electrons are infinitesimal particles with a negative charge that whirl at high speed around the cores of atoms.

22. To work they have to be set free from various substances in one of three ways: by heat, by the action of light, and by the bombardment or collision with other electrons.
Vocabulary
See pages 8 - 9 in the textbook Technical English

Exercises for the reading: Electronics

Exercise 1: Language Study Questions under Topics 1 and 2 (Sentences 1 - 6)

Conteste estas preguntas al final de las oraciones indicadas. Estas preguntas lo ayudaran a entender las palabras nuevas y las estructuras gramaticales que resultan dificiles en la seccion correspondiente a los topicos 1 y 2.

1. Sentence 1:

   (a) Sentence 1 expresses the idea:
   i) Electronics is a new area which is expanding.
   ii) Electronics is an old area which is not expanding.

   (b) is developing is the present continuous tense of the verb ________________.

2. Sentence 3:

   In this sentence, we learn that scientists invent new forms for utilizing electronics.

   devise is a synonym of ________________

   forms is a synonym of ________________

3. Sentence 5:

   They refers to: i) mechanical senses
   ii) some electronic machines
   iii) scientists

4. Sentence 6:

   (a) How do electronic machines remember, measure, count, etc.
   i) with great precision
   ii) with little precision
   iii) with no precision

   (b) precision is a synonym of ________________
Exercise 2: Comprehension Questions (Sentences 1 - 6)
Conteste estas preguntas después de haber leído las oraciones del 1 al 6. Le ayudarán a entender la información esencial en los topicos 1 y 2.

1. (a) Are scientists the only people who use electronic machines?  
   (b) Apart from science, where are electronic machines used?

2. What can electronic machines do?

Exercise 3: Language Study Questions (Sentences 7 - 22):
Topic 3
Conteste estas preguntas al final de las oraciones indicadas.

1. Sentence 8:
   (a) In this sentence we learn that an electron is too small to see. This means that an electron is:
      i) visible  
      ii) invisible
   (b) We cannot tell what an electron is like means in Spanish:
       i) No podemos decir lo que le gusta a un electron.  
       ii) No podemos decir como es un electron.

2. Sentence 9:
   What is one of the smallest particles in the universe that has negative electricity?

3. Sentence 12:
   They refers to: i) men  
                    ii) eyes  
                    iii) electrons

4. Sentence 15:
   They refers to: i) electrons  
                    ii) fires
5. Sentence 17:
Electrons are high speed calculators expresses the same idea as Electrons calculate extremely rapidly. Translate these two sentences into Spanish:

i) Electrons are high speed calculators = Sp. ____

ii) Electrons calculate extremely rapidly = Sp. ____

6. Sentence 18:
(a) Can electrons do mathematical operations? Yes/No
(b) Which word in sentence 18 means do? ________

7. Sentence 19:
Which of the following measurements do we use to weigh things:

i) cubic centimetre (cc)   iii) pound (lb)
ii) metre (m)               iv) kilogram (kg)

8. Sentence 20:
These small particles refers to:

(i) electrons
(ii) three hundred billions of billions of electrons

9. Sentence 21:
This sentence means that electrons rotate very fast round the centres of atoms.

(a) rotate is a synonym of _____________
(b) very fast is a synonym of _____________
(c) centres is a synonym of _____________

10. Sentence 22:
This sentence tells us that an electron must be liberated in order to work.

(a) to be liberated and _______________ are synonyms.
Exercise 4: Comprehension Questions under Topic 3 (Sentences 7 - 22):

Conteste estas preguntas después de haber leído las oraciones desde la 7 a la 22. Estas oraciones lo ayudarán a identificar la información esencial en el topico 3.

1. Which part of the reading describes what an electron can do?
   i) Sentences 8 - 10
   ii) Sentences 11 - 18
   iii) Sentences 19 - 22

2. (a) Which sentences tell us what an electron is?
   (b) Express in Spanish what an electron is.

3. How can an electron be liberated?

Exercise 5: Description of an electron (Sentences 7 - 22)

1. In this reading, the electron is described in terms of its __________________, __________________, and __________________.

2. Resume en español la información sobre el electron completando el cuadro siguiente:

<table>
<thead>
<tr>
<th>Característica</th>
<th>Información sobre el electron</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Exercise 6

Lea el párrafo siguiente y conteste las preguntas a continuación:

The history of the electron begins at the end of the 19th century. In 1894, Johnstone Stoney called cathode rays electrons. In 1895, Jean Perrin was able to demonstrate that they had a negative charge, and in 1897, J.J. Thomson measured their speed.
1. (a) Underline the verbs and state the time expressed in each case.  
(b) State whether the verbs are regular or irregular.
2. What expression is used to express ability?
3. Which characteristics of an electron are mentioned?
4. What do they and their refer to?
Galileo Galilei discovered the principles of the pendulum around the year 1583. He was watching the motion of the candelabra in the Cathedral of Pisa. The candelabra swung from side to side. The consecutive swings were becoming smaller and smaller as the candelabra was slowly coming to rest.

Did the time of each swing become smaller? He did not know the answer and decided to measure the time by counting his own pulse. To his surprise he discovered that although the swings were becoming shorter and shorter, their duration in time did not change; they remained exactly the same.

He repeated the experiment with a stone tied to the end of a string and found the same result. He also discovered that for a specific length of the string the oscillation period remained the same, no matter how heavy or how light the stone in his experiment was. This was the origin of the familiar device that we call a pendulum.

It is possible to repeat the measurements that Galileo made by using the apparatus known as the simple pendulum. This consists of a small heavy object, such as a sphere of lead (Pb), the bob, which hangs from a stationary point by a length of strong but thin thread. A convenient method of suspending the pendulum is to clamp the thread firmly between a pair of glass prisms. In this way, it is possible to alter the length of the thread and investigate the effect on the time of swing.

We can measure the time for several sequences of ten complete pendulum swings, for example, by using a stop-watch. You can see that when the length of the pendulum (i.e. the distance between the centre of the bob and the point of suspension) remains the same, then the periodic time, or time for one to-and-fro swing of the pendulum remains constant. Besides, the amplitude of the swing (half the distance through which the bob moves) does not affect the periodic time of the pendulum, when this amplitude is small compared with the length of the pendulum.

Vocabulary

See pages 21 - 22 in the textbook Technical English
Exercises for the reading: Galileo and Pendulums

Exercise 1: Recognition of sentences and paragraphs

1. (a) How many paragraphs are there between sentences 1 and 17?

(b) Write down and number each paragraph between sentences 1 and 17, and the sentences which correspond to each paragraph.

<table>
<thead>
<tr>
<th>Paragraph</th>
<th>Sentences</th>
<th>Paragraph</th>
<th>Sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 - 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Exercise 2: The main topic of the reading

In this reading, there are two main topics. Write down the paragraph numbers which correspond to each topic. To identify the two main topics, observe the verb tenses used in the reading.

<table>
<thead>
<tr>
<th>Topics</th>
<th>Paragraphs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Historical background to the discovery of the pendulum</td>
<td></td>
</tr>
<tr>
<td>2. Description of how a pendulum works</td>
<td></td>
</tr>
</tbody>
</table>

Exercise 3: Identification of sub-topics under Topic I

El topico I puede ser subdividido en 3 sub-topicos. En esta lectura, cada sub-topico corresponde a un parrafo. En cada uno de los parrafos, busque la oracion o las oraciones que contienen los 'indicadores', es decir, los elementos esenciales que nos permiten identificar cada sub-topico. Sigue el ejemplo del sub-topico 1.1.

<table>
<thead>
<tr>
<th>Topic I and sub-topics</th>
<th>Paragraph(s)</th>
<th>Markers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Historical background to the discovery of the pendulum</td>
<td>1, 2, 3</td>
<td>past tense</td>
</tr>
<tr>
<td>1.1 Observation of the phenomenon</td>
<td>1</td>
<td>sent. 1-4</td>
</tr>
<tr>
<td>1.2 The initial experiment: measurement of time</td>
<td>2</td>
<td>sentences</td>
</tr>
<tr>
<td>1.3 Repetition of the experiment</td>
<td>3</td>
<td>sentence</td>
</tr>
</tbody>
</table>
Exercise 4: Clarification of new words, connectors, difficult grammatical structures etc. under Topic I

1. Read sentences 1 and 2:

   Sentence 2 means: Galileo was observing the movement of the candelabra

   (a) watching is the equivalent to __________

   What is the simple form of watching? ______

   (b) motion is equivalent to __________ and in this context is: i) a verb

   ii) a noun

2. Read sentence 3:

   (a) swung is the past tense of the verb swing.

   The pendulum swung ... is equivalent to:

   i) the pendulum oscillates

   ii) the pendulum oscillated

   iii) the pendulum is oscillating

3. Read sentence 4:

   (a) In this sentence, swing(s) is a noun, not a verb.

   It is a synonym of: i) oscillate(s)

   ii) oscillation(s)

   (b) The consecutive swings were becoming smaller and smaller means that there was a progressive reduction in the size of the swings.

   Become smaller means in English: to be reduced in ______ and in Spanish:___________

   (c) In this sentence, as indicates:

   i) cause

   ii) simultaneous action

   iii) example

   In this context, as means in Spanish ______

4. Read sentence 5:

   (a) In Spanish, each means cada.

   Each swing means in Spanish __________
5. Read sentences 6 and 7:
   (a) The swings were becoming shorter and shorter means:
       i) The swings were very short.
       ii) There was a reduction in the size of the swings.
   (b) Although is a connector that expresses contrast. What two things are contrasted in sentence 7?
       i) Galileo's surprise and the pendulum swings.
       ii) the size of the swing and the time.
       iii) the length of the pendulum and the time.
   (c) In sentence 7, they remained exactly the same and their duration in time did not change
       i) express the same idea
       ii) express different ideas

6. Read sentence 8:
   (a) From this sentence, we learn that Galileo connected a rock to the end of a cord.
       in this context, tied is a synonym of _________
       stone is a synonym of _________
       string is a synonym of _________

7. Read sentence 9:
   (a) no matter how heavy or how light the stone ... means without considering the weight of the stone ... or independent of the weight of the stone ...
       . no matter how ... means in Spanish _________
   (b) Translate sentence 9 into Spanish _________
8. Read sentence 10:

(a) A pendulum is an example of a device.
(b) This refers to:
   i) the stone
   ii) Galileo's experiment and discovery
   iii) the pendulum

Exercise 5: Recognition of the essential information under Topic I (sentences 1 - 10)

If you have problems with words, grammatical structures etc., refer to your answers in Exercise 4.

1. Read sentences 1 - 4, which deal with sub-topic 1.1. (The observations of the phenomenon). Then answer the questions below if the information is given. If the information is not given, mark the blank with an X.

   (a) Who made the observation? ____________________
   (b) What exactly did the person observe? ____________
   (c) Why did the person observe this? ______________
   (d) When did the person make the observation? _____
   (e) Where was the person? _________________________
   (f) How many similar phenomena did the person observe? ________________________________

2. Read the sentences which deal with 1.2. (The initial experiment). Then answer these questions in Spanish:

   (a) What aspect of the phenomenon interested Galileo? _________________________________
   (b) What did he use to measure the time? ____
   (c) What did he find? ________________________________

3. Read the sentences that deal with 1.3. (Repetition of the experiment). Then answer these questions - if necessary, in Spanish:

   (a) What did Galileo use instead of the candelabra?
Exercise 6: Identification of sub-topics under Topic II

Topic II can be sub-divided into 2 sub-topics. In this case, each sub-topic is found in each of the two paragraphs. Find the sentence or sentences which contain the markers.

**Topic II and sub-topics**

<table>
<thead>
<tr>
<th>Paragraph(s)</th>
<th>Markers</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Description of how a pendulum works</td>
<td>4, 5 present tense</td>
</tr>
<tr>
<td>2.1 Parts of the pendulum</td>
<td>4 sentence</td>
</tr>
<tr>
<td>2.2 The periodic time of a pendulum in relation to length and amplitude</td>
<td>5 sentences</td>
</tr>
</tbody>
</table>

Exercise 7: Clarification of new words, connectors, difficult structures, etc. under Topic II (sentences 11 - 17)

1. Read sentences 11 and 12:

   (a) *such as* is a connector which indicates example. It is a synonym of *for example*. In sentence 12, then, a sphere of lead is an example of:

   i) a simple pendulum  
   ii) a small heavy object  
   iii) an apparatus

   (b) *a length of thin thread* means in Spanish *un tramo de hilo fino*.  

   .. in this sentence, *a length* means in Spanish and *thin* means in Spanish

2. Read sentence 13:

   This sentence tells us that a pair of glass prisms is used to hold the thread firmly.

   .. *clamp* means in English  

3. Read sentence 14:
(a) in this way refers to: 
   i) suspending the prisms 
   ii) clamping the thread between prisms

(b) Translate in this way into Spanish

4. Read sentence 15:
   (a) ten complete pendulum swings means:
   i) ten complete swings of a pendulum
   ii) ten complete pendulums that swing
   iii) ten swings of a complete pendulum

   (b) ten complete pendulum swings means in Spanish

   (c) A stop-watch is a watch that we can stop and start. It is an example of:
   i) something to measure the time of the pendulum swings
   ii) something to use in a pendulum

5. Read sentence 16:
   (a) In this sentence, the expression i.e. (es decir) and the parentheses indicate a definition of something previously mentioned. What is defined?
   i) a stop-watch
   ii) a pendulum
   iii) the length of the pendulum

   (b) In this sentence, periodic time is also defined. The definition is indicated by the comma and or. How is periodic time defined?

   (Note: a to-and-fro swing means a swing to one side from the other side.)

6. Read sentence 17:
   (a) Besides is a connector which indicates

   (b) What is the definition of the amplitude of the swing?
Exercise 8: Recognition of the essential information under Topic II (sentences 11 - 17)

If you have problems with words, grammatical structures, etc., refer to your answers in Exercise 7.

1. (a) Which part of the pendulum is described in terms of its size, weight and shape? 
(b) Complete the following sentence to express the description:
The __________ is (size) __________, (weight) __________ and (shape) __________.

2. (a) The other main part of the pendulum is also described. Which part is it? 
(b) It is described in terms of (mark with an X those characteristics that are described):
i) thickness ii) weight iii) strength iv) length v) shape vi) colour

3. Why is it convenient to clamp the thread between glass prisms? 

4. Read the part of the section which corresponds to 2.2. Which of the following statements are true according to the information given under this sub-topic:

(a) If the length of the pendulum is constant, the periodic time is constant.
(b) If the length of the pendulum changes, the periodic time changes.
(c) If the amplitude changes, the periodic time changes.
(d) A change in periodic time depends on the length of the pendulum, not on the amplitude.
CHAPTER III

READING 3: GRAVITATION

1 When you take a pencil in your hand and let it drop, it falls to the floor. In the same way, when you observe the falling leaves of a tree you will see that they drop to the ground; they fall downward.

2 Water runs downhill; a ball will roll downhill. An automobile will run downhill with its engine disconnected, but you need the power of the engine to take the car uphill. You will go down a hill without pedalling your bicycle, but it requires your human effort to pedal the bicycle uphill.

3 Everything on Earth obeys this attraction toward the Earth. This force that attracts all things in the Universe is gravitation. Through this force the Earth is attracting all things that are on it, and all things that are on it are attracting the Earth. Not only this, but every object on Earth attracts every other object, no matter how small it is or how apart they are. The masses of the Sun and the Earth are very big and even at a distance of 93 million miles they attract each other with a force of 4 trillion tons.

4 Greater bodies have a greater attracting force than smaller bodies.

5 Gravitation is, to be sure, only one of the forces of the Universe, but it is a very powerful one. It is acting all the time and we find sufficient and constant demonstration of its constancy in the work that is necessary when we want to perform or stop any movement against the line of its action.

6 Gravitation is the force responsible for the balance of the Universe. It acts according to the law Isaac Newton discovered in the 17th century. We can state the law in this way: every body of matter in the Universe attracts every other body along a straight line between them.

7 This law states that every single particle of matter in the Universe attracts every other particle with a certain force. The entire body of the Sun, consequently, is pulling on every individual atom that composes the Earth and vice-versa.

8 The force of attraction varies directly according to the product of their masses, and inversely according to the square of the distance between them. In other words, the force is greater between large,
heavy objects; it is greater between near objects. Greater objects have a greater attracting force.

Vocabulary

See pages 33 - 34 in the textbook Technical English
Exercises for the reading: Gravitation

Exercise 1: Identification of sentences and paragraphs

1. How many paragraphs are there between sentences 1 and 21?

2. Write down the number of each paragraph between sentences 1 and 21 and the sentence(s) which correspond to each.

<table>
<thead>
<tr>
<th>Paragraph</th>
<th>Sentence(s)</th>
<th>Paragraph</th>
<th>Sentence(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 - 2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Exercise 2: Identification of the main topic of 'Gravitation'

Esta lectura contiene un solo topico principal que se puede resumir en espanol de la forma siguiente:

La fuerza de gravitacion: lo que es y como varia

En 2 de los parrafos de la lectura, encontrara la informacion clave que corresponde a este topico. En otras partes de la lectura se encuentra esta misma informacion de otra forma o por medio de ejemplos.

Busque los dos parrafos que contienen la informacion clave relacionada al topico principal: The force of gravitation: what it is and how it varies.

Paragraphs ______________________

Exercise 3: Comprehension Questions (Paragraphs 1 - 3)

Answer these questions after you have studied the vocabulary on p. 33 of the textbook, Technical English.

1. Paragraphs 1 and 2 contain examples of the effect of gravitational force.

(a) How many examples are there?

(b) List the objects that are used in the examples ______________________

2. (a) Which aspect of gravitational force do the examples in paragraphs 1 and 2 illustrate?

   a. the attraction of the objects on the Earth towards the Earth
   b. the mutual attraction between the objects on the
c. the attraction between the objects on the Earth themselves
d. the attraction between all things in the Universe

(b) The 4 aspects mentioned above (a. - d.) are stated in sentences 6 - 9 (paragraph 3). Write down the letter of the aspect which corresponds to each of the sentences:

i. sentence 6: 
ii. sentence 7: 
iii. sentence 8: 
iv. sentence 9: 

(c) Which of the 4 aspects is sentence 10 an example of?

Exercise 4: Relationships between ideas: reference and connectors (Paragraphs 1 - 3)

1. Read sentences 1 and 2:
   (a) The phrase in the same way is a connector. It indicates a relationship between ideas of:
       i. contrast
       ii. consequence
       iii. similarity
   (b) in the same way = Sp.

2. Read sentence 8:
   (a) This force refers to _________ in sentence ______
   (b) it refers to _________ in sentence ______

3. Read sentences 8 and 9:
   (a) not only ... but is a connector which establishes a relationship between ideas of:
       i. contrast
       ii. additional information
       iii. simultaneous action
   (b) In sentence 9, this refers to:
       i. the Earth
       ii. the force of gravitation
       iii. the fact that the Earth is attracting all things on it and all
things on the Earth are attracting the Earth.

(c) Mark with an X, the expression which states the same idea as: ...no matter how small it is or how apart they are.

i. because of the size of an object on Earth and the distance between objects
ii. independent of the size of an object on Earth and the distance between objects
iii. in addition to the size of an object on Earth and the distance between objects

(d) Translate Sentence 9 into Spanish:

Exercise 5: Comprehension Questions (Paragraphs 4 - 8)

Read paragraphs 4 - 8 to answer the following questions:

1. (a) What two things (physical quantities) are considered when we calculate the force of attraction between objects? 

(b) Which is (or are) considered in:

i. sentence 11
ii. sentence 20
iii. sentence 21

2. Lea las oraciones siguientes e indique con un X las que expresan una realidad que no se limita al presente, pasado o futuro.

i. The book fell to the floor.
ii. Every body of matter in the universe attracts every other body.
iii. The ball rolled along the street.
iv. Water runs downhill.
v. Leaves will drop to the ground next December.

Exercise 6: Cause and Effect

Underline the cause in each of the following cause and effect relationships.

1. Electrons are infinitesimal. Consequently, they cannot be seen.
2. Galileo discovered the pendulum because he investigated the swing of the candelabra.
3. As a result of gravitation, a pencil falls to the floor.

Exercise 7: Consolidation of Chapter III

Read the paragraph below and answer the questions which follow it:

1. People say that one day a falling apple hit Sir Isaac Newton on the head and that, because of this, he hypothesized that all particles in the Universe attract each other. We do not know and will probably never know the truth about this story. However, many authorities accept the story as authentic.

1. A suitable title for the paragraph would be:
   i. Sir Isaac Newton
   ii. Falling Apples
   iii. The Law of Gravitation
   iv. How Sir Isaac Newton Discovered the Law of Gravitation

2. Look at the first sentence:

   (a) This refers to:
   i. Sir Isaac Newton's head
   ii. a falling apple
   iii. the fact that a falling apple hit Sir Isaac Newton on the head

   (b) The connector because of indicates a cause and effect relationship. What is the cause and what is the effect? (Answer in Spanish)
   i. causa: ______________________________________
   ii. efecto: ______________________________________

   (c) Why is the verb attract in the present tense and not in the past tense? (Answer in Spanish) ______
3. In sentence 3, however indicates contrast. What is contrasted?

   i. what we know and what many authorities accept
   ii. a story about Sir Isaac Newton and a story about many authorities
   iii. what people say and what many authorities accept
CHAPTER IV

READING 4: GLASS

1. Glass is used today in all spheres of life. In the home, we find a great variety of objects made of glass: bottles, jars, cups, plates, drinking glasses, tables, lamps, ornaments, etc. It is used extensively in construction to make windows and doors and even entire buildings. In the electronics industry, glass tubes and lamps are essential components of radio and television sets. In addition, glass is used for the lenses of cameras, telescopes, microscopes, etc. In brief, glass is a basic material of modern life.

2. The first glassmaker was nature. Glass was first formed out of sand (silicon and oxygen), soda (alkaline compounds) and lime (a compound of calcium and oxygen) in a natural process. This process was often brought about because of volcanic activity. Obsidian, for example, is a natural glass produced by volcanic eruption.

3. The natural process was then imitated by man. However, it is not known exactly when or where glass was first made. But it was the Romans who developed glassmaking into a real art. The Portland vase, made in Rome about 70 A.D. is considered the most valuable art glass object in the world today.

4. By the end of the 11th century, all fundamental glass-forming processes were known. Until the late 1700's advances in the glass industry were limited to the discovery of a few new raw materials and the development of the artisans's skills. Then machinery was introduced.

5. Today, the industry is almost completely mechanized although hand operations are still used in some specialized fields where the volume of production is low.

6. The most common steps in the glassmaking process are the following: First, sand and other materials are mixed to form what is called the glass 'batch'. Next, these materials are melted in a furnace at a very high temperature to produce molten glass. While the glass is molten, it is shaped. Then, it is cooled. Subsequently, when it is cool, a rigid piece is formed. Finally, the glass article is annealed; that is, it is reheated and then gradually cooled.
Exercise 1: Introduction to the reading "Glass"

Read the short paragraph below and then answer the questions that follow it:

It is not known exactly when and where glass was first made, but it has been used by man since very early times. For example, we know that the Egyptians used coloured glass for decoration in 4000 B.C. Glass was also used by the ancient Phoenicians, who invented the mirror.

1. A suitable title for this paragraph would be:
   i) Glass
   ii) The Use of Glass by Early Man
   iii) Glass and the Egyptians

2. Sentence 1:
   (a) The word it in it is not known:
       i) is an impersonal subject; it does not refer to anything
       ii) refers to glass
   (b) The word it in it has been used by man ...
       i) is an impersonal subject; it does not refer to anything
       ii) refers to glass
   (c) Which word in sentence 1 indicates contrast?
   (d) What two things are contrasted? (Answer in Spanish)

3. Read sentences 2 and 3:
   (a) Which expression indicates example?
   (b) What are the Egyptians an example of? (in Spanish)
   (c) Which word tells us that the ancient Phoenicians are another example of early man who used glass?

4. In the paragraph, find an example of:
(a) passive voice, present tense ____________________________
(b) passive voice, past tense ____________________________
(c) active voice, past tense ____________________________

5. In the paragraph, find the equivalent expression for:
   it is known that: ______________________________________

6. On a separate piece of paper, make a written translation of the paragraph into Spanish.

Exercise 2: Identification of the topics of the reading "Glass"

You are now going to identify the three topics of the reading "Glass". The topics are listed below in the order in which they appear in the reading.
Read only to identify the topics. Indicate the paragraph(s) where each topic appears. Be prepared to tell the teacher what the markers are.

Topics          Paragraph(s)     Markers
1. Importance of glass in the modern world
2. History of glassmaking
3. Description of the glassmaking process

Exercise 3: Importance of glass in the modern world

You are going to read the part of the reading that corresponds to the topic: Importance of glass in the modern world. Read only to answer these questions:

1. (a) Under the topic, Importance of glass in the modern world, the author tells us that glass is:
    i) extremely important in the world today
    ii) moderately important in the world today
    iii) of little importance in the world today.

   (b) Which sentences express the same idea as your answer to 1 (a)? ____________________________

   (c) How does the author support what he tells us?
       i) by comparing the use of glass with the use of other materials
ii) by quoting statistics (quote = Sp. 
citar)

iii) by giving examples of how glass is used

*Note: Remember that the verb support can be a false cognate. In this sentence, support means: i) soportar
ii) sustentar

2. In paragraph 1, find two connectors:

(a) one that expresses additional information (not and)

(b) one that indicates summary

Exercise 4: Reading for one piece of information

1. (a) Under the topic, History of glassmaking (paragraphs 2 - 5, sentences 7 - 18), read to find this one bit of information: What is an example of natural glass?

(b) Was it necessary to read the entire section corresponding to this topic to find the information requested?

2. Turn to page 69 in your textbook, Technical English to the reading Density. Read to find this piece of information: What is the density of pure water?

Exercise 5: Identification of the periods in the history of glassmaking (Paragraphs 2 - 5)

1. Seven periods in the history of glassmaking are mentioned in the reading. They are listed below in the correct order.

(a) In the left-hand column, write in the time of history. (In some cases, this information is already given.)

(b) Identify the sentences which correspond to each period.

(a) Time Activity or event (b) Sentence(s)

pre-history Formation of glass in nature, often by volcanic eruption
early man  Imitation of the natural process

Development of glass-making into an art

Knowledge of all basic glassmaking processes

No significant advances

Introduction of machinery

Almost total mechanization

Exercise 6: Nouns and verbs of the same family

Notice that the summary in Exercise 5 is expressed in the form of nouns. However, this same information is expressed in the form of verbs in the reading. To reinforce what you have just learned and to review other nouns and verbs, write the simple form of the verb which corresponds to each of the following nouns:

<table>
<thead>
<tr>
<th>Noun</th>
<th>Verb form in the reading</th>
<th>Simple form</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. consideration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. imitation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. formation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. limitation</td>
<td></td>
<td></td>
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<tr>
<td>5. operations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. mechanization</td>
<td></td>
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<tr>
<td>7. specialization</td>
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<td>8. production</td>
<td></td>
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<td>9. eruption</td>
<td></td>
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<tr>
<td>10. repetition</td>
<td></td>
<td></td>
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<tr>
<td>11. introduction</td>
<td></td>
<td></td>
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<td>12. knowledge</td>
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<td>13. development</td>
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<td>14. measurement</td>
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<td>15. discovery</td>
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<td>16. use</td>
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<tr>
<td>17. mixture</td>
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<td></td>
</tr>
<tr>
<td>18. shape</td>
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</tbody>
</table>

Exercise 7: Recognition of the steps in the glassmaking process

Read the part of the reading which describes the glassmaking process. Then look at the pictures below.

1. Number the pictures in the correct order according to the description.
2. Mark with an X any picture which does not correspond to a step in the process described.
3. In sentence 25, there is an explanation of annealing.
   (a) Which elements in the sentence introduce the explanation?
   (b) Explain annealing in Spanish.

Exercise 8: Consolidation of Chapter IV

Read the short paragraph below and answer the questions which follow it.

Advanced technology has brought about different kinds of glassmaking processes. In the glass industry today, various processes are used such as the pressing process and the rolling process.

1. (a) What has been the consequence, or result, of advanced technology in the field of glassmaking?

   (b) What expression in the paragraph indicates a cause and effect relationship?

2. (a) Which expression in the paragraph indicates example?

   (b) What examples are given?

   (c) What are they examples of?

3. Using the information from your answers to questions 1 and 2, complete the following diagram. (Notice that this diagram summarizes the information in the paragraph.)

   advanced technology →

   e.g. __________________

4. On a separate piece of paper:

   (a) Express the information in the summary (Question 3) in Spanish in the form of a paragraph.
(b) Translate into Spanish the paragraph at the beginning of the exercise.

(c) Compare your two paragraphs in terms of:
   i. informational content
   ii. the linguistic form in which the information is expressed.
The development of synthetic plastic materials represents one of the great triumphs of the organic chemist. The term "plastics", used by the modern plastics industry, refers to certain substances manufactured from organic compounds, that is, from combinations of carbon with hydrogen, oxygen, nitrogen, and other elements. The term does not include inorganic molding materials, such as concrete, cements, and ceramics, nor the organic substance we call rubber.

The four principal types of organic plastics (not including rubber) are synthetic resins, natural resins, cellulose derivatives, and protein substances.

We use synthetic resin plastics to make nylon clothes, unbreakable phonograph records, the plugs of electrical appliances and many other everyday products. The chemist is able to produce resinous materials that are as hard as stone, as transparent as glass, as elastic as rubber. When these materials are combined in the proper way, they can be molded into products that are strong and lightweight, and that resist moisture, moderate heat, sunlight, hard wear and acids.

Natural resins are generally known by their common names, such as shellac, rosin, asphalt and pitch. Natural resins are widely used in industry for the production of the fusible type of molded product. These hot-molding compositions are prepared by mixing shellac, rosin and asphalt with suitable fillers. Compositions containing shellac are used in electrical insulators for high-voltage equipment in telephone parts and in phonograph records. The terms resin and rosin are often confused. Rosin is a natural resin recovered as a solid residue after distillation of turpentine from pine tree extracts.
Cellulose derivatives. 

This type of organic plastic is probably the most widely used. The celluloid plastic used for making toys, pens, pencils, etc.; the cellulose acetate; the familiar cellophane and the common type of rayon, all belong to this group of plastics. The basic raw material, cellulose, is obtained from ordinary cotton or pulped wood. Treatment with chemicals converts cellulose into compounds that take any desirable shape. These plastics conduct heat slowly and can be tasteless, odorless and transparent. Their uses include photographic film, safety glass, lacquers, etc.

Protein plastics. These plastics are obtained from different sources, such as milk and soybean. These proteins are processed into a colloidal mass and finally formed into sheets, rods or tubes. The resulting product is used to make small articles such as buttons, beads, buckles, and other accessories.

Vocabulary

Please see pages 56-57 of the Textbook Technical English.
Exercises for the reading 'Plastics' (pp. 55 - 56 of the textbook)

Exercise 1: Recognition of sentences and paragraphs

1. How many paragraphs are there in this reading? _____

2. Quickly number all the sentences in the reading and write down each paragraph number and the corresponding sentence numbers.

Note: In sentence 8 on page 55 of the textbook, resin should read rosin.

Exercise 2: Identification of the topics and sub-topics

1. There are 3 main topics in this reading. They are listed below but not in their correct order. Number them according to their order in the reading and write down the paragraph(s) which correspond to each topic.

<table>
<thead>
<tr>
<th>Order</th>
<th>Topic</th>
<th>Paragraph(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____</td>
<td>Types of organic plastics</td>
<td></td>
</tr>
<tr>
<td>_____</td>
<td>Description of the different types of organic plastics</td>
<td></td>
</tr>
<tr>
<td>_____</td>
<td>Definition of the term 'plastics'</td>
<td></td>
</tr>
</tbody>
</table>

2. (a) Which of the topics has sub-topics? __________

(b) How many sub-topics are there? __________

(c) Write down an appropriate title for each sub-topic and the paragraph number where it is found:

<table>
<thead>
<tr>
<th>Sub-topic</th>
<th>Paragraph</th>
</tr>
</thead>
</table>
Exercise 3: Language Study Questions (Topic 1)

1. These questions correspond to topic 1. Therefore, which sentences of the reading are you going to read?

Answer the questions after you have read the sentence indicated. They will help you to understand new words, difficult grammatical structures and the relationships between ideas.

2. Read sentence 1:

   (a) **synthetic plastic materials** means materials that are made of synthetic plastics, i.e. plastics which have been produced by chemical synthesis.

      **. synthetic plastic materials = Sp.**

   (b) an organic chemist is: i. a science  
       ii. a person  
       iii. a substance

   (c) **triumph** is a synonym of **victory**. What do these two words mean in Spanish? **and**

3. Read sentence 2:

   (a) **the modern plastic industry** means the modern industry that produces plastics = Sp. **and**

   (b) 1. The expression that is indicates that what follows:

      i. is an example of previous information
     ii. is additional and different information
     iii. states the previous information in a different way

     2. **. combinations of carbon with hydrogen, oxygen, nitrogen and other elements:**

      i. are examples of organic compounds
     ii. are not organic compounds; they are something different
     iii. constitute organic compounds

4. Read sentence 3:

   (a) Which term does not include inorganic molding materials?
(b) inorganic molding materials means inorganic materials that can be molded. = Sp. ________

(c) 1. What are concrete, cements, and ceramics examples of? __________
2. Which expression in sentence 3 indicates example? __________

Exercise 4: The essential information under topic 1 (Paragraph 1)

Topic 1 deals with the definition of the term 'plastics'.

1. (a) The definition of 'plastics' that is given in this reading is:
   i. a general definition for all situations
   ii. a specific, or restricted, definition
(b) Support your answer to 1(a). (If necessary, answer in Spanish) ______________________

2. Summarize the definition in Spanish: __________

Exercise 5/
Exercise 5: The essential information in paragraph 3

In paragraph 2, we are told that there are four principal types of organic plastics. Paragraph 3 describes one of these types. It is described in terms of the products that are made from it and its properties. Complete the chart below that summarizes this information.

<table>
<thead>
<tr>
<th>Type of organic plastic:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Products (examples)</td>
<td>1.</td>
</tr>
<tr>
<td></td>
<td>2.</td>
</tr>
<tr>
<td></td>
<td>3.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Properties (a) of synthetic resins:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(b) of products made from synthetic resins:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
</tr>
<tr>
<td>4.</td>
</tr>
<tr>
<td>5.</td>
</tr>
<tr>
<td>6.</td>
</tr>
<tr>
<td>7.</td>
</tr>
</tbody>
</table>

Exercise 6: Essential information in paragraph 4

1. Classify the types of natural resins mentioned in this paragraph by filling in the chart below:

```
  natural resins
    ├───
    │   │
    │   │
    │   │
    │   │
    │   │
    │   │
    │   │
    │   │
```
2. Complete the following chart that summarizes the information in paragraph 4.

<table>
<thead>
<tr>
<th>Type of organic plastic:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Members of this group:</td>
<td>rosin</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Products:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. type:</td>
</tr>
<tr>
<td>b. method of preparation</td>
</tr>
<tr>
<td>c. examples of use: 1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
</tr>
</tbody>
</table>

3. (a) According to the explanation given in this paragraph:
   i. A resin is a rosin
   ii. A rosin is a resin
   iii. A resin and a rosin are the same thing.

   (b) In which sentence do you find this information?

   Exercise 7: Essential information in paragraphs 5 and 6

1. Which of the following information is given in paragraphs 5 and 6 about cellulose derivatives and protein plastics? If the information is given, write -- in the blank -- the number of the sentence where it is found. If the information is not given, mark the blank with an X.
2. In Chapter III, we studied that there are different levels of generality. In the last sentence of this reading, we have an example of a 3-level generalization. To help you identify it, three sentences are written below. Number them 1, 2, 3 from the most general to the least general:

1. Protein plastics are used to make beads and buttons.
2. Protein plastics are used to make small articles.
3. "Protein plastics are used to make accessories."

Exercise 8: Consolidation of Chapter V

Read the short paragraph below and then answer the questions which follow it:

The words in a language can be divided into two groups according to the information which they carry. There are content words (i.e. those which carry essential information) and there are function words (i.e. those which do not carry essential information). Information-carrying words include nouns, verbs, adjectives and adverbs. Non-information-carrying words include articles (e.g. the, a); pronouns (e.g. he, it, those); prepositions (e.g. from, to, into, for); conjunctions (e.g. that, if, and); auxiliary verbs (e.g. are, do, is, don't).

1. A suitable title for this paragraph would be:

2. (a) Express the following idea from sentence 1 in another way:
The words in a language can be divided into two groups.

(b) What is another way of saying: according to (sentence 1):
3. (a) Make a classification chart of the information given in the paragraph. Fill in the chart below:

(b) What is the basis of classification mentioned in this paragraph? ____________________________________________________________________________________________

4. What kind of relationship is indicated by the expression e.g.? ____________________________________________________________________________________________

5. What kind of relationship is indicated by the expression i.e.? ____________________________________________________________________________________________

6. (a) Circle the noun which is modified and underline the modifiers in each of the following expressions. Then translate the expressions into Spanish. (Note: the is an article. It is not considered a modifier.)

   i. the words in a language ____________________________________________________________________________________________

   ii. content words ____________________________________________________________________________________________

   iii. words which carry information ____________________________________________________________________________________________

   iv. information-carrying words ____________________________________________________________________________________________

   v. words which do not carry information ____________________________________________________________________________________________

   vi. non-information-carrying words ____________________________________________________________________________________________

(b) 1. Which expressions in 6(a) must be translated in the same way in Spanish? ____________________________________________________________________________________________

   2. Why? ____________________________________________________________________________________________
CHAPTER VI

READING 6: DENSITY

1. Every time you turn on the water in your kitchen or your bathroom, certain powerful forces in liquids and gases are working for you. Engineers have to calculate these forces with great accuracy when they build tunnels under rivers and mountains or construct airplanes that apparently defy the law of gravity.

2. Liquids and gases are made up of constantly moving particles called molecules. The forces in both liquids and gases are transmitted by these molecules as they strike one another and collide with the objects in their path. Liquids have some of the same properties as gases: they both flow freely from a container and have no definite shape. Liquids are different from gases in some aspects. The molecules of a liquid are held together much more tightly than those of gas. A liquid will fill a container up to a certain level and the upper surface of the liquid will be horizontal.

3. A gas, however, will fill uniformly the whole of the container into which it is put. It diffuses or spreads out into the open air if released from the container.

4. In order to measure accurately the forces within a liquid, we have to know its density: that is, the mass (amount of material) packed into a given quantity of the liquid. We express density in terms in terms of weight per unit volume; thus, we say of a given substance that it has a density of so many pounds per cubic foot (lb./ft.³).

5. The density of pure water is 62.4 lb./ft.³ when its temperature is 4°C. Alcohol is less dense than water and one cubic foot of it weighs only 50 lbs. Mercury, however, is the densest and therefore the heaviest of the three, because it weighs nearly 850 lbs./ft.³.

6. We can know the density of any liquid or of any solid by finding out how much a cubic foot or a cubic centimeter of it weighs. If we compare the density of the liquid or solid with that of the same volume of water, we will know what is called its specific gravity. Water is usually the basis of this type of comparison; and so, we say that the specific gravity of water is 1. A substance half as dense as water has the specific gravity of 0.5.

7. When we
say that the specific gravity of mercury is 13.6, we mean that it is 13.6 times as dense as water.

Vocabulary
See pages 70 - 71 in the textbook Technical English
Exercises for the reading 'Density'

Exercise 1: Recognition of sentences and paragraphs

Number the sentences and paragraphs in the reading. Then fill in the blanks below with the correct information.

In this reading, there are ___ paragraphs and ___ sentences. The second paragraph consists of sentences ___ to ___; the fourth paragraph includes sentences ___ to ___; the last paragraph is made up of sentences ___ to ___.

Exercise 2: Identification of the main topics of the reading

There are five main topics in this reading. They are listed below but not in the order in which they appear in the reading.

1. Number the topics according to their order in the reading.

2. Indicate which paragraph(s) deal with each topic.

   (1) Order  Topic                                      (2) Paragraph(s)
   ___      Comparison of liquids and gases             ___
   ___      The need to study the forces in liquids     ___
   ___      and gases                                  ___
   ___      Pressure                                  ___
   ___      Density: definition and examples           ___
   ___      Specific gravity and its relationship to   ___
            density                                    ___

Exercise 3: Looking for and understanding information in the reading

1. (a) Which of the following statements best summarizes the essential information given in paragraph 1?

   i) Certain powerful forces in liquids and gases are present when you turn on the water in a house.
   ii) Airplanes and tunnels under the rivers and mountains are affected by certain powerful forces in liquids and gases.
   iii) Certain powerful forces in liquids and
gases must be calculated by engineers when they build tunnels, airplanes, etc.

(b) The answer to question 1(a) is the essential information under topic _____.

2. (a) Which sentences define density? _______

(b) i) How many examples of the density of different sentences are given? _______

ii) List the substances which are used as examples: __________

(c) The answers to questions 2(a) and 2(b) constitute general information about topic ___

3. (a) What is pressure? ____________________________

(b) Explain in Spanish how density affects pressure: _________________________________

(c) The answers to questions 3(a) and 3(b) constitute the essential information under topic ______.

4. (a) Complete the following chart about the properties of liquids and gases. (Mark with an X, in the appropriate column, the property which belongs to a liquid or to a gas or to both.)

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>GASES</th>
<th>LIQUIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The molecules are held together very loosely</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. The molecules are held together loosely</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. The molecules move constantly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Forces are transmitted by the molecules</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. They fill the whole of a container uniformly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. They have no definite shape</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. They fill a container to a certain level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. The surface in a container is horizontal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. They diffuse into the open air</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) The answer to question 4(a) is the essential information under topic ______.

5. (a) What is the specific gravity of mercury? ____

(b) The answer to 5(a) is one specific bit of information related to topic ______.
Exercise 4: Relationships between ideas: reference and connectors

1. Find one example in the reading of each of the following kinds of connectors:

   (a) indicating contrast ........................................
       (sentence ______)

   (b) indicating reformulation .....................................
       (sentence ______)

   (c) indicating cause and effect ..................................
       (sentence ______)

2. (a) In sentence 2, these forces refers to:

   i) forces
   ii) forces in liquids
   iii) certain powerful forces in liquids and gases

   (b) In sentence 2, they refers to:

   i) forces
   ii) engineers
   iii) liquids and gases

   (c) In the last sentence, it refers to:

   i) a liquid
   ii) pressure
   iii) the force exerted by a liquid

Exercise 5: Translation into Spanish

Translate the sentences in the chart in question 4(a) of Exercise 8.
CHAPTER VII

READING 7: LARGE NUMBERS

To express the difference in size between ordinary objects and very small objects such as atoms and their nuclei, we use numbers like million and trillion. The number of atoms in the body is about 1,000,000,000,000,000,000,000,000; the name for this symbol is octillion and the usual symbol for it is 10^27. Since this number 10 is raised to the power of 27 (or 10 with the exponent 27) is the same number 1 followed by 27 zeros, this exponential notation is more convenient than writing out zeros or using a name like octillion. You will use the exponential notation almost exclusively and it is important for you to learn it.

Maybe you already know how to write and read these numbers. Even though you write 1 followed by 27 zeros, can you really appreciate the magnitude of this number? One way to grasp such size is to visualize a collection of a large number of familiar objects.

Let's start with a few smaller numbers. For example, suppose we have a million (10^6) dollars in one-dollar bills. Stack these on top of one another and they make a pile about 185 meters high. Lay this stack horizontally and it is twice the length of a football field. Now we ask what a billion (10^9) dollars would look like. Place them horizontally and the stack will be 160 kms. long, from Havana to Varadero. So we see that while a million reaches twice the length of a football field, a billion reaches 160 kms. This shows us how greatly we increase the numbers of things when we jump from a million to a billion by just adding three ciphers, going from 10^6 to 10^9.

Next, suppose that we have a trillion (10^{12}) dollar bills. This stack of dollar bills would be one hundred and sixty thousand km. long (160,000) enough to go round the world four times. So we see that as we go beyond the trillions, we deal with distances just as difficult to visualize as the numbers themselves. Therefore, let us try another approach.

Let's take a collection of beans as the next example. Count a hundred (10^2) average-sized beans and you will find that they occupy approximately the volume of a cubic inch.

A million (10^6) beans are just about enough to fill an ordinary refrigerator, and a billion (10^9) will
fill a whole two-storied house; thus, a trillion
\(10^{12}\) will fill a thousand houses, the number of a
medium-sized town, and a quadrillion \(10^{15}\) beans
will fill all the buildings in a large city.

22. Let us try a larger number. 23. Imagine that it is
raining beans all over the entire land area of the
globe, North America, South America, Europe,
Australia, Asia and Africa, so that all the
continents are covered with beans four feet deep.
24. This global layer will contain sextillion \(10^{21}\)
beans. 25. Then imagine that the oceans are frozen
over and the layer of beans covers the entire area of
the Earth. 26. Go out among the planets and stars and
collect two hundred and fifty planets, each the size
of the Earth, and cover each with a similar layer of
beans four feet deep. 27. Then you have septillion
\(10^{24}\) beans. 28. Finally go out into the remote Milky
Way and collect two hundred and fifty thousand
\(250,000\) planets, each the size of the Earth; cover
each in exactly the same way, four feet deep; then,
at last, you have octillion \(10^{27}\) beans, the number
of atoms in your body. 29. So you see what an
extraordinarily small object an atom is and how
complicated you are.

Vocabulary

See pages 81 - 82 in the textbook Technical English
Exercises for the reading 'Large Numbers'

Exercise 1: Identification of sentences and paragraphs.

Fill in the blanks below with the correct information.

In this reading, there are ___ paragraphs and ___ sentences. The first paragraph goes from sentence ___ to sentence ___. The third paragraph includes sentences ___ to ___. The fifth paragraph includes sentences ___ to ___. The first sentence of the last paragraph is number ___ and the last sentence is ___.

Exercise 2: Identification of the topic of 'Large Numbers'

This reading contains only one topic: Different ways to express large numbers and the difficulty in imagining what the number represents.

1. (a) In which paragraph does the author talk about the different ways to express large numbers? ___

(b) Which of the following ways of expressing large numbers are mentioned in paragraph 1? (Mark with an X and write down one example that is given.)

   i) ___ words (e.g.: ___)
   ii) ___ hieroglyphs (e.g.: ___)
   iii) ___ exponential notation (e.g.: ___)
   iv) ___ numbers/figures (e.g.: ___)
   v) ___ pictures (e.g.: ___)

2. In which sentence in paragraph 2 does the author refer to the problem of imagining what a large number represents? ___

Exercise 3: Language Study Questions (Paragraphs 1 and 2)

Answer these questions after you have read the sentences indicated. They will help you with new words, structures, etc.

1. Read sentence 1:

   (a) In this sentence, the word like is used as a synonym of such as. Therefore, like in the context of sentence 1 indicates a relationship of ___.
2. Read sentence 2:
   (a) The word it refers to __________

3. Read sentence 3:
   (a) Since is a connector which can indicate time or cause. In sentence 3, it indicates ________.
   (b) Notice the use of parentheses and or to reformulate an idea in sentence 3.

   . . 10 with the exponent of 27 is a reformulation of __________

4. Read sentences 4 and 5:
   (a) Which numbers does these numbers refer to?

5. Read sentence 6:
   (a) The connector even though is a synonym of although and though, and therefore indicates the relationship of __________

6. Read sentence 7:
   (a) such size refers to:
      i) the size of the number $10^{27}$
      ii) the number of atoms in the body
      iii) the size of a million
   (b) Which of the following words belong to the same family as the verb visualize. Mark with an X and indicate what kind of word it is (noun, adjective, etc.)

      i) vision ______ ii) visit ______
      iii) visual ______ iv) visually ______
      v) viscous ______ vi) visceral ______

Exercise 7: Understanding how the author develops the topic

1. In paragraphs 3 - 6 the author gives many examples to help the reader visualize large numbers. If we analyze the examples, we see that there are two types. In type I, the author illustrates the magnitude of large numbers by showing that $x$ number of things would cover a certain linear measurement (e.g. distance). In type II, he shows that $x$ number of things would occupy a certain volume.
(a) What 'things' are used in Type I examples?

(b) Which section of the reading corresponds to Type I examples? Sentences

(c) What 'things' are used in Type II examples?

(d) Which section of the reading corresponds to Type II examples? Sentences

2. Some of the examples are given below in picture form. Write down the number of the sentence which corresponds to each picture and indicate what number it represents.

(a) 

i) Sentence

ii) Number

(b) 

i) Sentence

ii) Number

(c) 

1 2 3 4

i) Sentence

ii) Number
3. The drawing below represents another example in the reading.

(a) This example is similar to a Type II example, but the author uses __________ instead of beans.

(b) Which sentence does the picture correspond to?

(c) What number does the picture represent?
(d) The size of this number is also illustrated in another example. Which sentence contains the other example?

(e) Which of the two examples is easier to understand? The one in sentence ___

(f) What is the purpose of the example showing the number of atoms in the human body? (Answer in Spanish)

4. What is the author's purpose in giving all the examples in the reading? (Answer in Spanish)
CHAPTER VIII

READING 8: THE NATURE OF ENERGY

1. What is energy? We are all familiar with some of the forms of energy. Suppose you have a ping pong ball and a baseball. You throw both balls at a window each with a speed of 100 cm/sec. The baseball shatters the glass. Why? Because the baseball has more energy. It is the energy in the motion of the baseball that at the moment of impact breaks into the window pane and tears apart the chemical bonds that held the glass together.

9. The form of energy associated with motion of this sort is called kinetic energy, and it will be denoted by the symbol $E_k$. It is related to the mass ($m$) and velocity ($v$) of a moving object by the equation:

$$E_k = \frac{1}{2}mv^2$$

11. In words, this states that kinetic energy is equal to one-half the product of the mass and the square of the velocity.

12. Let's consider our example of the two balls that are thrown at the same velocity; the baseball weighs one hundred times as much as the ping pong ball, so it has one hundred times more energy. It is not the ball but the energy of the ball that breaks the window; it is not the gasoline but the energy released by the combination of the atoms of carbon and hydrogen with oxygen in the engine-cylinder that makes your car go; it is not the food but the energy of the food that keeps you alive. This is why the study of chemistry is essentially the study of energy.

15. Since the things that happen when atoms combine depend largely on how much energy is released, we need to have a measure for energy in order to discuss chemical reactions, just as we need the yard or the meter to discuss distances. The formula for the kinetic form of energy involves mass and velocity, so in order to arrive at a measure for energy, we will first take a look at these two quantities on which energy depends.

17. Mass and Weight To measure kinetic energy, it is necessary to distinguish between mass and weight. Mass is the amount of substance; weight involves the downward pull on that substance exerted by the force of gravity, the attraction between the substance and the mass of the earth. One gram of mass is the same amount of substance anywhere on earth; but the weight of this one gram of substance
depends on where it is placed. At sea level in Havana it will have one value; in Moscow it will have another; on top of Mt. Everest it will have a smaller value because it is farther away from the center of mass of the earth and the pull of gravity on it is less.

In practice we can determine the mass of an amount of substance by comparing it with pieces of metal of known mass on a balance. Such reference masses are called weights.

Vocabulary

See pages 91 - 92 in the textbook Technical English
Exercises for the reading 'Energy'

Exercise 1: The physical structure of the reading 'Energy'

1. It is not easy to identify the paragraphs in the reading 'Energy'.

   The reading 'Energy' is made up of a total of 6 paragraphs and __ sentences. Sentence 1 to ___ make up paragraph 1. Paragraph 2 consists of sentences ___ to 11 and includes the equation \[ e_k = \frac{1}{2} mv^2 \] as part of sentence 10. The third paragraph contains 3 sentences (12-14), but the fourth has only ___ sentences. Paragraph 5 includes sentences ___ to 20, and Paragraph 6 starts with sentence ___ and ends with sentence ___.

2. Underline the words in the paragraph above which indicate structure and composition.

Exercise 2 Identification of the main topics (the informational structure) of the reading 'Energy'

1. We can divide this reading into 4 topics. They are listed below but not in order.

   (a) Number the topics according to their order in the reading.

   (b) Show which paragraph(s) correspond(s) to each topic.

<table>
<thead>
<tr>
<th>Order</th>
<th>Topic</th>
<th>Paragraph(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Difference between mass and weight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Illustration of kinetic energy by example</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Difference between speed and velocity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Explanation of the equation for kinetic energy</td>
<td></td>
</tr>
</tbody>
</table>

2. Which of the above topics could be (podrian set) considered sub-topics of a more general topic Kinetic Energy? (Write down the topic numbers.)

Exercise 3: Reading for information under the topics (If necessary, answer these questions in Spanish)

1. What is the equation for kinetic energy?
2. (a) What two kinds of balls are used in the example to illustrate kinetic energy? 

(b) In which aspect of the equation do the 2 balls (used in the example) differ?

3. (a) What is the difference between weight and mass?

(b) Which sentence gives this information?
APPENDIX E

CHAPTER V 1981-82 FIELD STUDY

- TRADITIONAL MATERIALS
(Chapter V from "Technical English")
(pages 528-538)

- EXPERIMENTAL MATERIALS
(Chapter V)
(pages 539-576)

- Exercises for Students (pages 539-549)
- Teachers' Notes (pages 550-570)
- Student Study Notes (pages 571-576)
CHAPTER V FROM "TECHNICAL ENGLISH"

TRADITIONAL MATERIALS

LESSON V

MODIFIERS OF THE NOUN

1. ORGANIC plastics are very frequently used.
2. CELLULOSE derivatives and PROTEIN substances are among these plastics.
3. PULPED wood and ORDINARY cotton are used to make cellulose.
4. HOT-MOLDING compositions are prepared with NATURAL resins.
5. PROTEIN plastics FROM DIFFERENT SOURCES are processed to make SMALL articles.
6. Rubber is not included in the PRINCIPAL types OF ORGANIC PLASTICS.

NOTICE:

1. That there are different types of modifiers:
   a) Adjectives, as ORGANIC in sentence 1.
   b) Nouns, as CELLULOSE and PROTEIN, in sentence 2.
   c) Past Participles (-ED modifiers) as in PULPED wood, in sentence 3.
   d) Present Participles, or gerunds (-ING modifiers) as in MOLDING, in sentence 4.
   e) Phrases Introduced by a preposition as FROM DIFFERENT SOURCES in sentence 5.

2. The position of these modifiers of the noun:
   a) Single word modifiers such as, adjectives, nouns and participles, usually precede the noun.
      Ex: ORGANIC plastics PULPED wood
      CELLULOSE derivatives HOT-MOLDING compositions
   b) Phrase modifiers follow the noun.
      Ex: Protein plastics FROM DIFFERENT SOURCES
3. That a noun may have single word modifiers and a phrase modifier at the same time, as in:

Rubber is not included in the PRINCIPAL types of ORGANIC PLASTICS.

EXERCISE I

Draw a circle around the modifiers of the underlined words.

1. The skilled technician is repairing the old molds.
2. The familiar cellophane belongs to the group of cellulose derivatives.
3. Inorganic molding materials are not included in the term "plastics".
4. The modern machines in the workshop are useful.
5. The chemistry experiments in that booklet are difficult.
6. The special laboratory equipment on the second floor needs care.
7. Treatment with chemicals converts cellulose into compounds of different forms.
8. Natural resins are usually known by their common names.
9. The modern plastic industry in our country is increasing now.
10. Resinous materials, of different types are hard, transparent and elastic.

EXERCISE II

Use the correct adjectival forms of the verbs in parentheses:

Ex: This is a (drill) drilled board.
    There is a (drill) drilling machine at the workshop.

1. Concrete is an inorganic (mold) _________ material used to make some (mold) _________ products.
2. A (mix) _________ process takes place when several materials are combined.
3. (Develop) _________ substances are used in photography.
4. A (manufacture) _________ product is obtained after a (manufacture) _________ process.
5. (Insulate) _________ tools are used to manipulate electric wires.
LEARN:

In the reading selection you will find the prepositions FROM, TO, FOR and INTO:

FROM: a) marks the starting point, followed by point of destination.

  e.g. The Central Highway extends from Pinar del Río to Oriente.

  Study from beginning to end.

  The supervisor checked the machine from one end to the other.

  They work from morning to night.

b) marks point of origin.

  e.g. He's from Matanzas.

  Measure from here to there.

  He comes from the factory at night.

c) in expressions such as:

  He learns more from day to day.

  The foreman goes from place to place checking the work.

  You can draw a line from side to side by using a long T-rule.

FOR: a) expresses purpose.

  e.g. Books for technicians are always necessary.

  Instruments for drawing are accurate.

b) expresses destination.

  e.g. He left for the factory.

c) expresses extension of time or space.

  e.g. He was sick for 3 days.

  It rained for a week.

  We walked for a mile without stopping.
§ 2 INTO: a) entering or penetrating or inserting, it implies movement.

* e.g. The train went into the tunnel.
  The students came into the class.
  You drive a nail into the wall.
  There isn't any water in the radiator; pour some into it.

b) a change of state or place.

* e.g. Water is changed into steam.
  Translate this paragraph into English.
  A solid can be changed into a liquid by heating it.

TO: a) towards, in the direction of.

* e.g. Please, turn to the right.
  Walk to the rear.
  We went to the library.
  They came to the laboratory.

b) in order to; indicates purpose.

* e.g. You study to learn.
  e.g. You practice to be skilled.

To draw you need special instruments.

EXERCISE III

Fill the blanks with the prepositions from the following list:

from - to - for - into

1. This is as interesting book you read.
2. Wire is usually made copper.
3. The heat turned the ice water.
4. The time taken light travel a short distance is very small.
5. It is not very difficult turn a liquid a gas.
6. Metals are obtained mines.
7. __________ his. experiment, the physicist submerged pieces of
rock ______ acid.

8. The engineer went _____ machine _____ machine, checking the work.

9. Plastics are used _______ making a great variety of articles.

10. Synthetic materials are molded _______ different products.

11. After working _______ a year, he found the answer _______ the problem.

12. Celluloid was the first plastic _______ find commercial use.

WORD STUDY

In the reading of this lesson we will find the words OBTAINABLE, SUITABLE, DESIRABLE, etc. They are formed by the verbs OBTAIN, SUIT and DESIRE plus the suffix - ABLE.

The suffix -ABLE is usually added to verbs to form adjectives.

<table>
<thead>
<tr>
<th>VERBS</th>
<th>ADJECTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoid</td>
<td>Avoidable - that can be avoided</td>
</tr>
<tr>
<td>Break</td>
<td>Breakable - that can be broken</td>
</tr>
<tr>
<td>Check</td>
<td>Checkable - that can be checked</td>
</tr>
<tr>
<td>Count</td>
<td>Countable - that can be counted</td>
</tr>
<tr>
<td>Prevent</td>
<td>Preventable - that can be prevented</td>
</tr>
</tbody>
</table>

Observe the following examples in which the verbs end in vowel "e"; this vowel is sometimes omitted before the suffix -ABLE.

| 1. remove | removable - that can be removed |
| 2. observe| observable - that can be observed |
| 3. measure| measurable - that can be measured |
| 4. change | changeable - that can be changed |
| 5. notice | noticeable - that can be noticed |

EXERCISE IV

Form similar adjectives from the following verbs and express what they mean:

1. read
2. move
<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>detect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>understand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>repair</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>compare</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>practice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>mix</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>define</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>work</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The development of synthetic plastic materials represents one of the great triumphs of the organic chemist. The term "plastics" used by the modern plastic industry, refers to certain substances manufactured from organic compounds, that is, from combinations of carbon with hydrogen, oxygen, nitrogen and other elements. The term does not include inorganic molding materials, such as concrete, cements, and ceramics, nor the organic substance we call rubber.

The four principal types of organic plastics (not including rubber) are synthetic resins, natural resins, cellulose derivatives and protein substances.

We use synthetic resin plastics to make nylon clothes, unbreakable phonograph records, the plug of electrical appliances, and many other everyday products. The chemist is able to produce resinous materials that are as hard as stone, as transparent as glass, as elastic as rubber. When these materials are combined in the proper way, they can be molded into products that are strong and lightweight, and that resist moisture, moderate heat, sunlight, hard wear and acids.

Natural resins are generally known by their common names, such as shellac, resin, asphalt and pitch. Natural resins are widely used in industry for the production of the fusible type of molded product. These hot-molding compositions are prepared by mixing shellac, rosin and asphalt with suitable fillers. Compositions containing shellac are used in electrical insulators for high-voltage equipment, in telephone parts and in phonograph records. The term resin and rosin are often confused. Rosin is a natural resin recovered as a solid residue after distillation of turpentine from pine tree extracts.

Cellulose derivatives. This type of organic plastic is probably the most widely used. The celluloid plastic used for making toys, pens, pencils, etc.; the cellulose acetate; the familiar cellophane and the common type of rayon, all belong to this group of plastics. The basic raw material, cellulose, is obtained from ordinary cotton or pulped wood. Treatment with chemicals converts cellulose into
compounds that take any desirable shape. These plastics conduct heat slowly and can be tasteless, odorless and transparent. Their uses include photographic film, safety glass, lacquers, etc.

**Protein plastics:** These plastics are obtained from different sources, such as milk and soybean. These proteins are processed into a colloidal mass and finally formed into sheets, rods or tubes. The resulting product is used to make small articles such as buttons, beads, buckles, and other accessories.

**VOCABULARY**

- **triumph** = victory.
- **rubber** = an elastic substance obtained from (see fig. 1) the juice of various tropical plants.
- **plug** = a piece used to fill a hole. Device to make an electrical connection (fig. 2).
- **common** = ordinary.
- **lightweight** = having little weight ≠ heavy weight, (see fig. 3).
- **moisture** = humidity.
- **hard wear** = much wear, (see fig. 4).
- **shellac** = Sp. goma laca.
- **pitch** = Sp. betún, brea, alquitrán.
- **suitable** = adequate, proper, correct.
- **belongs to** = is a part of, is the property of.
- **toy** = play thing for children. (see fig. 5).
- **rosin** = Sp. pez rubia.
- **filler** = a substance added to another one to increase its volume, weight, viscosity etc.
- **recovered** = got back, regained. (see fig. 6).
- **turpentine** = aguarrás, trementina. (Sp.)
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- **filler** = a substance added to another one to increase its volume, weight, viscosity etc.
- **recovered** = got back, regained, (see fig. 6)
- **turpentine** = aguarrás, trementina, (Sp.)
sheet = a thin piece of paper or any other material. (see fig. 7)
rod = a thin, straight bar of metal or wood. (see fig. 8)
beads = small balls or disks of glass, metal, etc. (see fig. 9)
buckles = Sp. hebillas.
desirable = that is desired.
cotton = Sp. algodón.
source = place of origin, from which anything is obtained.
appliances = devices, instruments, etc.
term = word.
chemicals = substances used for producing a chemical effect.

EXERCISE V
Answer the questions based on the reading.
1. What are plastics made from?

2. Is cement an organic or an inorganic molding material?

3. What is one of the principal qualities of the synthetic resin products?

4. What are electrical insulators made from?

5. How is rosin obtained?

6. What is ordinary cotton used for in the plastic industry?

7. Name a very common cellulose derivative plastic used in everyday life.

8. Which compounds take any desirable shape?
9. Which plastics have no taste?

10. Which are the basic raw materials for the production of protein plastics?

EXERCISE VI

A) Find an adequate single-word modifier for each of the following words:

- plastic
- chemist
- industry
- materials
- substances
- clothes
- record

- resin
- derivative
- products
- heat
- insulators
- type
- wood

- glass

B) Find an adequate phrase modifier for each of the following verbs

- industry
- combinations
- type
- insulators
- distillation
- treatment

EXERCISE VII

Fill the blanks with words from the list:

- moisture - plugs - fillers - appliances - shapes - suitable - sheets - triumphs.

1. One of the great ________ of the organic chemist is the development of synthetic plastics.

2. Substances added to other substances to increase their volume are called ________.
3. Cellulose derivatives can be molded into products of different
   ____________________
4. Plastics are also produced in thin, light and transparent ___
   ____________________
5. The ______ of some electrical ____________ are made of
   plastics.

EXERCISE VIII
Find, copy and translate:
1. a sentence in the passive voice.
2. a modifier that is a noun and the word it modifies.
3. an -ING modifier and the word it modifies.
4. a past participle or -ED modifier and the word it modifies.
5. An adjective and the noun it modifies.
6. a phrase modifier and the noun it modifies.
CHAPTER V

EXPERIMENTAL MATERIALS

Exercises related to Grammar:

Exercise 1: Complex English noun modification

In the following expressions, underline the main word that is modified (the thing we are talking about). Then translate the expression into Spanish.

1. complex English noun modification

2. transparent glass ornaments

3. Egyptian glass ornaments

4. modern drinking glasses made in Czechoslovakia

5. the colored glass windows in the house on 10th Street

6. the glassmaking process developed in Roman times

7. a thick protecting layer of paint

8. new automatic processing techniques

Exercise 2: Consolidation of Class 13

Read the short paragraph below and answer the questions which follow it.

Because of their molecular structure, it is possible to mold plastics into a great variety of products. Today, we can find every kind of plastic product from specialized articles for cosmonauts to common everyday objects such as drinking glasses and coffee cups.

1. In the first sentence, their refers to and is: i. forward reference ii. backward reference

2. Underline the word that is modified in each of the following expressions. Then translate the expression into Spanish. (All of the expressions are from the paragraph.)
(a) coffee cups ____________________________
(b) drinking glasses ________________________
(c) common everyday objects __________________
(d) specialized articles for cosmonauts ________
(e) every kind of plastic product ______________
(f) a great variety of products _________________
(g) the molecular structure of plastics __________

3. Find the following prepositions in the paragraph and indicate below what each expresses in this context:
   (a) into _________________________________
   (b) from ... to ____________________________
   (c) for ___________________________________

4. (a) Which expression indicates example? __________
    (b) What examples are given? ________________
    (c) What are they examples of? _______________

5. (a) Which expression in the paragraph indicates a cause and effect relationship? __________
    (b) Summarize this relationship by filling in the chart below:

<table>
<thead>
<tr>
<th>cause</th>
<th>effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>______________________</td>
<td>______</td>
</tr>
</tbody>
</table>

6. Translate the paragraph into Spanish
The development of synthetic plastic materials represents one of the great triumphs of the organic chemist. The term "plastics", used by the modern plastics industry, refers to certain substances manufactured from organic compounds, that is, from combinations of carbon with hydrogen, oxygen, nitrogen, and other elements. The term does not include inorganic molding materials, such as concrete, cements, and ceramics, nor the organic substance we call rubber.

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Protein plastics. These plastics are obtained from different sources, such as milk and soybean. These proteins are processed into a colloidal mass and finally formed into sheets, rods or tubes. The resulting product is used to make small articles such as buttons, beads, buckles, and other accessories.

Vocabulary

Please see pages 56-57 of the Textbook Technical English.
Exercises for the reading 'Plastics' (pp. 55 - 56 of the textbook)

Exercise 3: Recognition of sentences and paragraphs

1. How many paragraphs are there in this reading? _____

2. Quickly number all the sentences in the reading and write down each paragraph number and the corresponding sentence numbers.

Note: In sentence 8 on page 55 of the textbook, resin should read rosin.

Exercise 4: Identification of the topics and sub-topics

1. There are 3 main topics in this reading. They are listed below but not in their correct order. Number them according to their order in the reading and write down the paragraph(s) which correspond to each topic.

<table>
<thead>
<tr>
<th>Order</th>
<th>Topic</th>
<th>Paragraph(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Types of organic plastics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Description of the different types of organic plastics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Definition of the term 'plastics'</td>
<td></td>
</tr>
</tbody>
</table>

2. (a) Which of the topics has sub-topics? _________

   (b) How many sub-topics are there? _________

   (c) Write down an appropriate title for each sub-topic and the paragraph number where it is found:

<table>
<thead>
<tr>
<th>Sub-topic</th>
<th>Paragraph</th>
</tr>
</thead>
</table>


Exercise 5: Language Study Questions (Topic 1)

1. These questions correspond to topic 1. Therefore, which sentences of the reading are you going to read?

Answer the questions after you have read the sentence indicated. They will help you to understand new words, difficult grammatical structures and the relationships between ideas.

2. Read sentence 1:

(a) synthetic plastic materials means materials that are made of synthetic plastics, i.e. plastics which have been produced by chemical synthesis.

   synthetic plastic materials = Sp. ________

(b) an organic chemist is: i. a science

   ii. a person

   iii. a substance

(c) triumph is a synonym of victory. What do these two words mean in Spanish? ________ and ________

3. Read sentence 2:

(a) the modern plastic industry means the modern industry that produces plastics = Sp. ________

(b) 1. The expression that is indicates that what follows:

   i. is an example of previous information

   ii. is additional and different information

   iii. states the previous information in a different way

   2. .. combinations of carbon with hydrogen, oxygen, nitrogen and other elements:

   i. are examples of organic compounds

   ii. are not organic compounds; they are something different

   iii. constitute organic compounds

4. Read sentence 3:

(a) Which term does not include inorganic molding materials? ________
(b) inorganic molding materials means inorganic materials that can be molded. = Sp. __________

(c) 1. What are concrete, cements, and ceramics examples of?
2. Which expression in sentence 3 indicates example? ________________

Exercise 6: The essential information under topic 1 (Paragraph 1)

Topic 1 deals with the definition of the term 'plastics'.

1. (a) The definition of 'plastics' that is given in this reading is:
   i. a general definition for all situations
   ii. a specific, or restricted, definition

(b) Support your answer to 1(a). (If necessary, answer in Spanish) ________________

2. Summarize the definition in Spanish: ________________

Exercise 7/
Exercise 7: The essential information in paragraph 3

In paragraph 2, we are told that there are four principal types of organic plastics. Paragraph 3 describes one of these types. It is described in terms of the products that are made from it and its properties. Complete the chart below that summarizes this information.

<table>
<thead>
<tr>
<th>Type of organic plastic:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Products (examples)</td>
<td>1.</td>
</tr>
<tr>
<td></td>
<td>2.</td>
</tr>
<tr>
<td></td>
<td>3.</td>
</tr>
</tbody>
</table>

| Properties              |                  |
| (a) of synthetic resins:| 1.               |
|                         | 2.               |
|                         | 3.               |

| (b) of products made from synthetic resins: | 1. |
|                                             | 2. |
|                                             | 3. |
|                                             | 4. |
|                                             | 5. |
|                                             | 6. |
|                                             | 7. |

Exercise 8: Essential information in paragraph 4

1. Classify the types of natural resins mentioned in this paragraph by filling in the chart below:

```
natural resins
  /       \
 /         \
/           \
/             \
/               \
/                 \
/                   \
/                     \
/                       \
/                           \
```
2. Complete the following chart that summarizes the information in paragraph 4.

<table>
<thead>
<tr>
<th>Type of organic plastic:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Members of this group:</td>
<td></td>
</tr>
<tr>
<td>rosin</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Products:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. type:</td>
</tr>
<tr>
<td>b. method of preparation</td>
</tr>
<tr>
<td>c. examples of use:</td>
</tr>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
</tr>
</tbody>
</table>

3. (a) According to the explanation given in this paragraph:
   i. A resin is a rosin
   ii. A rosin is a resin
   iii. A resin and a rosin are the same thing.

   (b) In which sentence do you find this information?

Exercise 9: Essential information in paragraphs 5 and 6

1. Which of the following information is given in paragraphs 5 and 6 about cellulose derivatives and protein plastics? If the information is given, write -- in the blank -- the number of the sentence where it is found. If the information is not given, mark the blank with an X.
2. In Chapter III, we studied that there are different levels of generality. In the last sentence of this reading, we have an example of a 3-level generalization. To help you identify it, three sentences are written below. Number them 1, 2, 3 from the most general to the least general:

____ Protein plastics are used to make beads and buttons.
____ Protein plastics are used to make small articles.
____ Protein plastics are used to make accessories.

Exercise 10: Consolidation of Chapter V

Read the short paragraph below and then answer the questions which follow it:

The words in a language can be divided into two groups according to the information which they carry. 
There are content words (i.e. those which carry essential information) and there are function words (i.e. those which do not carry essential information). Information-carrying words include nouns, verbs, adjectives and adverbs. Non-information-carrying words include articles (e.g. the, a); pronouns (e.g. he, it, those); prepositions (e.g. from, to, into, for); conjunctions (e.g. that, if, and); auxiliary verbs (e.g. are, do, is, don't)

1. A suitable title for this paragraph would be:

2. (a) Express the following idea from sentence 1 in another way:
The words in a language can be divided into two groups

(b) What is another way of saying: according to (sentence 1):
3. (a) Make a classification chart of the information given in the paragraph. Fill in the chart below:

(b) What is the basis of classification mentioned in this paragraph?

4. What kind of relationship is indicated by the expression e.g.?

5. What kind of relationship is indicated by the expression i.e.?

6. (a) Circle the noun which is modified and underline the modifiers in each of the following expressions. Then translate the expressions into Spanish. (Note: the is an article. It is not considered a modifier.)

   i. the words in a language
   ii. content words
   iii. words which carry information
   iv. information-carrying words
   v. words which do not carry information
   vi. non-information-carrying words

(b) 1. Which expressions in 6(a) must be translated in the same way in Spanish?

2. Why?
**Chapter V: Modifiers of the noun**
- Different modifiers of the noun
- Prepositions: from, to, into, for

**Activity #13**

1. **INTRODUCTION**

1.1 Roll Call

1.2 Objectives:

1. Consolidar y comprobar lo estudiado mediante ejercitacion.
2. Repasar los distintos tipos de modificadores del sustantivo ya estudiados en las clases anteriores.
3. Aprender a reconocer la frase como modificador del sustantivo y su posicion en contraste con la de otros modificadores.
4. Reconocer la importancia de la modificacion en las ideas claves de un mensaje.
5. Reconocer y utilizar funcionalmente las preposiciones for, into, to y from.

1.3 **Correction of homework: Exercise 8 (Question 3)**

The teacher puts the following diagram from Question 3 of Exercise 8 of Unit IV on the blackboard: (S/he is going to use this diagram later in the teaching of complex noun modification.)

```
advanced technology  ➔  different kinds of glassmaking processes
e.g. rolling process
     pressing process
```

S/he then proceeds to correct the homework, which s/he might do in the following way?

- What is this diagram a summary of?
- What does the arrow indicate?

- We have studied many different expressions in English which express a relationship of cause and effect. Let us review the ones you have studied along with their Spanish equivalents. (The students should be able to supply all the prepositions, conjunctions,
adverbials and verbs that they have learned: e.g. because of, because, therefore, produce.

What does the abbreviation e.g. indicate? What other expressions do you know that express example?

English often has many ways of expressing the same idea. So does Spanish. In fact, so do all languages. Let's now correct part(s) of question 4 that you prepared for homework, i.e. expressing the information in the chart above in complete Spanish sentences. Let's see how many versions we can find in your answers. (The teacher should try to get as many versions as possible and might have a different student from the one giving the answer to tell him/her if the version correctly expresses the information. (If the students have to correct each other's work, they will pay more attention.)

Let us now compare your summaries with the translation of the paragraph in Exercise 8 (Question 4(b))

The teacher then takes up 4(c). (The students should be able to say that the informational content is the same but that the linguistic form is different and to substantiate their claim. (e.g. How is the form different?)

1.4 Vocabulary practice

The teacher should spend as much time as is left in the introduction reviewing the meaning of some of the verbs which they have studied, possibly asking if the verb is regular or irregular, and if irregular, asking for the 3 parts. S/he might also ask for the corresponding noun and adjective if there is one. (See the attached list of verbs which the students have studied from Chapter I - IV. Each teacher should know which verbs are problematic for a particular group of students.)

2. DEVELOPMENT

2.1 Modifiers of the noun

2.1.1 Essential words in a text: nouns, verbs and modifiers

The teacher has left the diagram on the board and now draws the students' attention to it again. S/he says:

As we have seen, this summary contains the key information of the short paragraph in Exercise 8 of Unit IV.
You have noticed that the number of words is considerably reduced from the original paragraph and yet those words convey all the key information.

We could reduce the number of words even more. How? (by removing:
- kinds of because different glassmaking processes and different kinds of glassmaking processes mean the same thing; they express the same idea
- the word process from the two examples. This word is not necessary as processes appears above in the box and the expression e.g. tells us that rolling and pressing are examples of processes.)

(The teacher then rubs off the extra words)

Now let us examine the kinds of words which summarize the essential ideas in our little paragraph:

The teacher reads out advanced technology and asks:
- What kind of word is advanced? Is it a noun, a verb, a modifier, a preposition? (To keep things simple, the teacher should refer to all types of modifiers as modifiers throughout this discussion. (The identification of adjectives, -ing forms, -ed forms, and phrases will come later in the lesson.)
- What kind of word is technology

The teacher then reads out different glassmaking processes and proceeds in the same way.

S/he then goes on to the analysis of pressing and rolling (they are modifiers of the noun processes.)

S/he then asks what kind of word in the paragraph the arrow represents (a verb).

Now, let us go over what we have just discovered through our analysis of the kind of words used in this summary. What kind of words are they?

We see that the words in the summary are:
- nouns (technology, processes)
- a verb (brought about)
- modifiers of the noun (advanced, different, glassmaking, etc.)

2.1.2 Summaries are like telegrams

This summary is like a telegram. When we send a telegram, we reduce the message to the essential words. Let's see some examples, first in Spanish and then in English.
Notice which words - in both languages - are left out and which words are essential.

The teacher rubs off the summary and writes the following sentences on the board, one at a time, and has the students tell him/her which words to cross out in order to be left with the essential message. S/he writes the essential message to the right of the full version.

1. Juan llegara el sabado a los 8 de la manana por tren.

2.1 El nuevo metodo de produccion de vidrio ha sido muy exitoso.

3. John will be arriving by train on Saturday at 8 o'clock in the morning.

4. The new method for making glass has been very successful.

2.1.3 Essential words are information-carrying words: non-essential words are non-information-carrying words

Let us now examine the kinds of words that convey the essential information:

- The teacher reads the 'messages' in the right-hand column: Juan llega sabado ... very successful.

- As we can see, these words, like the ones in the summary, include nouns. Let's pick out the nouns - in Spanish and English.

- verbs. Let's pick out the verbs (in this case, making might be considered a verb or a noun. It is a gerund, which as we know has the function of a noun. The teacher can simply say that it is a verb-form functioning as a noun.

- modifiers (8 a.m. and Saturday should be considered as modifiers of the verb as they both tell us when.)

- Let's now examine the words we have eliminated. What kind of words are they? (The teacher may have to give either the category or the category and the examples, although s/he should first try to get the students to tell her/him.)

- articles. What examples do we have?
- prepositions
We can say that these kinds of words generally do not contain or convey the essential information. It is interesting to note that these kinds of words: prepositions, articles, conjunctions, auxiliary verbs, belong to classes of words that do not expand in the language. New words that enter a language are verbs, nouns and modifiers (e.g. the new language to describe computer technology: software, hardware, input, output, etc; in Spanish: alunizar, etc.

Let me clarify: Prepositions, articles, etc. do not usually contain the essential information. However they contain information. For example, the article in English can give us information about the generality of things. (We studied this in Chapter III). The definite article often indicates that something is specific, whereas no definite article often indicates a generalization. So remember: although we say that some words carry information (Which words?) and that some words do not carry information, this is relative. We are talking about the essential information.

(The teacher might wish to include this point or not):
We do not speak or write like a telegram. There are a number of reasons for this. Among them are:
- the need to be precise and to express subtleties
- the need to repeat information in order to ensure that if one part of the message is lost it can be recovered from other parts of the message.
- the brain is not able to process too much information at one time, so the message cannot be too concentrated. The non-information-carrying parts give us time to digest the information-carrying parts.

2.1.4. Nouns, verbs and modifiers belong to families of words

So we have seen that modifiers are very important because they, along with nouns and verbs, carry important information. These words are called the content words of a language. An important thing to realize is that nouns, verbs and modifiers form families of words. That is why we ask you to give us the noun form of adverb or the adjective form of a noun etc.

The teacher writes the word advanced on the board. This is a modifier: the -ed form of the verb. Let's look at the other words in the same family:
- What is the verb? (advance)
- What is the noun? (advancement or advance)
- What would the -ing modifier form?

Not all verbs would have a corresponding noun form and modifier forms, but many many do and that is why it is important for us to study all these forms and to know what is a verb, a noun, a modifier.

2.1.5. Different types of noun modifiers

Now we are going to look at different types of noun modifiers. The teacher puts up Chart 23 (Chart 17 of last year's course) and explains it.

Chart 23

<table>
<thead>
<tr>
<th>MODIFICATION OF THE NOUN</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOUN MODIFICATION</td>
</tr>
<tr>
<td>advanced technology</td>
</tr>
<tr>
<td>different kinds of glassmaking processes</td>
</tr>
<tr>
<td>the glass industry in Czechoslovakia</td>
</tr>
<tr>
<td>the rolling process</td>
</tr>
</tbody>
</table>

Procedure:
- We've just looked at the word advanced. What kind of modifier is it? (past participle of the verb advance)
- What kind of modifier is different? (The teacher might ask for the noun form (difference) and the verb form (differ)
- Glass?
- Rolling?
- Notice that a phrase can also modify a noun: of glassmaking processes (modifying kinds); of the noun (modifying modification in the title); in Czechoslovakia (modifying industry)
- Notice that phrases always go after the noun, whereas other kinds of modifiers in English usually go before
- Notice that within the modifying phrase of glassmaking processes there is a further example of modification. What is it? (glassmaking modifies processes). The teacher writes the phrase glassmaking processes on the board
- Now notice that we could also express glassmaking processes in a longer form:
  - processes for making glass
  - processes which have been developed (for making glass (to make glass
- Tell me what the various Spanish forms are for
expressing this idea. Notice the difference between the English and the Spanish

2.1.6. The difference between English and Spanish

It is extremely important to notice that in Spanish we are not able to reduce the number of words the way we can in English. English can be reduced like a telegram. This has a lot to do with the fact that the word order in English is more rigid than in Spanish and by placing one noun before another it changes its function, etc.

- This type of telegram-style noun modification is very common in English — particularly in scientific and technical writing — and we can find long strings of modifiers modifying a noun
- Let's look at an example of a more complex string of modifiers and examine how we de-code it.

2.1.7. Decoding strings of modifiers

- The teacher writes this example on the board:
  computer-controlled glassmaking processes
- To decode this type of complex modification, we must first identify what it is we are talking about. What are we talking about in this case? (processes)
- Let's number processes with the number 1 (processes)
- Now let's see which processes we are talking about? In other words, let's identify the modifiers
- We are talking about processes for making glass that are controlled by computer. S/he writes this on the board and numbers the words in the string:
  3 2 1
  computer-controlled glassmaking processes = processes for making glass that are controlled by computers
- This helps us to translate it into Spanish because we do not have an equivalent short form. That is when we translate it into Spanish, we must put it into the full, non-telegram version. What is the translation?
- So you see that in Spanish, we must use more phrases (prepositions + nouns) and clauses
- Now, it is not always easy to decode these strings. The one on the board was relatively simple because it was a question of reading backwards: 1, 2, 3
- Look what happens if I add the word new:
  new computer-controlled glassmaking processes
- Are we still talking about processes? (yes)
- But they are now new processes for making glass that are controlled by computer. So, in order to translate it, we would have to number it: 1 4 3 2 (=Sp. nuevos procesos...)
- And if I add the phrase in Czechoslovakia? What are we talking about? (new processes in Czechoslovakia for making glass that...)
- How do you translate that into Spanish?
We are now going to do an exercise on noun modification.

2.1.8. Summary of main points about noun modification

(The teacher should go over these points in the conclusion to the class, so at this point, s/he might prefer to tell the students what the main points were and then in the conclusion get them to tell her/him, or s/he might prefer to have the students tell him/her on both occasions. Time will determine this, no doubt)
- modifiers are information-carrying words in the language, as are nouns and verbs
- modifiers, nouns and verbs belong to families. These are the classes of words that expand in a language. New words that enter the language are nouns, verbs and modifiers.
- there are different types of noun modifiers:
  - adjectives
  - nouns
  - -ing form of verbs
  - -ed form of verbs
  - phrases (preposition + noun + clauses that are controlled ...)
- noun modification in English can be telegram-style, eliminating phrases and clauses. This is common in scientific and technical writing in English. Spanish does not have an equivalent. In Spanish it is necessary to make phrases and clauses. (See example) (The chart should still be up on the board so that the teacher can refer to it when necessary)

2.1.9. Exercise 1: Complex English noun modification

Let us do Exercise 1 on your sheets. The teacher should do questions 1, 2, 3, with the students pointing out that they must be careful to identify which words are adjectives and where the adjective fits in the string.

# 1: Complex modifies modification = complex modification of the English noun
# 2: transparent modifies glass = ornaments made of transparent glass
# 3: In this case, Egyptian modifies ornaments = Egyptian ornaments made of glass
- If the students have trouble with the exercise, the teacher should help them until they are able to continue on their own.

(As this kind of modification is extremely difficult for the Spanish speaker and is so common in English scientific and technical writing, the teacher should, in future classes, take every opportunity to work with any examples which appear in readings, exercises, instructions, etc., getting the student to first decode the string and then translate it into Spanish.)
2.2 Prepositions: Chart 24 and 25

Charts 24 and 25 are now shown and explained.

Chart 24

<table>
<thead>
<tr>
<th>PREPOSITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>From ________ point of origin</td>
</tr>
<tr>
<td>e.g.: He came from the factory.</td>
</tr>
<tr>
<td>1. direction towards (= towards)</td>
</tr>
<tr>
<td>e.g.: The students go to the library.</td>
</tr>
<tr>
<td>2. purpose</td>
</tr>
<tr>
<td>e.g.: They go there to study.</td>
</tr>
<tr>
<td>From ... to ____ range in time, space, importance, use, etc.</td>
</tr>
<tr>
<td>e.g.: from morning to night; from Havana to Moscow; from the highest to the lowest</td>
</tr>
</tbody>
</table>

Chart 25

<table>
<thead>
<tr>
<th>PREPOSITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. purpose</td>
</tr>
<tr>
<td>e.g.: These instruments are for drawing</td>
</tr>
<tr>
<td>FOR ________ 2. destination</td>
</tr>
<tr>
<td>e.g.: Mary left for the factory at 6 p.m.</td>
</tr>
<tr>
<td>3. extension of time or space</td>
</tr>
<tr>
<td>e.g.: It rained for 3 days. They walked for a mile.</td>
</tr>
<tr>
<td>INTO ________ implies movement, e.g. change of place or state</td>
</tr>
<tr>
<td>e.g.: The students came into the room</td>
</tr>
<tr>
<td>Water can be changed into steam</td>
</tr>
</tbody>
</table>

2.3. Exercise 2: Consolidation of Class 13

Once the teacher has explained the two charts on the prepositions, the students do as much of this exercise as there is time for in the Development of the class, the rest of the exercise being assigned for homework. (The
ideal would be to try and finish the first three questions as they cover the teaching points of Class 13)

3. CONCLUSION

3.1. Review of the topics of the day's class

The teacher asks the students to recall the main points learned under the topic of modifiers (See p. 551 of the Teachers' Notes) and to tell him/her what prepositions they learned.

3.2. Homework

As always, to study what they have learned today, to review vocabulary, especially verbs, and to finish Exercise 2.
Activity #14

1. INTRODUCTION

1.1. Roll call

1.2. Objetivos:

1. Senalar las dificultades detectadas en el TCC2.
2. Consolidar y comprobar lo estudiado mediante ejercitacion.
3. Enriquercer el vocabulario cientifico-tecnico.
4. Reconocer el sufijo -able.
5. Identificar los topicos de un texto, tomando como ejemplo la lectura Plastics.
6. Identificar la informacion clave de un topico.

1.3. Review of the difficulties found in Test #2

1.4. Vocabulary review

The teacher should use whatever time is left in the introduction to continue the work with verbs (see Class 13 and the list of verbs on the supplementary sheet).

2. DEVELOPMENT

2.1. Checking of homework: the rest of Exercise 2

Question 4(c): Drinking cups and coffee cups are examples of everyday objects. However, it could be interpreted that in this paragraph the author is saying that they are examples of common everyday objects made of plastics. Either answer should be accepted as it is a question of interpretation.

Question 5(b): The cause could be stated in a number of ways: molecular structure, their molecular structure, the molecular structure of plastics. The effect is: it is possible to mold plastics (the possibility of molding plastics). The student might also write down the whole last part of sentence 1: it is possible to mold plastics into a great variety of products. This too would be a correct answer. The teacher should point out, however,
that the important part of the information is that plastics can be molded (son moldeables).

This exercise now leads into the following teaching point.

2.2. Suffix: -able

After the last question of Ex. 2 has been checked, the teacher draws the students' attention to the phrase in the text: it is possible to ... and then makes the following points:

- Does 'it' refer to anything? What do we call this type of 'it'? We call it impersonal 'it' because it does not refer to anything. And we also call it anticipatory 'it' because the 'it' construction anticipates the important part of the message or information. Let's analyze that:
  - When we read (or hear) the expression 'it is possible to ...' we know that we are going to learn about the possibility of something. The 'something' is what comes next in the statement.
  - What is the possibility that is mentioned in the reading? (the possibility of molding plastics)
  - Let's now look at another, or rather other, ways of expressing 'the possibility of molding'.
  - The teacher then shows Chart 26 and explains it.

Chart 26

<table>
<thead>
<tr>
<th>POSSIBILITY OF MOLDING</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is possible to mold plastics.</td>
</tr>
<tr>
<td>Plastics are moldable.</td>
</tr>
<tr>
<td>We can mold plastics.</td>
</tr>
<tr>
<td>Plastics can be molded.</td>
</tr>
<tr>
<td>Plastics are moldable</td>
</tr>
</tbody>
</table>

Points to make:

- can and be able to express the idea of possibility. (They can also express the idea of capacity or ability. These are related to possibility but are not exactly the same thing, because the possibility of doing something is not always the same as having the capacity to do something.)
- Plastics can be molded is a passive form.
- The adjective moldable is made up of the verb mold and the suffix -able.
- We can add the suffix -able to many verbs to form adjectives which convey the idea of the possibility of something.
- The teacher writes this example on the board:
  - Glass is breakable.
  - What are the other ways of expressing this idea? (See chart)
  - How is the word 'breakable' formed?
- Turn to p. 53 in your books and look at some more examples.
- The teacher reads out the examples on p. 53 and then to check the students' comprehension, puts this sentence on the board and asks them to express it in different ways in English and to give all the possible Spanish equivalents:
  - Some errors are avoidable; others are unavoidable.
  - (The students should be able to deduce the negative meaning of 'unavoidable')

2.3. Reading: Plastics - Introduction

The teacher now says that they are going to read about plastics and asks the students if they know the origin of this word 'plastics'. S/he may then have to explain that it comes from the Greek word plastikos, which means able to mold or give shape to. The word, plastic, then is a very old word, but the modern substance which we call plastics is not. When was the substance discovered or first made? (20th century). Therefore, we must be careful to distinguish between the substance which we call 'a plastic' (North American) or 'a plastics' (British), and this quality of being plastic, but are not plastics. Can you give me an example? (rubber)

2.4. Exercise 3: Recognition of sentences and paragraphs

By now, the students should be able to identify the paragraphs immediately, so question 1 could be answered in a matter of seconds. The students should then go on to answer question 2. The teacher might give them a time limit - say three minutes - and then take up their answers on the board.

2.5. Exercise 4: Identification of the topics and sub-topics

The teacher should, as always, have a student tell him/her in Spanish what it is they have to do in this exercise, according to the instructions given.
- Question 1 should be done and corrected before going on to Question 2.
- Although there is no mention of markers in the exercise, the students should be asked to identify the markers of the topics, or to identify the sentences where the markers appear.
  - (Note to the teachers for your information: Markers are elements in the language which indicate or mark information (in general). We have stressed this term in connection with marking topics and
sub-topics, but a marker can mark all types of information:
- the ending -ed marks past tense
- the connector but can mark a relationship of contrast
- the ending -s can mark plural; it can also mark third person singular
- the punctuation mark : can mark a string of something, for example, a string of examples
- the suffix -able can mark the possibility of doing something
- drawings and diagrams can be markers of different types of information

In the search for topics and sub-topics, the markers are usually words and phrases although we have seen that sometimes tense will be a marker if there is going to be a change of tense in the text because of the change of topic.

When we ask the students to look for the sentences with the markers we should be careful to point out that it is certain words and phrases within the sentence that mark the information. (e.g. in the reading, the markers for Topic 1 are found in sentences 2 and 3, but not all the words in sentences 2 and 3 are the markers. In sentence 2, the markers are:
- The term 'plastics' (used by) ... refers to ...
In sentence 3, the markers are:
- The term does not include ...

Be careful that the students do not confuse 'marker' with the essential information. The marker merely indicates or points to the essential information. It is not the essential information.

Underlining is another way of marking important information. This is why new words in a text should not be underlined, unless, of course, they are key words. (In this reading, the sub-topics of Topic 3 are all underlined, but it is not clear to the student whether this is something the author did or something the teacher preparing the text did in order to point out new words. It is feasible that the author would have underlined these words to show what the topic of each of paragraphs 3, 4, 5, and 6 is.

The markers of the topics and sub-topics are:
- Topic 1: certain words and phrases in sentences 2 and 3 (see p. 63)
- Topic 2: sentence 4: The four principal types of organic plastics are
- Topic 3: paragraph 3: synthetic resin plastics. and words like:
  - we use ... to make (description of use)
  - the chemist is able to produce ... hard, transparent (description of properties)
  - products that are strong and lightweight,
2.5. Exercise 5: Language Study Questions (Topic 1)

- Additional questions which the teacher might ask orally (in some classes there might be time for any of these or for only some of them. The teacher should use his/her discretion in selecting the ones to ask)

After question 2(b):

- The teacher asks the students what the word is for the science and for the substance (chemistry and a chemical)
- S/he might reinforce the teaching point by writing the words: - physics and physicist on the board and asking which one is the person and which one is the science.

After Question 3(b)

- The teacher should ensure that the students see the connection between parts 1 and 2 of this question and understand why '. (therefore) is inserted before part 2. S/he could ask the students 'Why do we say 'therefore'?'

2.6. Exercise 6: Essential information under Topic 1

- If there is not time to finish this exercise on class, the rest should be assigned for homework, the teacher trying to do it orally at least. They will also be assigned Exercise 7 for the homework as well as vocabulary.

3. CONCLUSION

3.1. Review of the day's topics
To review the suffix -able, the teacher writes this sentence on the board and asks the students to express the idea in different ways in English and to express the idea in Spanish:
- Most plastic objects are unbreakable.

S/he then asks them:
- What is the difference between a plastic substance and a plastic(s)? (a plastic substance may not necessarily be made of the synthetic substance, plastic(s), but may simply have the quality of plasticity.
- What is an example of a plastic substance that is not made from plastic(s)?

3.2. Homework

- To review all that they learned today. To help them do this, they should:
  - finish Exercise 6 (if necessary)
  - do Exercise 7 (the teacher ensures that the students understand the instructions)
  - study the vocabulary of the reading (pp. 56-57)
Week 11
Class 15
Chapter V: Modifiers of the noun
Exercises related to the reading Plastics Classification

Activity #15

1. INTRODUCTION

1.1. Roll Call

1.2. Objectivos:

1. Consolidar y comprobar lo estudiado mediante ejercitacion.
2. Entrenar al alumno en la comprension de la informacion esencial de un texto y en la elaboracion de un resumen de esta.
3. Enriquecer el vocabulario cientifico-tecnico.

1.3 Correction of homework: (Exercise 6 and Exercise 7)

Note: In the properties of the products, the students must be careful to indicate that the products resist moisture, resist moderate heat, etc. (They cannot put heat, etc. as properties)

- If there is time, the teacher might want to teach that we can make an adjective out of the verb resist by adding the suffix -ant. We can then say that these products are:
  - moisture-resistant
  - moderate-heat-resistant
  - sunlight-resistant
  - acid-resistant
  (We have to say hard-wearing, not hard-wear-resistant)

- The teacher might ask the students to translate: unbreakable phonograph records, and could point out that records, in this context, is a noun; but that it can also be a verb.

- If there is time left in the introduction, the teacher should have one or more students make an oral summary in Spanish (in complete-sentence form) of the information in the chart. This could be done spontaneously without any kind of preparations at their seats.
2. DEVELOPMENT

2.1. Vocabulary

The teacher should spend about 3 minutes checking and evaluating words from the vocabulary list that were assigned for homework.

2.2. Teaching of classification

The teacher now says that in Exercise 7 they saw a description of one type of organic plastic. S/he reminds them that in paragraph 2 the different types of organic plastics were mentioned. What were they?

- S/he then says: When we say that there are different types of something, we are classifying these things according to some common characteristics.
- Today we are going to study classification: What it is and how to express it in language.
- Let us take the examples of cars. There are many different kinds of cars in the world, aren't there? If we want to group these different kinds, we have to choose a common characteristic. In other words, we have to have a basis for classification.
- For example, we could choose the number of cylinders as one basis for classification. In this case, what kinds of care would we say there were? (2-cylinder, 4-, 6- and 8-cylinder cars)
- What is an example of a 2-cylinder car (a Citroen)
- a 4-cylinder car? (a Lada, a VW, etc.)
- What are some other bases we could use to classify cars? (e.g.: country where made: German, Italian, Soviet, etc.
- decade in which made: 1920's, 1930's, etc.)
- number of wheels
- way in which the engine is cooled
- type of transmission

- In the reading, are we told what the basis of classification is?
- Can we, nonetheless, infer what the basis of classification is? (the substances from which the plastic is made)
- Although the basis for the classification is not always stated, it exists in an implicit way.
- Let us now look at the ways (some of the ways) that we have in English for expressing classification when we want to show how things are grouped according to some characteristic or criterion.
Organic plastics are classified as resins, ... We can classify organic plastics into ... Organic plastics can be classified into four main types. Organic plastics can be divided into four main groups. Organic plastics can be grouped into ... classes. The four main types of ... are ... There are ... types of ... groups, classes, categories, families, kinds, varieties.

Points for the teacher to make when explaining the chart:
- the highlighted words 'mark' a classification showing division into classes.
- notice that this classification shows division into classes (from the general to the particular); there is another type (from the particular to the general). We will study the second way in our next class.
- all the sentences should be translated into Spanish and it should be emphasized that all the sentences gave the same information although the way of expressing it is different.
- Although there is no mention of the basis for classification in the reading, let us see how we can express this in English. The teacher then writes on the board: (These are some ways only) Cars can be classified according to their inventor on the basis of in terms of ...
- We are now going to draw a classification chart to show diagrammatically the information in paragraph 2. The thing that we are going to classify into groups is put at the top of the chart. The teacher then draws the first box on the board: S/he asks the students to tell him/her what to put in the box.
- Now the reading says that there are four types. But if we analyze this carefully, we will see that two types are really sub-divisions of one, more general type. Let's see if you can fill in the boxes correctly:
resins | cellulose der. | protein plastics
natural | synthetic

(The teacher may have to help the students, but s/he should see if they can do it themselves.

- Now we are going to read paragraph 4 for the essential information in it, and you are going to do Exercise 8. You will notice that question 1 of Ex. 8 is a question on classification. We'll see if you have understood the lesson that you've just been taught.

2.3. Exercise 8: Essential information in paragraph 4

Question 3(b): Both sentences 8 and 13 give this information. An oral summary should be made of the info in the chart.

2.4. Exercise 9: Essential information in paragraphs 5 and 6

Question 2: Point out that beads and buttons are examples of accessories, which in turn are a type of small articles, therefore, the most general term is small articles (If they have trouble with this, go back to the reading and analyze the sentence. The word other indicates that beads and buckles are types of accessories.)

2.5. Making a classification of all the information in the reading

- In various parts of the reading, we have had the classification of different things. Let's now put all that information together in one big classification chart of organic plastics.
- The teacher puts the chart with the empty boxes on the board and tells the students to do this in their workbooks (i.e. copy the chart and fill in the boxes with the correct information, which they can take from the reading or from their answers.

[Chart]/
3. CONCLUSION

3.1. Review of the day's topics

3.2. Homework

- Review Chapter V. To help students do this, they are assigned Exercise 10
- They should also review all the vocabulary learned to date, particularly the verbs

Note:

Re Exercise 8: If there is time, the teacher could have several students make an oral summary of the information in the chart of this exercise, and then have several other students translate the corresponding paragraph (4) into Spanish in order to be able to compare the direct translation with the summary.

- The same could also be done with paragraph 3 and the chart in Exercise 7.
Study Notes
CHAPTER V

1. Modificacion del sustantivo
(Noun modification / Modification of the noun)

1.1 Tipos de modificadores
(Types of modifiers)

1. advanced technology
(participio pasivo)

2. different kinds of glassmaking processes
(adjetivo) (frase modificadora)

3. the glass industry in Czechoslovakia
(sustantivo) (frase modificadora)

4. the rolling process
(modificador -ing)

- Observe que las palabras subrayadas modifican a los sustantivos 'technology', 'kinds', 'industry' y 'process'.

1.2. Posicion de los modificadores
(Position of modifiers)

- Los modificadores, adjectivos, participios pasivos, sustantivos y modificador -ing proceden generalmente al sustantivo modificado.

- La frase modificador (preposicion + sustantivo que a su vez puede estar modificado) va siempre despues de la palabra modificada.

1.3. Comparacion de la modificacion del sustantivo en ingles y en espanol
(Comparison of noun modification in English and in Spanish)

<table>
<thead>
<tr>
<th>Ingles</th>
<th>Espanol</th>
</tr>
</thead>
<tbody>
<tr>
<td>'estilo telegrama'</td>
<td></td>
</tr>
<tr>
<td>1. glassmaking processes</td>
<td>procesos para la fabricacion del vidrio</td>
</tr>
<tr>
<td>2. complex English noun</td>
<td>modificacion compleja del sustantivo en</td>
</tr>
<tr>
<td>modification</td>
<td>ingles</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>version larga</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. processes for making glass</td>
<td></td>
</tr>
<tr>
<td>2. complex modification of the noun in</td>
<td></td>
</tr>
<tr>
<td>English</td>
<td></td>
</tr>
<tr>
<td>modification</td>
<td></td>
</tr>
</tbody>
</table>
Observe que:

- en inglés: muchas expresiones pueden ser con frecuencia 'estilo telegrama'; es decir, podamos eliminar frases, preposiciones, artículos, oraciones subordinadas, etc. Sin embargo, las mismas expresiones pueden ser llevadas a una versión más larga.

- en español: no es posible el 'estilo telegrama'. Necesitamos con frecuencia más palabras (frases preposicionales, preposiciones, oraciones, oraciones subordinadas, etc.) para expresar una misma idea; es decir el equivalente a la versión larga en inglés.

2. Preposiciones

2.1.

<table>
<thead>
<tr>
<th>PREPOSITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>FROM -------- point of origin</td>
</tr>
<tr>
<td>e.g.: He came from the factory.</td>
</tr>
<tr>
<td>1. direction towards (= towards)</td>
</tr>
<tr>
<td>e.g.: We are going to the library.</td>
</tr>
<tr>
<td>TO 2. purpose (= in order to)</td>
</tr>
<tr>
<td>e.g.: The students come here to study engineering.</td>
</tr>
<tr>
<td>FROM ... TO range in time, space, importance, use, etc.</td>
</tr>
<tr>
<td>e.g.: Some people work from morning to night.</td>
</tr>
<tr>
<td>He travelled from Havana to Moscow.</td>
</tr>
<tr>
<td>She corrected all the errors, from the most important to the least important.</td>
</tr>
</tbody>
</table>

2.2./
### PREPOSITIONS

<table>
<thead>
<tr>
<th>Number</th>
<th>Preposition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>purpose</td>
<td>e.g.: This instrument is for drawing.</td>
</tr>
<tr>
<td>2</td>
<td>destination</td>
<td>e.g.: Mary left for the factory at 6 a.m.</td>
</tr>
<tr>
<td>3</td>
<td>extent of time or space</td>
<td>e.g.: It rained for 3 days. We walked for a mile.</td>
</tr>
</tbody>
</table>

**INTO** implies movement, i.e. change of place or state  
**e.g.**: The students came into the room.  
Water can be changed into steam.

### POSSIBILITY

<table>
<thead>
<tr>
<th>Number</th>
<th>Statement</th>
<th>Spanish Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>It is possible to mold plastics.</td>
<td>(Es posible moldear los plasticos.)</td>
</tr>
<tr>
<td>2</td>
<td>We can mold plastics.</td>
<td>(Podemos moldear los plasticos.)</td>
</tr>
<tr>
<td>3</td>
<td>We are able to mold plastics.</td>
<td>(Podemos moldear los plasticos.)</td>
</tr>
<tr>
<td>4</td>
<td>Plastics are moldable.</td>
<td>(Los plasticos son moldeables.)</td>
</tr>
<tr>
<td>5</td>
<td>Plastics can be molded.</td>
<td>(Los plasticos pueden ser moldados.)</td>
</tr>
</tbody>
</table>

### 3.1. Indicadores de la idea de posibilidad (Markers of possibility)

En el cuadro, las expresiones subrayadas son indicadores (markers) de la idea de posibilidad:  
- Oración 1: It is possible to + verb  
- Oraciones 2 y 5: can + verb (voz pasiva)
- Oracion 3: be able to + verb
- Oracion 4: adjetivo con la terminacion -able

3.2. El sufijo -able (Oracion 4)

-able se adiciona a muchos verbos para formar adjetivos que expresan la idea de la posibilidad de hacer algo.

Otros ejemplos:

- changeable = Sp. cambiable
- measurable = Sp. medible
  (Ver mas ejemplos en la pagina 53 del libro de texto)

Note que el equivalente en español no es siempre un adjetivo: - noticeable = Sp. que se puede ver/notar

4. Clasificacion
(Classification)

Ejemplo: Clasificacion de las palabras

4.1 Formas de expresar clasificacion linguisticamente
(Ways of expressing classification linguistically)

1. Division en clases
Division into classes

- Se enfantiza la clase y no sus miembros.
- Se expresa la clasificacion de lo mas general a lo menos general.

Ejemplos/
Ejemplos:
Cuadro #1

(a) Words are classified into 2 groups according to the information which they carry as content words and function words.

(b) Words can be classified as content words and function words.

(c) The two main types of words are: content words and function words.

(d) We can classify words into 2 types.

(e) There are 2 main types of words.

2. Miembros en una clase
(Membership in a class)

- Se enfatiza los miembros de una clase.
- Se expresa la clasificacion de lo menos general a lo mas general.

Ejemplos:
(Cuadro #2)

(f) 'He' is a word.

(g) 'He' and 'it' are members of the group called function words.

(h) 'He' is a kind of pronoun.

4.2 Indicadores de clasificacion
(Markers of classification)

La idea de clasificacion, como cualquier otra idea, puede expresarse de formas diferentes. Las expresiones subrayadas de los cuadros #1 y #2 son algunas de los indicadores (markers) que nos pueden ayudar a identificar una clasificacion. Algunas
expresiones indican división en clases (cuadro #1); otras indican miembros en una clase (cuadro #2).

4.3 Criterio de clasificación
(Basis for classification)
- es la característica sobre la cual basamos una clasificación.
- puede estar implícito o explícito. (En la oración (a) del cuadro #1, el criterio de clasificación es explícito.)

Ejemplos de expresiones lingüísticas que indican criterio de clasificación:
- according to (ver oración (a), cuadro 1)
- on the basis of
- in terms of
- depending on

4.4 Niveles de generalización en las clasificaciones
(Levels of generalization in classification)
- Las clasificaciones pueden presentar diferentes niveles de generalidad.

Ejemplo:
Cuadro #2: La clasificación expresada por la oración (f) es más general que la expresada por la oración (g), y esta, a su vez, es más general que la de la oración (h), ya que: word es más general que function word que, a su vez, es más general que pronoun. O, en otras palabras: pronoun es menos general que function word que es menos general que word.

4.5 Información dada en una clasificación
(Information given in classification)
- La cantidad de información que podemos obtener de una oración que expresa clasificación puede variar. Por ejemplo, podemos encontrar:
  - clase, criterio de clasificación y miembros de la clase (ej: oración (a), cuadro 1)
  - clases y todos, algunos, o solo un miembro de la clase (ejs: - oraciones (a), (b), (c), cuadro 1 - clase y todos
  - oración (g), cuadro 2 - clase y algunas miembros
  - oraciones (f) y (h), cuadro 2 - clase y un solo miembro)
- clase y cantidad de miembros en ella (ejs: oraciones (d) y (e), cuadro 1)