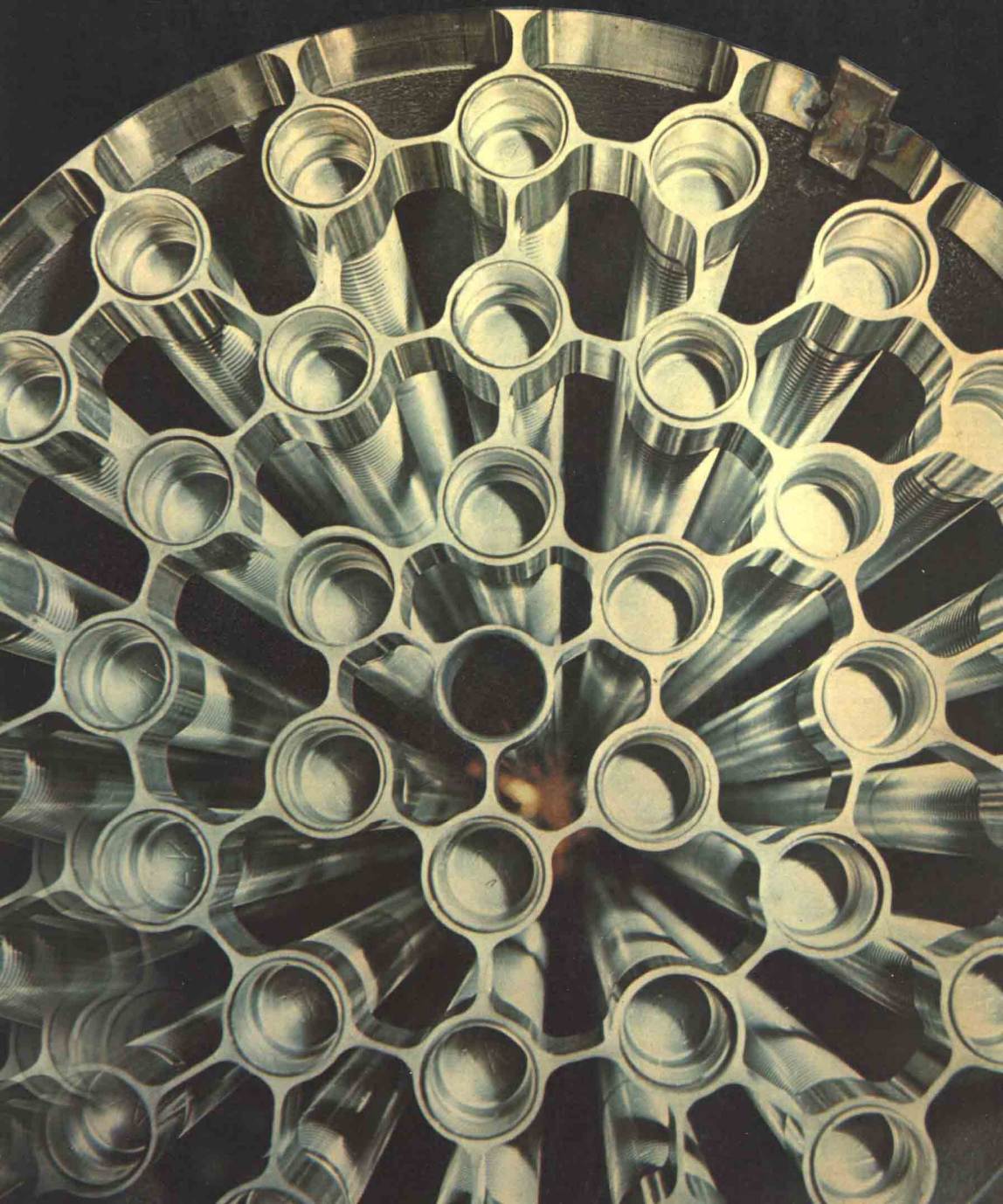
ENGLISH IN FOCUS

English in Mechanical Engineering

Eric H. Glendinning

TEACHER'S EDITION



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Editors' Preface

The aim of the *English in Focus* series is to develop in students who are entering higher education an ability to handle the kind of written English that they will be concerned with as an integral part of their specialist subject. The approach is one which recognizes that learning a language is not merely a matter of learning sentence patterns and vocabulary but must also involve an understanding of how people use these linguistic forms in order to communicate. Our purpose is to make students aware of the way English is used in actual written communication, and thereby to help them develop techniques of reading and to provide them with a guide for their own writing.

The books in this series are based on the belief that intermediate and advanced students who are studying English as a necessary part of their specialist studies need a distinctive type of textbook: one which reflects the nature of the learning problems encountered at this stage, and which presents the language as an aspect of the subject they are studying. We feel that a textbook directed at students at this level should attempt to do more than simply repeat the formulas in elementary language teaching material. Most courses of English concentrate on teaching the language system and fail to show how this system is used in communication. As a result, students may know about such formal items as affirmative sentences or modal verbs, but not know how these items are put to use in the making of different kinds of statements and in the production of continuous pieces of discourse.

The principal purpose of the *English in Focus* series is not to teach more grammar, but to show students how to use the grammar they already know. In writing these books two basic assumptions have been made. Firstly, it is assumed that the students have had a good deal of instruction in grammar and that they have a considerable dormant competence in English. The books are directed at activating this competence, and extending it, by leading the student to relate his previously acquired linguistic knowledge to meaningful realizations of the language system in passages of immediate relevance to his specialist studies. Secondly, it is assumed that students already have a basic knowledge of their specialist subject. The aim is not to teach subject-matter but to develop in the reader an understanding of how this subject-matter is expressed through English. It should be emphasized that these books are not designed to teach either language in isolation or subject-matter in isolation but the

manner in which both combine in meaningful communication. Our belief is that by relating content and expression in this way, the subject-matter takes on a new interest and the linguistic difficulties are reduced.

In order to ensure the natural communicative function of language, grading is by *focus* rather than by *exclusion*. Since it is assumed that the readers of these books already have a fairly wide knowledge of English grammar, and also have access to a standard dictionary and other reference books, the authors have been able to avoid an unnatural step-by-step presentation of grammatical patterns and vocabulary, and instead aim to show how a fluent writer uses the whole resources of the language in performing various acts of communication. At the same time, care has been taken not to overload the student with new material and complex structures have been avoided except where they are necessary in maintaining a natural use of language. We believe that the books in the series will prepare the student to cope with greater linguistic complexity by developing in him a reading strategy which he can bring to bear on the material in the textbooks he has to read.

In the exercises an attempt has been made to avoid the more mechanical types of drill. The users of these books will be people whose minds are directed towards rational thought and problem-solving and the exercises have been designed to take this fact into account. Wherever possible, exercises are used which require the sort of mental activity which students would naturally be engaged in as part of their specialist studies. It is hoped that this type of exercise will make the student see the relationship between expression and content, and will therefore persuade him of the relevance of English learning to his own specialist field. In the last resort, the authors depend on the student being prepared to teach himself, to concentrate diligently on the features of language exemplified in the texts, and to approach the linguistic content of these books with the same spirit of enquiry and desire for knowledge as he would be expected to bring to the study of his speciality.

It is appreciated that, even in a course whose primary concern is with the written language, the teaching process must inevitably bring in the spoken form as well. Therefore, in order to assist both teacher and learner, the texts have been recorded on tape, as also have those exercises containing additional vocabulary, the pronunciation of which might otherwise pose a problem.

Edinburgh
1974

J. P. B. A.
H. G. W.

Introduction

1 Guide to the book

The book contains eight units, each of which is divided into five sections:

I: Reading and comprehension
II: Use of language
III: Information transfer
IV: Guided writing
V: Free reading

Each of the five sections follows the same basic pattern.* This is as follows:

I READING AND COMPREHENSION

This section begins with a reading passage within which are inserted sets of comprehension checks in the form of statements which may or may not be correct. The learner has to decide on the correctness of each statement. These checks are inserted within the reading passage itself rather than at the end because we want to encourage the learner to think about what he reads *as* he reads and to pay close attention to what is actually expressed in the passage. Once the learner realizes that his understanding is going to be systematically checked in this way he is likely to read more attentively for meaning and to treat his reading not simply as a language exercise relevant only to the English class but as a technique for acquiring information which will be useful in a wider field of study.

The comprehension checks require the learner to indicate whether a given statement is true or false according to the passage. But it is important that he should know *why* a statement is true or false and be able to recognize what it is in the passage that leads him to decide one way or the other. This is why each comprehension check is provided with a solution.

The solutions refer the learner to those features of the reading passage which provide evidence for the truth or falsehood of the statements in the

* With the exception of Section I in Unit 8 where it was necessary to organize the material differently in order to give emphasis to the teaching points with which this section is concerned.

comprehension checks. They are explanations in that they point out what the reader must notice and how he must reason in order to arrive at the correct decision. Explanations of this kind are of course not necessary for someone who already has an efficient reading ability in English. At first glance it might appear that the solutions are sometimes too elaborate and detailed. But it must be remembered that the learner must be made aware of what is involved in reading with understanding before this ability can become habitual. What we aim to do by means of these solutions is to develop in the learner a reading strategy which he can apply generally to the texts he has to deal with as part of his study of engineering.

Sometimes a solution may serve simply to remind the learner of the knowledge of English he already has. In Unit 3, for example, comprehension check (c) requires the learner to recognize that the same idea can be expressed by using different verbs, with appropriate changes in the postverbal structure. The solution appears as follows:

A force can start something moving.
= A force can cause something to move.
= A force can cause movement.

It is quite likely that the learner will be familiar with sentences of this type, and that he will have no difficulty in recognizing that 'A force can start something moving' means the same as 'A force can cause movement'. However, the ability to recognize whether a given statement is true or not according to the passage does not come only from an understanding of the meaning of individual words and sentences. Very often it is a matter of recovering information which is implied rather than explicitly stated and of tracing the way in which what is expressed or implied in one sentence is related to what is expressed or implied in another. It is the function of many solutions, therefore, to make such implications explicit and to spell out the relationship between different statements.

Let us consider an example from Unit 4. Comprehension check (i) presents the following statement: 'If the mass of a body sliding over another is increased, the sliding friction force between them will also increase'. The student has to decide whether this statement is true or not with reference to the reading passage. In order to make this decision it is necessary to relate what is expressed in two different sentences: 15 and 18. This relating process is represented in the solution as follows (the symbols on the left indicate the kind of reasoning which is involved):

This shows that sliding friction is proportional to the reaction between the surfaces in contact. (18)
i.e. (*that is to say*) If the reaction between the two surfaces in contact is increased, sliding friction is also increased.
but We can make the normal reaction between two surfaces in contact twice as large by doubling the mass carried by one surface. (15)

i.e. The reaction between surfaces in contact increases as the mass carried by one surface increases.

∴ (*therefore*) If the mass of a body sliding over another is increased, the sliding friction force between them will also increase.

What solutions of this kind do, then, is to spell out certain reasoning processes which are employed by the efficient reader as a matter of habit. Moreover, they are the sort of processes which are overtly employed in many fields of scientific enquiry. Their use here as a language exercise is intended to appeal to the particular cognitive inclination of engineering students, and to make them see that the 'content' and the 'expression' of scientific writing are dependent upon each other.

The first three exercises following the reading passage are a logical development from the solutions. Each focuses on a feature of language use which is frequently referred to in the solutions and which is particularly relevant to an understanding of how English is used in written communication.

EXERCISE A *Rephrasing*

The object of this exercise is to make the student realize that writers commonly express the same idea in different ways and that there is no one-to-one correspondence between one linguistic form and one meaning. It is important that the student should realize this because two phrases may mean the same thing only within the context of a particular passage and it is therefore only by studying the context that the equivalence can be established. In Exercise A the student has to show how different forms function as synonymous expressions by replacing selected phrases in sentences with words from the reading passage which have the same meaning. For example (Unit 1, Exercise A) the following sentence is presented:

Chromium steels *resist* corrosion.

The student searches the reading passage and discovers the sentence 'Ceramics are often employed by engineers when materials which can withstand high temperatures are needed.' In this context *resist* = *withstand*, so the sentence in the exercise can be rephrased:

Chromium steels withstand corrosion.

In the same exercise we have the sentence

Chromium *can be included in* steel to provide a good cutting edge.

In this case two sentences in the reading passage are relevant: 'Certain elements can improve the properties of steel and are therefore added to it. For example, chromium may be included to resist corrosion. . . .' In this context *included in* = *added to* and *can* = *may*, so a suitable rephrasing of the sentence in the exercise is:

Chromium may be added to steel to provide a good cutting edge.

EXERCISE B *Contextual reference*

This exercise draws the learner's attention to the way pronouns and demonstratives are used to refer to something already mentioned and so serve to relate one statement to another in a text. Very often there is more than one grammatically possible connection between noun phrases and the reader has to decide which reference makes sense in the context of the passage concerned. The following example is from Unit 1:

> [2]Engineers must also understand the properties of these materials and how they can be worked.

The student's ability to assign the correct referential value to 'they' is tested as follows:

In sentence 2, 'they' refers to
(a) the engineers
(b) the materials.

Exercise B, then, obliges the learner to scrutinize the passage to assign the correct referential value to such anaphoric language items as pronouns, demonstratives and so on. This exercise is not difficult, and it may sometimes seem obvious what a given item refers to. But again it must be remembered that we are not just concerned with getting the learner to recognize the contextual reference of a particular language item in a particular passage but with developing a general ability to handle this feature of language use. The point is that this exercise directs the learner's attention to the way anaphoric devices work and so prepares him for those cases where identification of the referent is not so easy.

EXERCISE C *Relationships between statements* (Units 2–8)

Expressions like *therefore*, *consequently*, *however*, etc. indicate what function a particular sentence is meant to fulfil. A sentence which contains *therefore* is used to make a statement which follows logically from a previous statement. Similarly, *for example* indicates that the sentence is used to make a statement which illustrates a point made previously. Such expressions are explicit indicators of the communicative function of sentences. But writers do not use explicit indicators in every sentence. Very often a writer assumes that the reader will realize how a particular sentence is to be understood without the assistance of such indicators. It is of course crucial for the student learning to read a foreign language to understand which statements are meant to be illustrations, qualifications, conclusions and so on, and how statements are logically related to one another. The purpose of Exercise C is to make the learner aware of such communicative functions and of the way they are used in the development of written discourse.

In Exercise C the student proceeds in one of two ways. Sometimes he is provided with explicit indicators in the reading passage itself and he is

required to replace these indicators with others which have an equivalent function. Thus in Unit 2, Exercise C he is given:

therefore (6)

In this case the student has simply to refer to sentence 6 in the reading passage, remove *then* and replace it with *therefore*:

Force, then, is a vector quantity

becomes

Force, therefore, is a vector quantity.

But it may not be a matter of simple replacement. Let us consider an example from Unit 3:

on the other hand (5)

It is possible to replace *also* in sentence 5 with the given phrase, but commas must be added and the resulting sentence sounds rather strained:

A force can, on the other hand, stop something moving or hinder motion.

A better solution is to put *on the other hand* at the beginning of the sentence and to delete *also*:

On the other hand a force can stop something moving or hinder motion.

In the above examples the student is required to replace one indicator with another of equivalent function. Elsewhere he is required to insert indicators so as to give statements an explicitness they would not otherwise have. In Unit 2 we have the following:

examples of (4)
thus (12)

Sentence 4 of the reading passage is:

Mass, volume and length are scalar quantities

This can be shown explicitly as an exemplification by inserting the given indicator as follows:

Mass, volume and length are examples of scalar quantities.

Similarly, sentence 12 can be made explicit as a conclusion deriving from what has been stated previously:

Thus the line is vertical because the direction of the force it represents is vertical.

The central purpose of this exercise, then (notice *then!*), is to bring to the learner's notice the ways in which sentences are used to perform different acts of communication and how such acts are related to one another in the development of a discourse.

The exercises in section I are designed to make little demand on the learner's productive ability. Their purpose is to direct the learner to a discovery of what is involved in the comprehension of written communication. The exercises in sections II–IV are intended to extend comprehension into written work.

II USE OF LANGUAGE

The Use of Language section contains a variety of exercises of which two types call for special comment: statements based on diagrams and grammar practice.

Statements based on diagrams vary from unit to unit but all these exercises have the same basic aim. This aim is to guide the student to use his understanding of the reading passage to perform for himself the communicative acts which appear to be of particular importance in mechanical engineering. Thus in Unit 1 the learner is required to complete a diagram according to his understanding of the reading passage. When the diagram is completed it serves as a model for writing classifying sentences at various levels of generality. In Unit 2 diagrams are used for producing definitions, classifications and generalizations, and in the following units other acts of communication are presented in a similar way.

One type of activity which appears in section II might be called *rhetorical transformation*. This involves changing one mode of communication into another. For example, we see in Unit 2 that the definition:

> A scalar quantity is a physical quantity which has magnitude but not direction

can be changed, or transformed, into a generalization:

> A scalar quantity has magnitude but not direction.

Similarly, a pair of sentences of which one is an instruction and one a result can be transformed into an observation (Unit 3), or one or more observations can be transformed into a special kind of generalization called an induction (Unit 4).

As stated above in the editors' preface, it is assumed that the student already has a knowledge of basic grammar. It is also assumed that this knowledge will be consolidated during the course of the book as the student experiences language used in meaningful contexts. For these reasons no attempt has been made to provide a detailed review of English grammar. Instead, the grammar exercises in this section are designed to focus on points which are particularly important in the context of engineering, especially those points which may represent continuing 'trouble spots' for many students.

III INFORMATION TRANSFER

Information transfer is essentially a development of the exercises in section II. It brings the learner's attention to bear on problems which are related both

to the subject matter and the language use of the preceding reading passage and exercises. To solve the problems the learner has to call upon his experience of both English and engineering and in providing a solution he is necessarily integrating the two areas of knowledge in a meaningful way. The aim of section III is to give the student practice in transferring information from one medium to another. For example, the student is asked to write recommendations based on a graph of a table (Unit 4), or design specifications based on a diagram (Unit 7). Elsewhere, he has to write inductions based on diagrams or tables (Unit 6) or, having been provided with appropriate vocabulary, he must describe the shapes of various engineering objects as completely as possible (Unit 8). This kind of exercise is of particular relevance to students of engineering, who are frequently required to convert information from tables, diagrams and graphs into verbal form, and the reverse.

IV GUIDED WRITING

The aim of the guided writing exercises is integrative rather than analytic; that is, the student uses a wide range of grammatical devices and sees how they combine to produce an integrated piece of writing. The guided writing sections vary in design, and become more difficult in the later units. A typical guided writing exercise is done in three stages. At the first stage the student examines various groups of words and combines each group into a sentence by following the clues provided. Some sentences are easy to write, some are more difficult; this reflects the situation in actual writing, where simple sentences alternate with more complex structures according to the nature of the message the writer wishes to convey. At the second stage the student creates a coherent text by rewriting the sentences in a logical order, deciding on paragraph divisions and adding various 'transitional' features where necessary. Thirdly, the student is presented with a number of diagrams which illustrate the passage. The student labels the diagrams and incorporates them into the passage, making any changes to the text that may be necessary. The guided writing is designed to allow some scope for the student to exercise his own judgement in the choice of words and structures, so there is no reason why the student's version should be identical to the one given in the key. If the paragraphs differ, the student should try to evaluate the relative merits of the two versions. Classroom discussion of these differences should help the student to develop a sense of style.

V FREE READING

This section consists of a passage of prose which is longer and more difficult than the reading passage in section I. The reason for including this section is to give the student an opportunity to learn for himself. The previous sections impose a fairly strict control over the student's activities; the free reading enables him to try out what he has learnt in his own way and his own

time. No matter how carefully we develop our teaching procedures, it appears that learners develop their own individual way of learning, and the free reading passages are meant to give the reader a chance to think for himself without being imposed upon.* It is assumed that the reader's interest in the way language is used in an engineering context will have been sufficiently aroused in the preceding sections for him to be ready to apply his own intensive reading technique without specific directives in the form of further exercises. The free reading section provides additional opportunities for word study and gives the student a chance to try his skill in locating further examples of the points he has studied in the unit. It is hoped that the final section of each unit will provide a bridge to more extensive reading beyond the confines of this book, and that the student will be encouraged to consult his standard engineering texts as a further source of information about the way language is used.

2 Teaching suggestions

The following notes indicate how the second unit might be dealt with in the classroom; the other units can be handled in a similar way. These notes are intended to be suggestions only. It is expected that the teacher will develop his own procedures according to the needs of his students. A particular teacher, for example, may find that he needs to place greater emphasis on one type of exercise than on another. He may wish to pay more attention to oral than to written work, or the reverse. It will also be up to the teacher to decide, according to his own circumstances, how the work is to be divided into class sessions, and which part of it can most appropriately be done as homework.

I READING AND COMPREHENSION

(i) Reading the text

Get the class to read sentences 1–7 by themselves.
Do questions (a) and (b) with them so that it is clear what they have to do.
Get the class to do questions (c) and (d) on their own.
Choose one student. Ask him whether he has written down 'true' or 'not true' for question (c). Get him to justify his decision with reference to the appropriate parts of the text. Ask other students whether they agree, and if not why not. Get the class to turn to the relevant solution. Read it aloud to the class while the students follow it in their books.
Choose another student, and do the same with question (d).
Read sentences 1–7 aloud to the class, while they follow in their books.
Get the class to read sentences 8–14 by themselves.
Get the class to do questions (e)–(h) on their own, and repeat the process as for questions (c) and (d).

* For those teachers who prefer to supplement free reading with more formal practice, a set of comprehension questions for all the free reading passages is provided on p. 103.

Read the whole passage aloud to the class, without the questions, while the students follow in their books.

(ii) Exercises

EXERCISE A *Rephrasing*

Get the class to do the exercise in their notebooks.
When the class have finished the exercise, write the first sentence on the board. Underline the expression which is to be replaced.
Select a volunteer to come to the board and write in the replacing expression above the words which are underlined.
Ask the class to judge whether the rephrasing is appropriate. Consider alternatives if necessary.
Bracket together the appropriate replacement(s) with the original expression as follows:

We $\left\{\begin{matrix}\text{calculate}\\\text{measure}\end{matrix}\right\}$ mass in kilogrammes.

Do the remaining sentences in the same way.

EXERCISE B *Contextual reference*

Get the class to do the exercise in their notebooks.
Ask the class to show which choices they have made in question 1 by putting up their hands.
Ask students to replace the item indicated with the phrase they have chosen, and read out the sentence which results. For example, a student choosing 2(a) will read out 'Scalar and vector quantities have size, or magnitude, but only vector quantities possess direction.' A student choosing 2(b) will read out 'Physical quantities have size, or magnitude, but only vector quantities possess direction.'
Ask the class to judge which statement is correct.
Repeat the process for the other questions.

EXERCISE C *Relationships between statements*

Get the class to do the exercise in their notebooks.
When the class have finished the exercise, write sentence 4 on the board.
Select a volunteer to come to the board and indicate the change.
Ask the class to judge whether the change is correct.
Do the remaining sentences.
The following methods of indicating a change may be used:

Mass, volume and length are $\overset{\text{examples of}}{\wedge}$ scalar quantities.

Force, ~~then~~ $\overset{\text{therefore}}{,}$ is a vector quantity.

Although
∧ Both have size or magnitude, ~~but~~ only vector quantities possess direction.

II USE OF LANGUAGE

EXERCISE A *Classification of physical quantities*

Get the class to copy out and complete the diagram, and use it to write out sentences in their notebooks as instructed.
Put the diagram on the board and complete it with the students' help. Get the students to correct their own diagrams.
Get the individual students to read out the sentences they have written.

EXERCISE B *Making definitions*

Get the students to study the diagram and read the explanation carefully.
Do the sentences orally.
Get the students to write the sentences in their notebooks. While they are doing this, go round the class and give individual help where necessary.

EXERCISES C and D

Proceed as in Exercise B.

III INFORMATION TRANSFER

EXERCISE A *Changing vector diagrams to written descriptions*

Allow the students several minutes to study the example.
Do one or two sentences orally.
Tell the students to write the sentences in their notebooks. They should write all the sentences, including the ones given in the text.

EXERCISE B *Sentence building*

Get the students to read the example and write the sentences in their notebooks.
Select students to read out their versions. Use the students' answers to write a correct version of each sentence on the board.

IV GUIDED WRITING

STAGE 1 *The use of the passive in the description of an experiment*

Get the students to read the explanation carefully.
Do one or two sentences orally.
Tell the students to write all the sentences in their notebooks. Give individual help where necessary.
Taking the sentences one by one, get individual students to read out what they have written. Write the correct version of each sentence on the board.

STAGE 2 *Paragraph building*

Get the students to write a paragraph in their notebooks, following the instructions. Tell them to label the diagram and include it in the paragraph.
After the students have written their paragraphs, get the class to number the sentences on the board in the correct order.
Invite one of the students to copy the diagram onto the board and to label it.
Get the class to suggest a suitable title for the paragraph.
Discuss any differences between the students' versions and the version in the key.
Give the students time to change their own paragraphs where necessary.

V FREE READING

Tell the students to read the passage in their own time.
Encourage them to look for points of interest in the text and to relate them to the exercises in this and other units.
Tell the students to make a note of any unfamiliar words and to look them up in their dictionaries. Get them to practise using these words in sentences of their own.
Repeat this process with further passages selected from standard texts used by the students in their engineering classes.

RECORDING

Recordings of the reading passages and the answers to those grammar exercises in Section II which contain the most difficult vocabulary are available on cassette from Oxford University Press.
A useful revision exercise is to play the recordings of the reading passages while the students follow the text in their books. If it is necessary to develop the learners' ability to comprehend spoken English, follow this up by giving comprehension questions orally. (See pages 103–4 for questions relating to the free reading sections.) Recordings of answers to the grammar questions will serve as a model if the teacher wishes to do these exercises orally.

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