ENGLISH IN FOCUS

English in Physical Science

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Introduction

The aim of this book is to develop a basic knowledge of how English is used for communication in the physical sciences. It is intended for students who already know how to handle the common English sentence patterns but who need to learn how these patterns are used in scientific writing to convey information and to develop logical arguments.

The exercises direct the student's attention to certain features of English which are specific to scientific writing. The aim is to provide the student with a strategy for reading more difficult scientific texts and to prepare him for making effective use of English in his own writing.

Although the emphasis is on English as a medium of expression in the physical sciences, the basic elements of the language have not been neglected. Pattern practice is provided, particularly in the grammar and paragraph writing sections of each unit, but this kind of work is always presented in relation to a scientific context and not simply as an exercise in making sentences for their own sake.

This book does not aim at teaching the subject-matter of science, and it does not aim at teaching grammatical structures and vocabulary as such. Its purpose is to show how language is used as a medium for the study of science, and so to give students a grounding in one particular set of communication skills in English.

Edinburgh
October, 1973

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

Contents

1 The Properties of Air

I READING AND COMPREHENSION

[1]The earth is surrounded by a layer of air. [2]This is between 150 and 200 km thick and is called the atmosphere.

[3]Air is invisible and therefore it cannot be seen. [4]But it occupies space and has weight in the same way visible substances do. [5]This fact is illustrated in Problems A and B.

Study the following statements carefully and write down whether they are true or not true according to the information expressed above. Then check your answers by referring to the solutions at the end of the passage.*

(a) A layer of air surrounds the earth.
(b) A layer of air is called an atmosphere.
(c) Air can be seen.
(d) Air is a visible substance.

[6]Air, then, takes up space and has weight. [7]The atmosphere, therefore, weighs down on the surface of the earth. [8]However, this weight cannot be felt pressing on us because air not only exerts a downward pressure, but it also exerts pressure upwards and sideways, and this pressure is balanced by the equal pressure which our blood exerts in all directions.

[9]In short, air exerts pressure in every direction.

(e) The atmosphere presses down on us.
(f) We can feel the weight of the atmosphere.
(g) Air only exerts pressure upwards and sideways.
(h) Air exerts an upward pressure.

*The following symbols are used in the solutions:
i.e. that is to say
e.g. for example
$=$ equals/means the same as
$\neq$ does not equal/mean the same as
$\therefore$ therefore

Solutions

(a) The earth is surrounded by a layer of air. (1)
= A layer of air surrounds the earth.

(b) A layer of air = ANY layer of air.
A layer of air surrounds the earth. THIS layer of air is called the atmosphere. (1, 2)
i.e. THE layer of air [which surrounds the earth] is called *the* atmosphere.
∴ It is NOT TRUE that a (= any) layer of air is called an atmosphere.

(c) Air is invisible and therefore it cannot be seen. (3)
IS INVISIBLE means CANNOT BE SEEN
IS VISIBLE means CAN BE SEEN
∴ Air CANNOT be seen.

(d) it (i.e. air) occupies space and has weight in the same way visible substances do. (4)
∴ Air is a substance.
but Air is not a VISIBLE substance.
i.e. Air is an INVISIBLE substance.

(e) The atmosphere . . . weighs down on the surface of the earth. (7)
this weight cannot be felt pressing on us. (8)
∴ This weight presses down on us.
This weight = the weight of the atmosphere
∴ *The atmosphere presses down on us.*

(f) The weight cannot BE FELT. (8)
= We cannot FEEL the weight.
The weight of the atmosphere cannot be felt. (7)
i.e. We CANNOT feel the weight of the atmosphere.

(g) air *not only* exerts a downward pressure, *but* it *also* exerts pressure upwards and sideways. (8)
= Air *not only* exerts pressure upwards and sideways, *but* it *also* exerts a downward pressure.
exerts a downward pressure = exerts a pressure downwards
∴ It is NOT TRUE that air only exerts pressure upwards and sideways.

(h) Air exerts a pressure upwards.
= *Air exerts an upward pressure.*

EXERCISE A *Contextual reference*

1. In sentence 2, *this* refers to:
   (a) The earth
   (b) The layer of air
2. In sentence 5, *this fact* refers to:
   (a) The fact that air is invisible and occupies space.
   (b) The fact that air is invisible and therefore cannot be seen.
   (c) The fact that air occupies space and has weight.
3. In sentence 8, *this weight* refers to:
   (a) The weight of the atmosphere.
   (b) The weight of the earth.
4. In sentence 8, *it* refers to:
   (a) The atmosphere
   (b) The earth
   (c) Air
5. In sentence 8, *this pressure* refers to:
   (a) The downward pressure of air.
   (b) The pressure which air exerts in every direction.
   (c) The pressure which air exerts upwards and sideways.

EXERCISE B *Rephrasing*

Rewrite the following sentences replacing the words printed in italics with expressions from the text which have the same meaning.

EXAMPLE

The layer of air which surrounds the earth is between 150 and 200 km thick.

The atmosphere is between 150 and 200 km thick.

1. Air *weighs down* on the surface of the earth.
2. Air exerts pressure *upwards, downwards and sideways.*
3. Air *cannot be seen* but occupies space in the same way as do *substances which can be seen.*
4. Air *takes up* space and has weight.
5. The fact that air occupies space *is shown* in Problems A and B.

EXERCISE C *Relationships between statements*

Place the following expressions in the sentences indicated. Replace and re-order the words in the sentences where necessary.

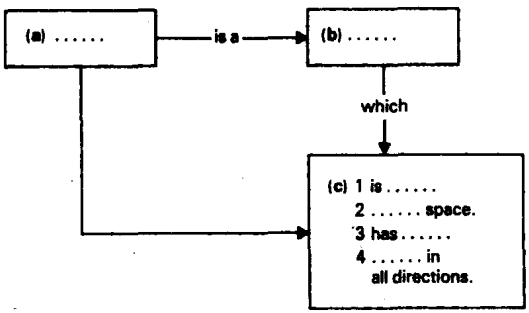
EXAMPLE

since (3)
Air is invisible and *therefore* it cannot be seen. (3)
Since air is invisible, it cannot be seen.

(a) consequently (3)
(b) however (4)
(c) in short (6)
(d) it follows that (7)
(e) nevertheless (8)
(f) then (9)

EXERCISE D *Statements based on diagrams*

1. Draw the following diagram and complete it, by referring to the reading passage.



2. Use your completed diagram to write out as many sentences as you can as follows:
   (a) → (b) → (c)
   (a) → (c)
3. Use all the information in your completed diagram to write a *definition* of air in one sentence.

EXERCISE E *The writing of definitions*

Use the expressions in columns (b) and (c) in the following table to write appropriate definitions for the items in column (a).

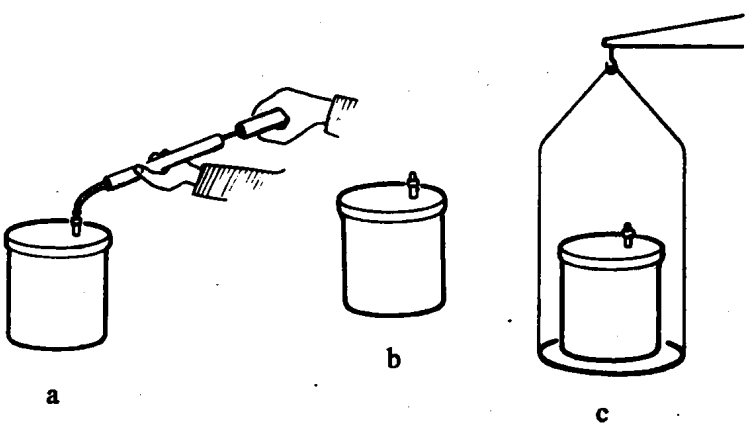
EXAMPLE

Hydrogen *is a* gas *which* is less dense than air.

a	b	c
lead		measures atmospheric pressure
propane		is less dense than air
a barometer	gas	burns at a high temperature
water	metal	measures electric current
hydrogen	liquid	is prepared by electrolysis
an ammeter	instrument	is used in thermometers
alcohol		contains hydrogen
aluminium		has a high relative density

II PROBLEMS
THE DESCRIPTION OF SIMPLE EXPERIMENTS

A. (1) Take a large plastic water can.
Make a hole in the cap.
Glue the valve from an old bicycle tyre into it.
Put the cap back on the can.
Weigh the can on a pair of balances.
Pump extra air into the can.
Weigh it again.
(2) The can weighs more after the extra air has been pumped into it than it did before.
(3) This shows that . . . (quote from the text)
Indicate the correct order of the following diagrams:

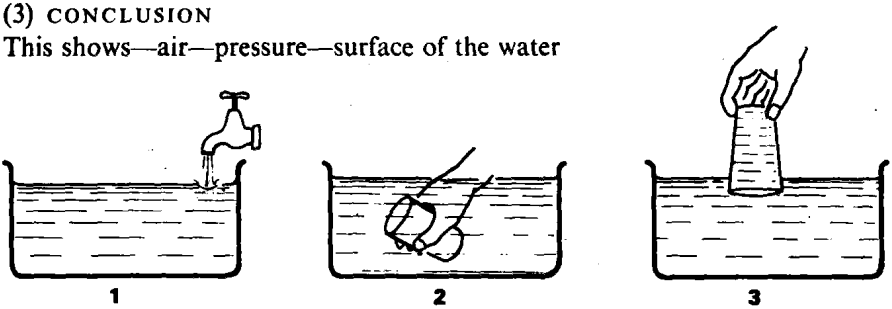


B. (1) Take a large glass container and half fill it with water.
Place a cork on the surface of the water.

Take a glass and lower it, mouth downward, over the cork and push it below the surface of the water.
(2) The air in the glass pushes the part of the surface which is under the glass below the surface of the surrounding water.
(3) This shows that . . . (quote from the text)
Draw a diagram of the result of this experiment (i.e. of (2)).

C. (1) Fill a glass to the brim with water.
Place a piece of cardboard over it.
Hold the cardboard against the glass and turn the glass upside down.
Take your hand away from the cardboard.
(2) The cardboard remains against the glass and the water remains in the glass.
(3) This shows that . . . (quote from the text)
Draw a diagram of the result of this experiment (i.e. of (2)).

D. Give a written version of the experiment illustrated below by using the notes provided.
Use Problems A–C as a guide and divide your version into three parts as shown:
(1) DIRECTIONS
Take large container—fill with water—take a glass—place in water—when the glass is full—hold the glass—mouth of the glass—surface of the water
(2) STATEMENT OF RESULT
The water—in the glass
(3) CONCLUSION
This shows—air—pressure—surface of the water



III GRAMMAR

EXERCISE A *Conditional sentences*

Look at the following sentence:

If [A hot water is poured on to ice] [B the ice will melt]

If [A] states when [B] is true.

Write ten sentences with a pattern if [A] [B]. Put each sentence from column **A** with a sentence from column **B** so that the complete sentence makes sense.

[A]	[B]
1. the mercury (II) oxide is heated	1. the charge which has the same sign as the inducing charge disappears
2. a layer of methylated spirit is floated on the surface of some water	2. fumes of nitrogen dioxide are driven out
3. a straight stick is inserted obliquely into water	3. the water is gradually pushed out by a colourless gas
4. we examine the works of a clock	4. it will be found to contain soil and fragments of plant material
5. one side of a block is rougher than the other sides	5. a uniform mixture of water and spirit will result
6. a bone is pulled into one position	6. it will appear to be bent at the surface of the water
7. the conductor is touched while the charged body is still near it	7. the nitrous acid is oxidized into nitric acid
8. an earthworm is opened	8. a second muscle is needed to pull it back into the first position
9. the solution is exposed to air for some time	9. friction is increased when the block rests on that surface
10. we heat some copper (II) nitrate in a dry tube	10. we will find that separate trains of wheels drive the hour hand and the minute hand

EXERCISE B *Sentences with* although *and* but

Note the following patterns:

1. *although* [A] [B] 2. [A] *but* [B]

1. *Although* [air is invisible] [it is a substance which fills up space.]
2. [Air is invisible] *but* [it is a substance which fills up space.]

1. *Although* [lead is a base metal] [it has many important uses.]
2. [Lead is a base metal] *but* [it has many important uses.]

Write ten pairs of sentences, using (a) *although* (b) *but*. Put each sentence from column A with a sentence from column B so that the complete sentence makes sense.

[A]	[B]
1. the oil deposits are not very extensive	1. it burns if surrounded with an atmosphere of oxygen
2. light is a catalyst in this experiment	2. the efficiency of the engine was not seriously affected
3. man has affinities with the beasts	3. in larger animals this process would be too slow
4. there was a small leakage of steam	4. it frequently has to be purified
5. the direct measurement of the velocity of sound is not an easy experiment	5. they are still worth exploring
6. the majority of our engineering products are made of iron and steel	6. the problem can be attacked indirectly
7. ammonia will not catch fire in the air	7. heat rapidly causes the acid to distil over
8. water is never manufactured	8. he is unique in many intellectual and moral capacities
9. nothing happens when the retort is cold	9. other non-ferrous metals are sometimes used
10. in simple single-celled animals oxygen is directly absorbed	10. the reaction will take place slowly in the dark

IV PARAGRAPH WRITING

STAGE 1 *Sentence building*

Join each of the groups of words below into one sentence, using the additional material at the beginning of each group. Omit words in italics. Number your sentences and begin each one with a capital letter.

EXAMPLE

1 THAT		
we can show *this*	→ we can show . . .	→ We can show that
air has weight	air has weight	air has weight.
2 THAT/RUSHING		
you know *this*	→ you know . . .	→ You know that air
air *rushes* along in	air . . . along in	rushing along in the
the form of wind	the form of wind	form of wind can
air can exert a large	. . . can exert a large	exert a large force on
force on your body	force on your body	your body.

3 ALTHOUGH/IT/WHICH

air is invisible	→ air is invisible	→ Although air is invis-
air is a substance	. . . is a substance	ible it is a substance
air fills up space	. . . fills up space	which fills up space.

Now do these in the same way:

4 SO MUCH/THAT/TOTAL WEIGHT OF THE/SURROUNDING/AMOUNTS TO
there is *a lot of* air
the atmosphere *surrounds* the earth
the atmosphere weighs many million million tonnes
5 LITTLE MORE THAN
a cubic metre of air weighs *about* 1·2 kg
6 IF YOU/THAT/ITS
wave a large sheet of cardboard about
you will find *this*
the air resists *the* movement *of the cardboard*
7 SLIGHTLY HEAVIER/THAN IT WAS/WHEN/IT
the inner tube is *heavy*
there was no air in *the inner tube*
8 ,/IT/,/AND/IT
take a deflated inner tube from a bicycle tyre
weigh *the inner tube* on a pair of balances
inflate the inner tube
weigh *the inner tube* again

STAGE 2 *Paragraph building*

Rewrite the eight sentences in a logical order to make a paragraph. Before you write the paragraph, make the following changes:

write 'by means of the following experiment' at the end of sentence 1
join sentence 2 and sentence 6 with 'and'
join sentence 5 and sentence 4 with 'but'.

When you have written your paragraph, re-read it and make sure that the sentences are presented in a logical order. Give the paragraph a suitable title. Compare your paragraph with the relevant paragraph in the Free Reading passage on p. 10. Make any changes that you think are necessary, but remember that sentences can often be arranged in more than one way.

STAGE 3 *Paragraph reconstruction*

Read through the paragraph again. Make sure you know all the words, using a dictionary if necessary. Without referring to your previous work rewrite the paragraph. Here are some notes to help you.