

## Unit 16 The Air: (1) Two important gases

### Vocabulary

breathing

height

jar

upright

A

At first people believed that air *was made of only one gas*. But by experiment they *found out* that it is made of two important gases and *very small amounts* of others.

Here is a *description* of one experiment which they *did to find out* what one of these two important gases is.

They placed a lighted candle upright in water and covered it with a *jar shaped like a bell*. As the candle burned, the water level *slowly went higher* in the jar, and, *after some time*, the candle went out.

In this way they *showed* that the candle had burned some of the air, but that it *could not burn the air which was left in the jar*. The gas which the candle used for *burning* is known as oxygen. Consequently it is said that oxygen *allows things to burn in it*. The gas *which was left*, and which the candle could not use for burning, is known as nitrogen. Consequently, *it can be said that nitrogen does not allow things to burn in it*.

Oxygen is a *very important* gas, because animals and green plants use it for *breathing* and most substances cannot burn in its absence. Nitrogen is also very important, because animals and green plants *need it to make them grow*.

The air also *has in it* very small amounts of other gases, and water vapour. At *great heights above the earth*, the air *surrounding the earth* is thinner.

B

At first it was believed that air (1) consisted of a single gas. But by experiment it was (2) discovered that it (1) consists of two important gases and (3) traces of others.

One experiment which (4) was carried out to discover what one of these two important gases (5) might be, (6) is described as follows:

A lighted candle was placed upright in water and covered with a (7) bell-jar. As the candle burned, the water level (8) gradually rose in the jar, and (9) eventually the candle went out.

(10) Thus it was proved that the candle had burned some of the air, but (11) was unable to burn (12) the remainder. The gas which the candle used for (13) combustion is known as oxygen. Consequently it is said that oxygen (14) supports combustion. The (15) remaining gas, which the candle (11) was unable to use for (13) combustion, is known as nitrogen. Consequently, (16) nitrogen cannot be said to (14) support combustion.

Oxygen is a gas (17) of great importance, because animals and green plants use it for (18) respiration and most substances (11) are unable to burn in its absence. Nitrogen is also (17) of great importance, because animals and green plants (19) require it for their growth.

The air also (20) contains (3) traces of other gases, and water vapour. At (21) high altitudes, the (22) atmosphere is rarefied.

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**Exercise 1** Find the way in which the words and phrases italicised in Text A are expressed in Text B:

- |                                      |  |
|--------------------------------------|--|
| 1 was made of only one gas           | 13 burning                               |
| 2 found out                          | 14 allows things to burn in it           |
| 3 very small amounts                 | 15 which was left                        |
| 4 did to find out                    | 16 it can be said that nitrogen does not |
| 5 is                                 | 17 very important                        |
| 6 Here is a description              | 18 breathing                             |
| 7 jar shaped like a bell             | 19 need it to make them grow             |
| 8 slowly went higher                 | 20 has in it                             |
| 9 after some time                    | 21 great heights above the earth         |
| 10 In this way they showed           | 22 air surrounding the earth is thinner  |
| 11 could not                         |  |
| 12 the air which was left in the jar |  |

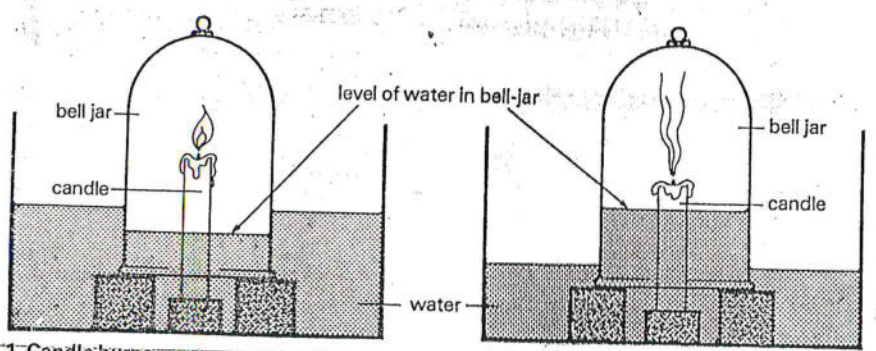
**Exercise 2** Compare these two ways of saying the same thing. In scientific writing, (b) is more often used:

- (a) Air is *very important*. (b) Air is of *great importance*.

Read and rewrite these sentences as in example (b):

- This is the description of an experiment which is very important.
- Air consists of two very important gases and traces of others.
- Oxygen is very important to animals and green plants for their respiration.
- Nitrogen is also very important for their development.

Diagram of experiment



- These two gases are therefore very **important**.
- It is also important to remember that air **contains traces of other gases** and water vapour.
- The pressure exerted by an expanding gas is very strong.
- A growing root exerts a pressure which is very strong.
- The root of a small plant may be very long.
- To reach the light, a shoot may be very long.
- To reach the light, the trees at the centre of a thick forest are very high.
- To measure body temperature, a clinical thermometer does not have to be very long.

**Exercise 3** MIGHT is often used to express a doubt or a possibility:

- (a) It was not known what the gases *were*.  
 (b) It was not known what the gases *might be*.

Read and rewrite these sentences as in example (b):

- An experiment was carried out to discover what the gas *was*.
- It was thought that air *consisted of* a single gas.
- At first it was not known if the remaining gas *supported* combustion.
- Later experiments were carried out to discover what other gases the air *contains*.
- An experiment could be carried out to discover if nitrogen *supports* combustion.
- It is *possible to say* that nearly all substances require oxygen for combustion.
- It is *possible to say* that animals and green plants cannot survive without oxygen and nitrogen.

**Exercise 4** Compare these two ways of making a negative sentence:

- (a) It *can be said* that nitrogen *does not support* combustion.  
 (b) Nitrogen *cannot be said to support* combustion.

Rewrite these sentences as in example (b):

- It *can be said* that a candle *does not burn* in nitrogen.
- It *can be said* that the remaining gases *do not support* combustion.
- It *can be said* that green plants and animals *do not develop* normally without sufficient nitrogen and oxygen.
- It *was at first believed* that air *did not consist of* more than one gas.

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**Exercise 5** ABLE TO/UNABLE TO are often used instead of CAN/CANNOT and COULD/COULD NOT.

- (a) The candle *could not burn* in the remaining gas.
- (b) The candle *was unable to burn* in the remaining gas.

Read and rewrite these sentences as in example (b):

- 1 At first people *could not believe* that air is not a single gas.
- 2 At first people *could not understand* that air exerts a pressure.
- 3 However, they *could carry out* experiments to prove that air is not a single gas.
- 4 Experiments were carried out to prove that combustion *cannot take place* in the absence of oxygen.
- 5 Experiments were carried out which *could prove* that air exerts a pressure.
- 6 When the candle went out under the bell-jar, it was proved that it *could not burn* in the remaining gases.
- 7 The gas which the candle *could not burn* is known as nitrogen.
- 8 A candle *can use only* oxygen for burning.
- 9 Most substances *cannot burn* in the absence of oxygen.
- 10 Animals and green plants *cannot breathe* without oxygen.
- 11 Animals and green plants *cannot develop* normally without nitrogen.
- 12 People *cannot breathe* comfortably in a rarefied atmosphere.

**Exercise 6** Rewrite this passage, using passive forms, deciding which sentences need an expressed agent and which do not. (The subjects of the passive sentences are italicised):

People believed that *air* consisted of a single gas. Later, however, they discovered that *air* consists of two important gases and traces of others. They carried out *experiments* to discover what they might be. We can carry out *one of these experiments* quite simply:

They placed a *lighted candle* upright in water, and covered *it* with a bell-jar. The candle used *the oxygen inside the bell-jar*, and then it went out. The candle could not use *the remaining gas* for combustion. We give *the name of nitrogen* to this gas. We say that *oxygen* supports combustion, and we say that *a gas which cannot be used for burning* does not support combustion. Consequently we cannot say that *nitrogen* supports combustion.

Animals and green plants require *oxygen* for respiration, and they require *nitrogen* for their development.

**Exercise 7** Questions for further discussion:

- 1 Could you burn a candle in (a) a vacuum? (b) pure oxygen? (c) pure nitrogen? Give reasons.
- 2 Would it be better if the air were pure oxygen? Give reasons.
- 3 Why does a fire burn more brightly when you blow on it?
- 4 Why does a blacksmith use bellows?
- 5 Why is a forest fire more dangerous when there is a strong wind?
- 6 When flying very high, why do pilots use masks?

**Vocabulary**

bellows	pilot	vacuum
blacksmith		

## Unit 17 The Air: (2) Carbon dioxide and respiration

### Vocabulary

to blow  
to breathe  
cloudy

to get rid of  
headache

lime-water  
lung

pure  
unusual

#### A

When anything burns or breathes, it uses oxygen in the air and *makes another gas which we call carbon dioxide*. This gas turns lime-water cloudy. If you blow through a tube into lime-water, you can see it turning cloudy rapidly, because the air which we *are breathing out/contains more* carbon dioxide than the air which we *breathe in*.

When animals breathe in, they take in air and the blood *takes up* oxygen from it. In the lungs the blood is *made pure* when oxygen *takes the place of* carbon dioxide. When the oxygen is *carried* to other parts of the body, the sugar in the blood is *burned up, and carbon dioxide is made,* just as it is made when a candle burns. The body then *gets rid of* this carbon dioxide by breathing out. Our bodies are *kept warm* by this *burning up* of sugar in the blood.

All *animals and plants, except for a few unusual ones, need oxygen for breathing*. When a number of people are in a closed room, the carbon dioxide *slowly* takes the place of oxygen. *Because of this*, they will in time feel sleepy and get headaches. *This is why* it is important to *bring fresh air into* any crowded place.

However, *the amount of carbon dioxide does not increase* in the atmosphere because it dissolves in water. Because of this, the rain and the seas *take away a lot of it*. Green plants also *use it up* for their growth.

#### B

When anything burns or breathes, oxygen in the air is used and (1)another gas, known as carbon dioxide, is formed. This gas turns lime-water cloudy. If you blow through a tube into lime-water, it can be seen to turn cloudy rapidly, because the air which (2)is being exhaled (3)is richer in carbon dioxide than the air which (4)is inhaled.

When animals (4)inhale, air is taken in and from it oxygen (5)is absorbed by the blood. In the lungs the blood is (6)purified when oxygen (7)replaces carbon dioxide. When the oxygen is (8)transferred to other parts of the body, the sugar in the blood is (9)consumed, (10)forming carbon dioxide, (11)similarly to the way in which it is formed when a candle burns. The body then (12)eliminates this carbon dioxide by (2)exhaling. Our bodies are (13)heated by this (14)consumption of sugar in the blood.

All (15)living organisms, (16)with the exception of a few unusual ones, (17)require oxygen for respiration. When a number of people are in a closed room, the oxygen is (18)gradually (7)replaced by carbon dioxide. (19)Consequently, they will (20)eventually feel sleepy and get headaches. (21)For this reason it is important to (22)ventilate any crowded place.

However, (23)carbon dioxide does not accumulate in the atmosphere because it dissolves in water. (19)Consequently, (24)much of it is removed by the rain and the seas. It (25)is also consumed by green plants for their growth.

**Exercise 1** Find the way in which the words and phrases italicised in Text A are expressed in Text B:

- |                                   |   |
|-----------------------------------|---|
| 1 makes another gas which we call | 14 burning up                                     |
| 2 are breathing out               | 15 animals and plants                             |
| 3 contains more                   | 16 except for                                     |
| 4 breathe in                      | 17 need oxygen for breathing                      |
| 5 takes up                        | 18 slowly   |
| 6 made pure                       | 19 Because of this                                |
| 7 takes the place of              | 20 in time  |
| 8 carried                         | 21 This is why                                    |
| 9 burned up                       | 22 bring fresh air into                           |
| 10 and carbon dioxide is made     | 23 the amount of carbon dioxide does not increase |
| 11 just as it is made             | 24 take away a lot of it                          |
| 12 gets rid of                    | 25 use (it) up                                    |
| 13 kept warm                      |   |

**Verbs formed from adjectives**

Sometimes -FY/-FIES/-FIED may be added to an adjective to form a verb meaning MAKE + adjective:  
to make solid — solidify

**Exercise 2** Form verbs from these adjectives in the same way. (Be careful with the spelling):

- |                        |              |
|------------------------|--------------|
| 1 make liquid          | 4 make rare  |
| 2 make pure            | 5 make solid |
| 3 make bigger (magni-) | 6 make humid |

Now use these verbs in their correct form to complete these sentences:

- When ice is heated, it \_\_\_\_\_.
- If you cool water sufficiently, it \_\_\_\_\_.
- When oxygen replaces carbon dioxide, the blood is \_\_\_\_\_.
- A magnifying glass is a glass which \_\_\_\_\_ things.
- At great heights above the earth the air is \_\_\_\_\_.
- Water evaporating from the earth's surface \_\_\_\_\_ the atmosphere.

**Word order**

If a phrase or clause is very important, it is often placed at the beginning of a sentence:

- The blood is purified *in the lungs*.
- In the lungs* the blood is purified.

**Exercise 3** Rewrite these sentences, making each phrase or clause italicised more important by placing it at the beginning of the sentence:

- The atmosphere is rarified *at great heights above the earth*.
- Oxygen is used *when anything breathes or burns*.
- Lime-water can be seen to turn cloudy, *if you blow into it through a tube*.
- Oxygen is absorbed *from the inhaled air* by the blood.
- The blood is purified *when carbon dioxide is replaced by oxygen*.
- Our bodies are heated *by the process of consuming sugar in the blood*.
- All living organisms, *with the exception of a few*, require oxygen for respiration.
- It is important to ventilate any crowded room *to prevent people from getting headaches*.
- The oxygen is rapidly consumed *in a closed or crowded place*.
- It is important to ventilate a crowded room *for these reasons*.

**Exercise 4** The nouns given in brackets come from verbs. Use each verb in its correct form to complete these sentences:

- When anything breathes in and out, it is said to \_\_\_\_\_ (respiration)
- The air which is \_\_\_\_\_ is richer in carbon dioxide than the air you \_\_\_\_\_ (exhalation/inhalation)
- The air is taken into the lungs where oxygen is \_\_\_\_\_ from it, and the carbon dioxide is \_\_\_\_\_ (absorption/replacement)
- The replacement of carbon dioxide by oxygen \_\_\_\_\_ the blood. (purification)
- Sugar is \_\_\_\_\_ in the blood, and carbon dioxide is \_\_\_\_\_ before being \_\_\_\_\_ from the body by \_\_\_\_\_ (consumption/formation/elimination/exhalation)
- A crowded room should be well-\_\_\_\_\_ to prevent carbon dioxide from \_\_\_\_\_ in the room. (ventilation/accumulation)

**Exercise 5** Rewrite this passage, using passive forms with or without agent. (The subjects of the passive sentences are italicised):

- Anything which burns uses *the oxygen in the air*.
- While it burns, it forms *another gas known as carbon dioxide*.
- When we breathe in, the blood absorbs *oxygen from the air inhaled*.
- Oxygen replaces *carbon dioxide* in the blood.
- The process of consuming sugar heats *our bodies*.
- Oxygen in the lungs purifies *the blood*.
- The body eliminates *the carbon dioxide* by exhaling.
- All living organisms except a few require *oxygen* for respiration.
- A large number of people in a closed room use up *the oxygen*.

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- 10 People should ventilate a crowded room.
- 11 The rain dissolves much of the carbon dioxide in the atmosphere.
- 12 Green plants also consume it.

Exercise 6 Fill in each blank in the following sentences with the ONE correct word required:

- 1 Air which is — is richer in carbon dioxide than air —.
- 2 Green plants and animals require oxygen for —.
- 3 The blood — oxygen from the air taken into the lungs where it is —.
- 4 Blood is purified when oxygen — carbon dioxide.
- 5 The body — the carbon dioxide by —.
- 6 Carbon dioxide is — by green plants for their growth.
- 7 A crowded room should be —.
- 8 Carbon dioxide does not — in the atmosphere since it — in water and much of it is removed by the rain and seas.

Exercise 7 Questions for further discussion:

- 1 Why should at least one window be open in a classroom, even if it is a cold day?
- 2 What would happen if carbon dioxide did not dissolve in water?
- 3 Hundreds of millions of years ago, the earth's atmosphere was richer in carbon dioxide than it is now. What effect do you think this had on the plants growing then, and why?
- 4 Why does the air feel fresher after rain?
- 5 Why do some people believe that carbon dioxide is a poisonous gas? Is this true? To what extent is it untrue?
- 6 How do fish breathe under water? Why do they die when they are taken out of water and kept in air, although it is richer in oxygen than water?
- 7 (a) Why do you change the water often in a fish tank?  
(b) What other methods of replacing oxygen are used in an aquarium?
- 8 Why does boiled water taste 'flat' (have little taste)?

Vocabulary  
to what extent

effect

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Exercise 8 Suggestions for further activities:

- 1 Put a glass tube into a bottle of lime-water and blow gently down the tube. Observe the lime-water turning milky.
- 2 Stand a lighted candle upright on a table and hold a glass or jar upside down over it for a minute or two. Very quickly cover the glass with a piece of stiff paper and turn it right way up. Pour into it a little lime-water. The lime-water will turn milky. Why?
- 3 Boil some tap water and let it cool. Taste it, and then taste ordinary unboiled tap-water. Which has the pleasanter taste?