How to use this book

Welcome to the beginning of your Human and Social Biology course! We hope that you really enjoy your course, and that this book will help you to understand your work, and to do well in your examinations.

How the book is organised

The book is divided up into numbered spreads. Each spread covers a particular topic. Sometimes, you will find more about a topic on another spread, so be prepared to follow the page references if you want to know more. Sometimes, your teacher may give you a worksheet that explains a little more about a topic.

Answering questions

After each section on a spread, you will find a question or two to answer. This will help you to think about what you have just read, or seen on a diagram. If you answer the questions carefully, it will help you to understand, and this makes it much easier to learn.

Learning and using the terminology

At the end of each spread, there are some sentences for you to copy out and complete. You will find all the words you need on the spread. They may be shown as bold in the text, or they may be on a diagram or in a table. If you keep a full set of your answers to these, they will be really helpful when you do your revision.

There is a glossary/index on pages 218 to 234, in which there are definitions and page references for many important terms used in the book.

Developing skills

As well as learning a lot of facts, you also need to develop your skills during your course. For example, you need to become good at drawing diagrams, interpreting graphs, and selecting the most appropriate information to answer a question. There are questions in this book that will help you to develop these skills, and your teacher may give you worksheets that will also help.

1 The characteristics of living organisms

Look around you. How many different kinds of living organisms can you see? You and the other people in your class are alive. So are the plants growing outside.

What do they all have in common that makes them different from non-living things?

Nutrition

All living things take materials from their environment. They need these materials to keep them alive. This is called **nutrition**.

1 List *three* kinds of **nutrients** that you need to eat in your food.

2 What is the name of the process by which plants make their food?

Respiration

All living things respire, all the time. **Respiration** is a chemical reaction. It takes place inside every living cell.

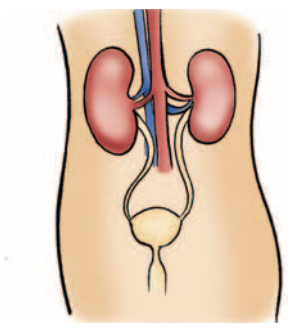
In respiration, energy is released from food. The cells can then use the energy.

3 What gas do you need for respiration?

4 What gas is produced by respiration?

Excretion

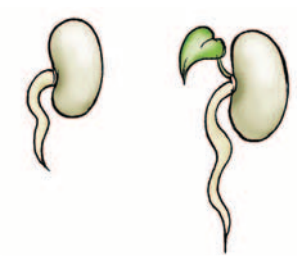
Some of the chemical reactions inside our body cells make waste substances. We need to get rid of these. Plants also have waste substances they need to get rid of. Getting rid of these wastes is called **excretion**.



5 Kidneys help with excretion. What do they excrete?

Growth

Living organisms **grow** bigger.



6 You began as a single cell. What happens to your cells when you grow?

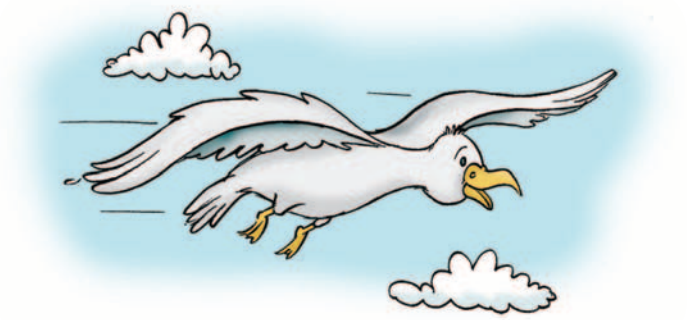
Irritability

Living organisms can sense changes in their environment. These are called **stimuli** (singular: **stimulus**). The organisms may **respond** to these changes. This is called **irritability**.

7 Can you think of a stimulus that both you and a plant can sense and respond to?

Movement

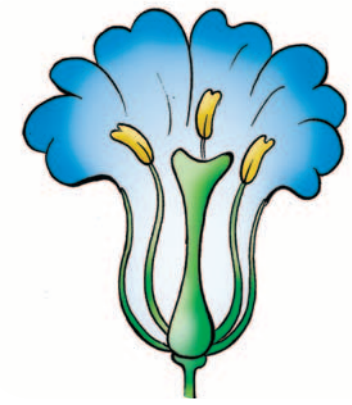
Living organisms can **move**. Even plants can move parts of their bodies. For example, some plants close their leaves up at night.



8 What is the name of the structures in your body that you use to make your arms and legs move?

Reproduction

Living organisms can make more organisms like themselves. This is called **reproduction**.



9 How does a flowering plant reproduce?

You will learn a lot more about each of these characteristics later in your course. If you want to know more now, then use the index to find the pages where they are explained.

What you need to remember *Copy and complete using the **key words***

The characteristics of living organisms

There are seven characteristics of living organisms. Nutrition is the taking in of _____ which are needed to build bodies and provide energy. The energy is released from the food in a chemical reaction called _____. Waste substances produced in the body cells are removed by _____.

Living organisms get bigger. This is called _____. They can sense changes in their environment and respond to them, which is called _____. Sometimes, these responses involve _____, for example a plant closing its leaves at night or an animal running away from something.

Living organisms can make more of themselves. This is called _____.

2 Animal and plant cells

All living organisms are made up of **cells**. Cells are very small. Most cells are so small that we cannot see them except with a microscope.

1 Look at a ruler that has 1 mm divisions marked on it. A cell from a plant's leaf is about 0.1 mm across. How many of these cells could you line up between two of the 1 mm lines on your ruler?

Your smallest cells

The smallest cells in your body are your red blood cells. Each one is only about 5 micrometres across. (A micrometre is one thousandth of a millimetre.)

Red blood cells have a hard life. They have to go round and round the body, being pushed through tiny blood capillaries only just wide enough for them. They only live, on average, for 120 days. Dead ones are collected and disposed of by cells in the liver.

You have more red blood cells in your body than any other kind of cell – probably about 25 000 000 000 000 of them. Can you work out how many new red blood cells your body has to make every day, to replace the old ones that die?

Animal cells

This diagram shows an animal cell. The structures inside a cell are called **organelles**.

The **nucleus** contains the chromosomes of the cell. The chromosomes are made of **DNA**. Each chromosome is made up of many **genes**. The genes control the activities of the cell.

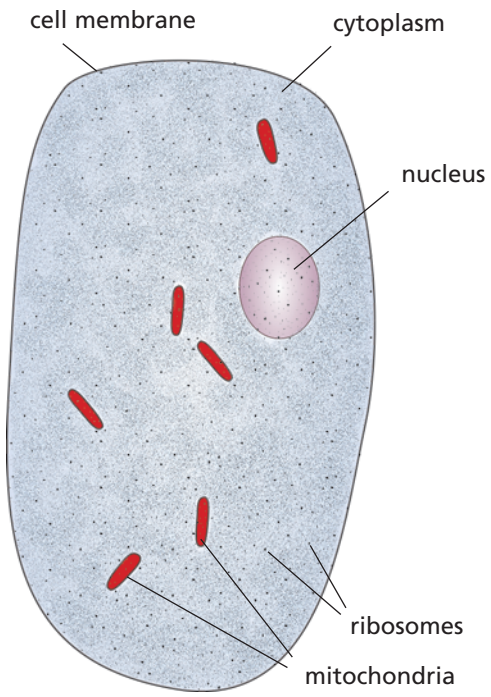
The **cell membrane** controls what enters and leaves the cell.

The **cytoplasm** is like a watery jelly. Many different chemical reactions, called **metabolic reactions**, take place here.

Mitochondria (singular **mitochondrion**) are where respiration takes place. This releases energy from food. Mitochondria are the power houses of the cell.

Ribosomes are where proteins are made. The genes on the chromosomes tell the cell which proteins to make.

2 Make a copy of the diagram of the animal cell and label it. Then write the functions of each part next to its name. (The function of something is its role – what it does.)



An animal cell.

Plant cells

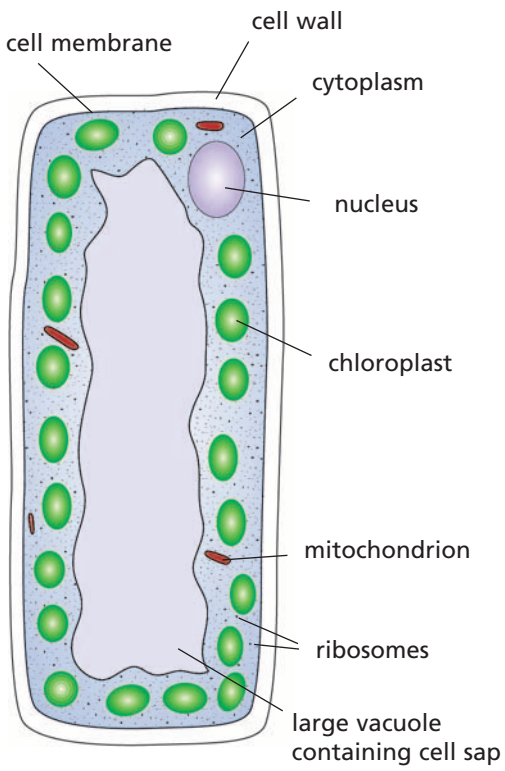
This diagram shows a plant cell.

This cell has three structures that the animal cell does not have.

The **cell wall** is an extra, tough layer that surrounds the cell. It is made of **cellulose**. It helps to keep the cell in shape. It stops the cell from bursting when the cell fills up with water.

The **chloroplasts** contain a green substance called **chlorophyll**. Chlorophyll absorbs energy from sunlight, so the chloroplast can use it to make food in photosynthesis.

The **vacuole** contains a liquid called **cell sap**. Cell sap contains sugars and other substances dissolved in water. It is a storage area for the cell.



A plant cell.

3 Make a copy of the diagram of the plant cell and label it. Then write the functions of each part next to its name.

4 List *three* structures that are found in animal cells and in plant cells.

5 List *three* structures that are found in plant cells but not in animal cells.

6 The cells in the roots of a plant do not have chloroplasts. What could be the reason for this?

What you need to remember *Copy and complete using the **key words***

Animal and plant cells

All cells are surrounded by a _____ _____ which controls what goes in and out of the cell. Plant cells also have a _____ _____ which helps to hold the cell in shape.

Cells contain a watery jelly called _____. There are also several different structures called _____. The _____ of a cell contains chromosomes, made of _____. These control the activities of the cell. They provide instructions telling the cell what proteins to make. Proteins are made on the _____.

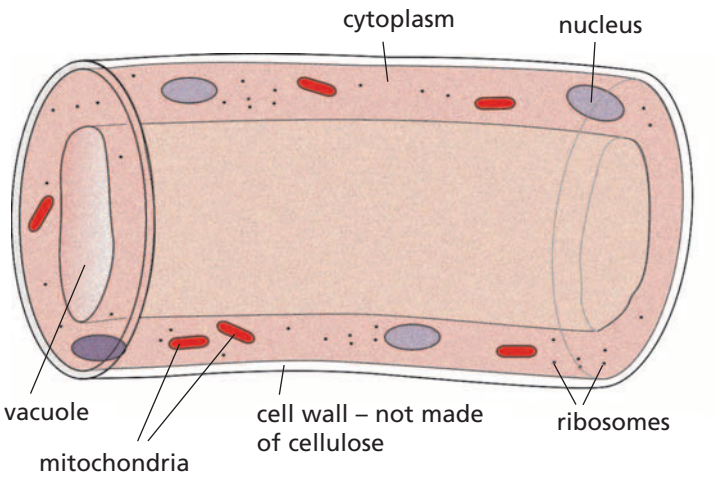
Energy for the cell is provided by respiration, which happens inside the _____.

Some plant cells have _____ which contain a green substance called _____.

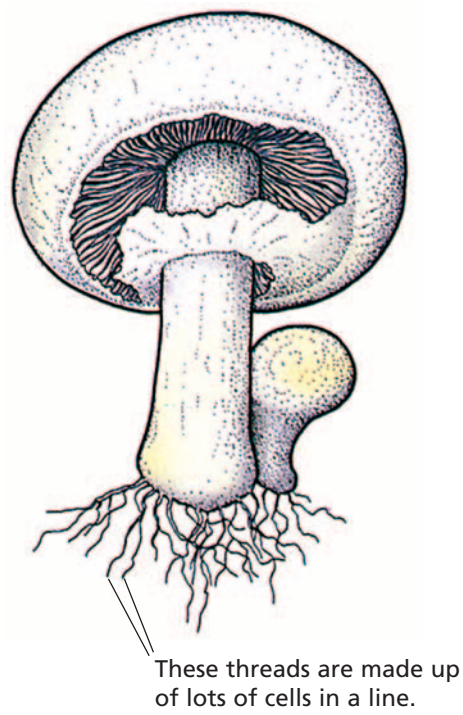
3 Other kinds of cells

Fungi

Fungi is the plural of **fungus**. Mushrooms and toadstools are fungi. Fungi have cells that are about the same size as plant and animal cells. Most fungi are made of many cells.



Part of a fungal cell.



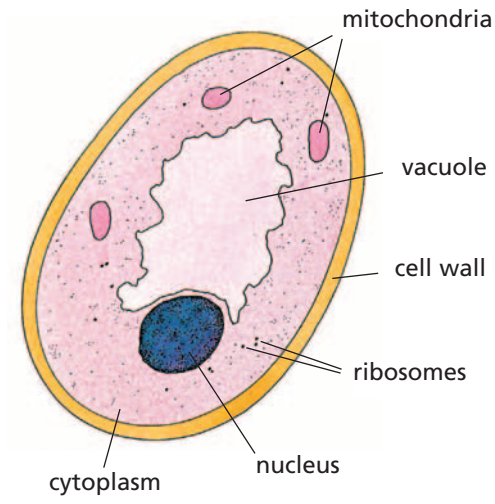
A mushroom.

Fungi do not have chlorophyll, so they cannot photosynthesise. So fungi are not plants. Fungi feed on waste material or bodies of animals and plants. They secrete (produce) enzymes which digest the food that they are living on. Then the digested food is absorbed into their cells. This is called saprotrophic nutrition.

Yeast is an unusual fungus. It has just one cell. Yeast is a single-celled organism.

1 Write down *three* similarities between a cell of a fungus and a cell of a plant.

2 Write down *two* differences between a cell of a fungus and a cell of a plant.



A yeast cell.

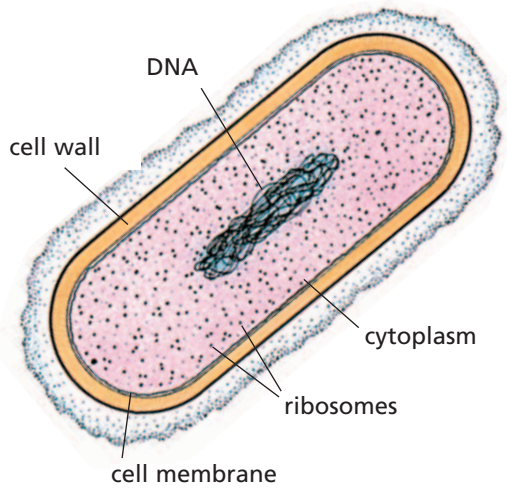
Bacteria

Bacteria is the plural of **bacterium**. Bacteria are usually made of just one single cell. A bacterial cell is much smaller than an animal cell or a plant cell. Another difference is that a bacterial cell does not have a nucleus.

3 Write down *two* differences between a bacterial cell and an animal cell.

Some bacteria, for example the ones that we use to make yoghurt, are helpful to us. Other bacteria, for example ones that cause diseases such as tuberculosis, are harmful.

Bacteria live everywhere. There are millions upon millions of bacteria in just one small spoonful of soil.



A bacterial cell.

Viruses

Viruses are not made of cells at all. They are just a little piece of DNA surrounded by a coat made of protein. They are much, much smaller than bacteria. You could fit thousands of viruses inside just one human cell.

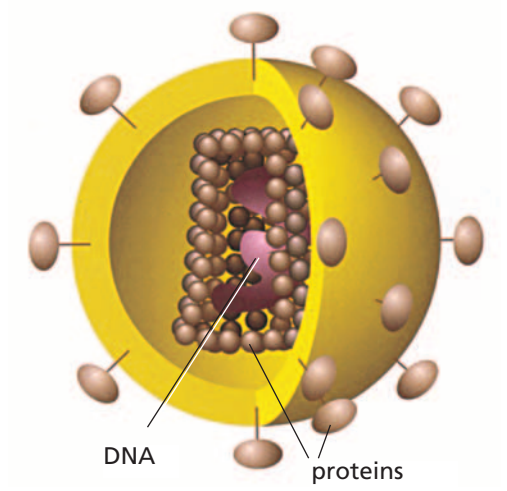
Viruses cannot do anything at all for themselves. They cannot feed, respire, move or show any of the characteristics of living things. They can, however, reproduce, but they can only do this inside other living cells.

When you get a viral infection, the viruses get inside your cells. They hijack the cell, and make it produce more viruses.

4 Some people say that viruses are not living organisms.

a Give *one* feature of viruses that could mean that they should be classified as living organisms.

b Give *two* features of viruses that could mean that they should not be classified as living organisms.



A virus.

What you need to remember *Copy and complete using the **key words***

Other kinds of cells

The cell of a _____ has a cell wall but no chloroplasts. It cannot photosynthesise. It feeds by secreting enzymes that digest the food it is growing on.

The cell of a _____ also has a cell wall, but it has no nucleus. It is much smaller than the cell of a fungus, animal or plant.

_____ are not made of cells at all. They are much smaller even than a bacterium. The only characteristic of living things that they have is reproduction, and they can only do that by hijacking a living cell.

4 Specialised cells in humans

You began your life as a single cell. This cell divided over and over again to form all the cells in your body.

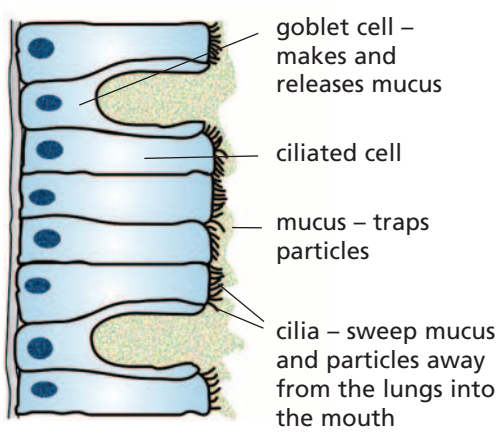
Most of the new cells became specialised in some way. They changed their structure so that they could carry out a particular function. This is called **differentiation**.

Epithelial cells

Epithelial cells cover a surface. The diagram shows the epithelial cells lining your **trachea** (windpipe).

1 Name the *two* kinds of specialised cells in the epithelium lining the trachea.

2 Describe what each of these cells does.

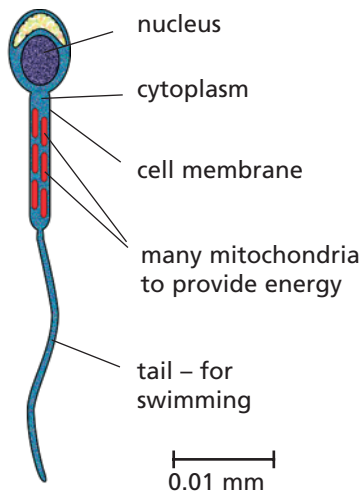


Epithelial cells lining the trachea.

Sperm cells

Sperm cells are specialised to fertilise egg cells.

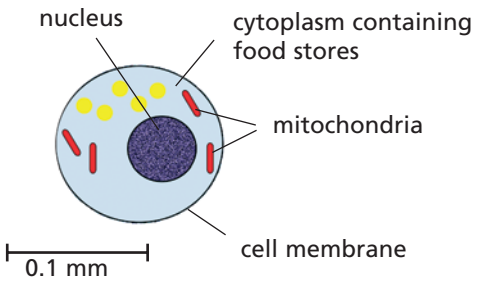
3 Describe *two* ways in which the structure of a sperm cell helps it carry out its function.



A sperm cell.

Egg cells

Egg cells are much bigger than sperm cells. This is because they contain **food** stores to keep them alive after fertilisation and before they sink into the uterus wall.



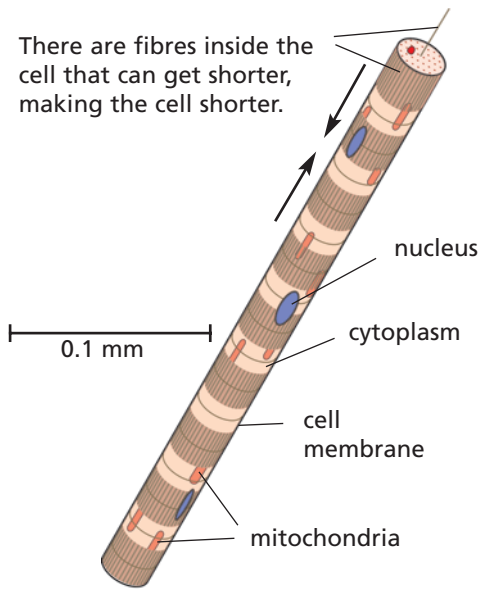
An egg cell.

Nerve cells and muscle cells

Nerve cells are sometimes called **neurones**. They carry electrical impulses from one part of the body to another. You can see a diagram of a nerve cell on page 34.

Muscle cells can get shorter. This is called **contraction**. They often do this when they receive an electrical impulse from a nerve cell. Muscle cells use a lot of energy when they contract.

4 Muscle cells usually have a lot of mitochondria. How does this help them to carry out their function?



Part of a muscle cell. A complete cell is much longer than the part shown.

Tissues and organs

Cells that have the same function are often found together. A group of specialised cells, working together to carry out a particular function, is called a **tissue**. For example, an epithelium is a tissue that covers a surface. It is made of epithelial cells.

Different tissues may work together in an **organ**. Your stomach is an organ. It contains several different kinds of tissues. It contains **epithelial tissues** covering its surface, and **muscle tissues** in its walls.

Your body also contains many different **connective tissues**, which connect and support other tissues.

What you need to remember *Copy and complete using the **key words***

Specialised cells in humans

In the human body, different cells become specialised to carry out different functions. This is called _____.

Cells that cover a surface are called _____ cells. The cells that cover the inside of the _____ make mucus which traps dirt and bacteria.

_____ cells have a long tail that helps them to swim to egg cells. Egg cells contain _____ for the new embryo.

_____ cells carry electrical impulses in the body. _____ cells can contract, which means 'get shorter'.

A group of cells carrying out the same function is called a _____.
An _____, such as the stomach, is made of many different tissues.

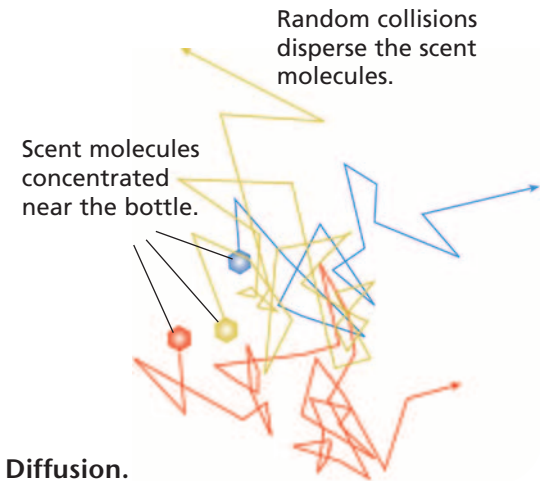
5 Diffusion and osmosis

Diffusion

Particles are always moving around. For example, if you open a bottle of perfume, scent molecules (particles) come out of the bottle and go into the air. They shoot around randomly in the air. If they bump into another molecule, they bounce off and shoot off in a different direction.

To start with, there are a lot of scent molecules near the bottle, and none on the far side of the room. But soon they spread all over the room.

This is called **diffusion**.



Diffusion.

Diffusion of gases into and out of a cell

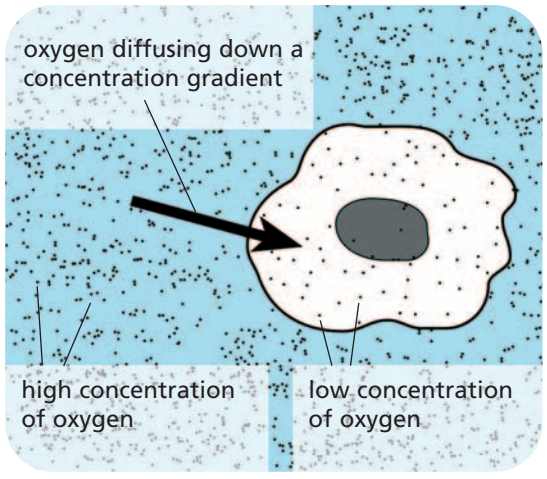
Cells respire. This uses up oxygen. So there is not much oxygen inside a cell.

There is a higher concentration of oxygen outside the cell. We say there is a **concentration gradient** for oxygen.

Oxygen molecules diffuse into the cell, down their concentration gradient. They don't do it on purpose. It just happens naturally, as the oxygen molecules move around randomly.

1 When the cell respires, what gas does it produce?

2 Suggest how this gas moves out of the cell.

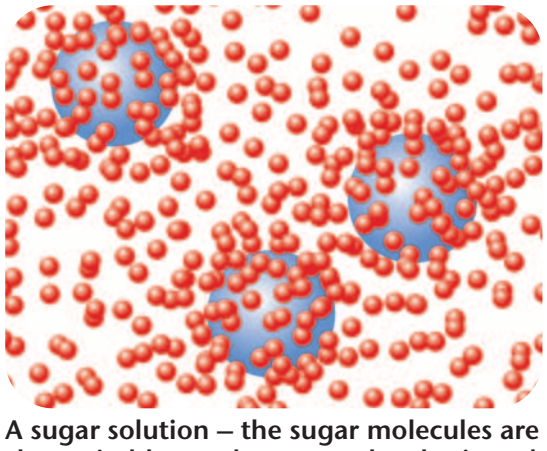


Diffusion of oxygen into a cell.

Osmosis

This diagram shows a sugar solution.

3 Which are larger – the water molecules or the sugar molecules?



A sugar solution – the sugar molecules are shown in blue and water molecules in red.