

# The elements of life

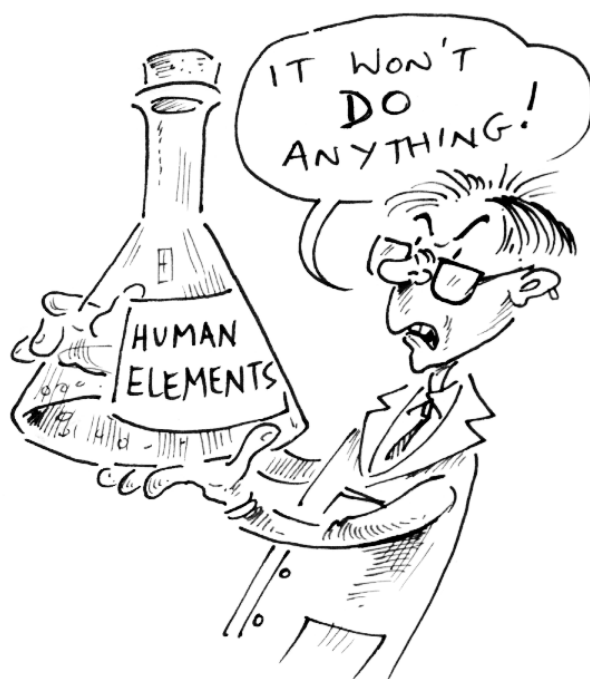


## UNIT A7

This unit looks at the definition of an element and at the elements present in the human body. Pupils are reminded about the conservation of mass and how these elements have existed in the past and will be present in the future.

### Using this unit

It may be best to use this unit after pupils have been given a list of elements and to link it with earlier work on elements, compounds and mixtures. The unit as a whole, or parts of it, could be set as homework.



### Links with KS3 programme of study

- ◆ How elements vary widely in their physical properties; how they combine through chemical reactions to form compounds; and when physical and chemical changes take place, mass is conserved (Sc3 materials and their properties).
- ◆ The need for a balanced diet containing minerals among other things (Sc2 life processes and living things).

### Moral and spiritual aims

- ◆ To challenge any claims that a chemical account of the bits that make us up is all there is to be said about us.
- ◆ To promote reflection on the past and future of the elements in our bodies and on the possibility of life after death and bodily resurrection.

## Answers

- (a) B  
(b) A  
(c) C
- Metals are good conductors of electricity and heat, have high melting and boiling points, usually have high density, are malleable (bendy), sonorous (clangy), and are usually hard and shiny. (Accept any 4 of these.) Many standard science texts cover these properties in detail.
- Web sites are particularly useful for this activity, e.g. the web elements from Sheffield University at <http://www.webelements.com>
- Calcium, iron, potassium, sodium and magnesium.
- (a) Calcium from a skeleton.  
(b) Carbon from coal or from dinosaur's breath.  
(c) Oxygen from dinosaur's breath or the glacier.  
(d) Hydrogen from the glacier.  
(e) Nitrogen from the gunpowder.

There may be some variations to these answers.

- Carbon in the cereal is first broken down to simpler chemicals (glucose) then absorbed through the gut into the bloodstream, then pumped down by the heart to your toe.
- In body - in worm - in duck - in me. (Words and melody of the song can be found at the web address: <http://www.ingeb.org/songs/wherehas.html>)
- Baby grows inside the woman - shares same blood supply, may be fed on breast milk.
- When you breathe out carbon dioxide, it is not absorbed by other humans. The only way carbon is absorbed into the body is by eating food.
- A statement changed to include the words 'nothing but' is one of the classic methods of recognising reductionism. It is sometimes called 'nothing buttery'.

Questions 11 and 12 are intended to stimulate further discussion of 'nothing buttery'.



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## UNIT A7

### 1 What is an element?

The word "Elementary" is used in a variety of ways:

'Elementary, my dear Watson.'

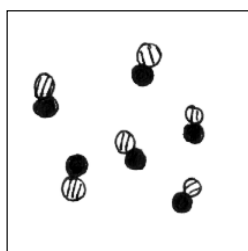
'We learn the elementary ideas of maths at school.'

'You keep making rather elementary spelling mistakes.'

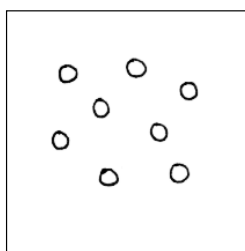
It means simple and basic. An **element** in science is a substance that is very simple and the tiny particles that make it up are all of the same type. So, with a pure gold necklace, however much you cut it up, or try to split it with acids or heat or anything else, there is only one type of material inside it - gold. The tiny particles that make up the necklace are called **atoms** of gold. Two or more different elements can join together. They make something more complicated - a **compound**.

- (a) Which of the boxes shows a single element?  
 (b) Which of the boxes shows a compound?  
 (c) Which picture is a mixture of two different elements?

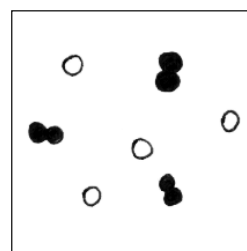
A



B



C

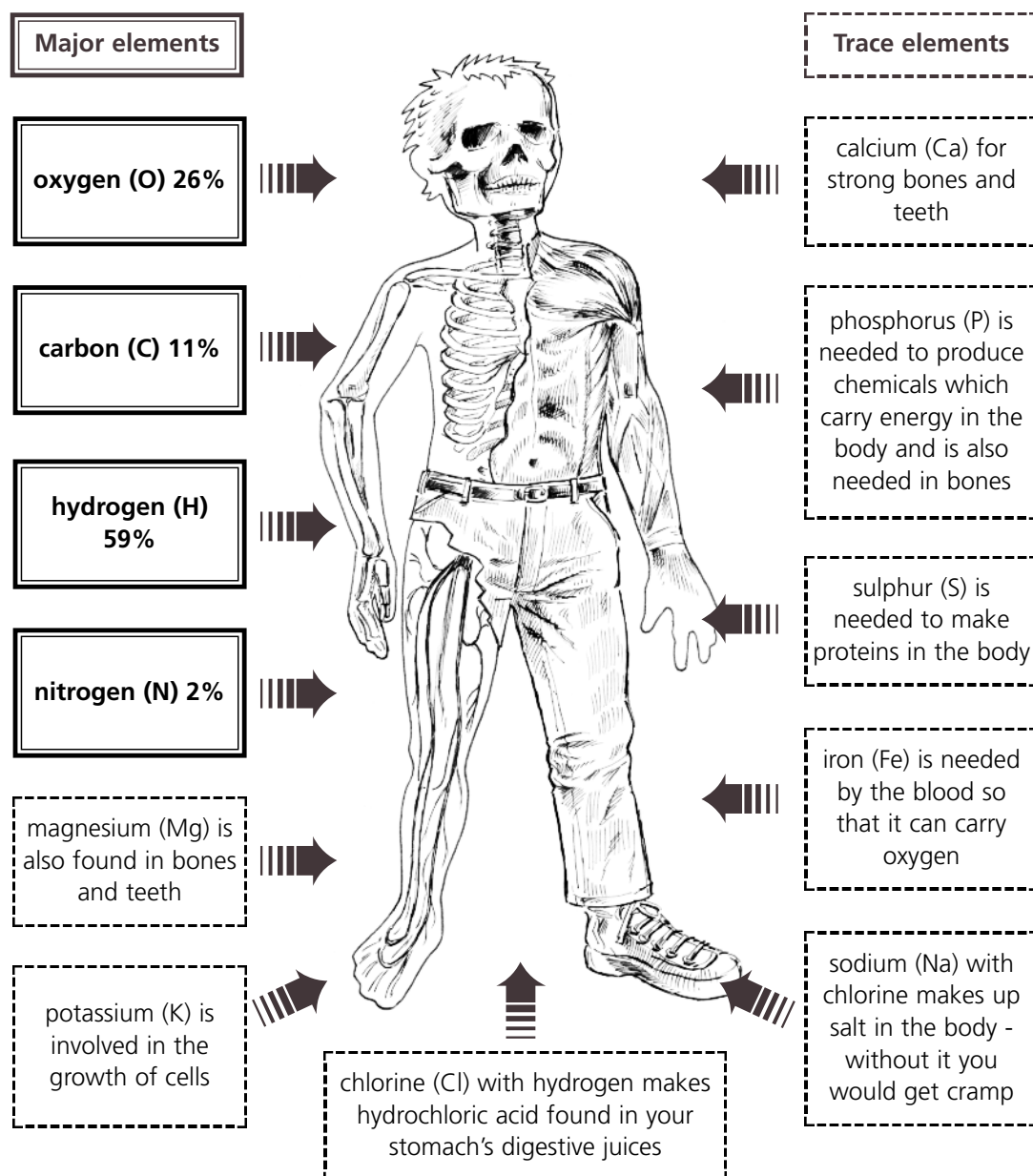


- There are two different types of elements: metals and non-metals. List 4 differences between metals and non-metals.

## 2 The elements in our bodies

So what are we made from?

Some might say 'trunk, arms, legs and a head' because these can be seen. Others might say organs like kidneys, hearts, stomachs, etc. because they understand what is under the skin. But what are these organs made from? They are made from chemical compounds and these compounds are themselves made up of elements joined together.



3. Choose one of these elements and find out about some of its properties. (Remember that, in your body, it will be joined up with other elements as a compound.)
4. Which 5 of the elements shown in the diagram are metals?



Elements are a bit like the letters of the alphabet. There are thousands of words in any dictionary made from just twenty six letters and similarly there are millions of compounds made up from about one hundred elements.

Just as some words are made from very few letters, e.g. 'an', 'on', 'up', 'as' and 'if', so too some compounds, like water (H<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>), are made from very few elements. Common salt is NaCl and even a plastic substance like a polythene bag is just two elements in a big chain (CH<sub>2</sub>).

But just as some words are long and complicated like 'antidisestablishmentarianism', so too are some chemical compounds from which you are made. Examples of these include proteins (muscle fibres, insulin and hair). The DNA which makes up your genes is even more complicated.

The human body is made up of elements that have been joined together in very complicated and amazing ways.

### 3

#### Where have our elements been in the past?

One important law in science is that 'matter cannot be made and cannot be destroyed'. We can't make atoms or elements from nothing or make them disappear. All that happens in chemical reactions, when we make new substances, is that the elements rearrange themselves and join up with different elements.

*Imagine where some of the atoms of elements in our bodies may have been before.*

- Some may have been in the nitrate gunpowder in the Guy Fawkes gunpowder plot.
  - Some may have been breathed out in carbon dioxide gas by a large dinosaur chasing a smaller dinosaur.
  - Some may have come from the ancient forests which later formed black coal under the ground.
  - Some may have come from the skeletons of the first animals.
  - Some may have come from an ancient glacier which cut the valleys of Wales.
5. From the list above, give one source which you think could have provided each of the following elements in our bodies:
- (a) calcium;
  - (b) carbon;
  - (c) oxygen;
  - (d) hydrogen;
  - (e) nitrogen.
6. Breakfast cereal contains the element carbon. Explain how an atom of carbon in the cereal you ate yesterday might eventually end up in your big toe.

## 4 What will happen to our elements in the future?

A few of the atoms inside our body will be handed on to our children and their children's children. Others will end up in worms. This is the story told in the Yorkshire folk song 'On Ilkley Moor'.

### On Ilkley Moor

#### Verse 1

Where hast 'a been since I saw thee,  
On Ilkley Moor bah' t'at? \*  
Where hast 'a been since I saw thee, (x2)  
On Ilkley Moor bah' t'at? (x3)

#### Verse 2

Tha's been a-courtin' Mary Jane.

#### Verse 3

Tha'll surely catch tha death o' cold.

#### Verse 4

Then we shall have to bury thee.

#### Verse 5

Then worms 'll come and eat thee up.

#### Verse 6

Then ducks 'll come and eat up worms.

#### Verse 7

Then we shall come and eat up ducks.

#### Verse 8

Then we shall a' have eaten thee.

(\* For those living outside Yorkshire this means 'on Ilkley Moor without a hat'!)

7. Draw a flow chart to illustrate what happens to atoms of the elements in the body in the song.
8. Why do you think that far more atoms from a mother are passed on to her baby than from the baby's father?
9. When you breathe out, some of the atoms of carbon that were inside you come out as carbon dioxide gas. The person next to you will breathe in some of these atoms. Why won't they remain inside their body?



## The chemistry inside us

Our bodies constantly need feeding with elements (building blocks) and they get them from the compounds we eat. The digestive system helps break down the food that we eat and then our bodies start to manufacture the chemicals we need to live and grow.

Have you ever thought what wonderful chemistry happens in a cow?

The grass they eat is slowly digested and broken down in their four stomachs and can then be rebuilt into other chemicals. They produce for example:

- milk which we can drink;
- skin which we turn into leather;
- muscle (meat) which we can eat as roast dinner.
- the cow can even use the chemicals to grow baby calves inside her!

... all from grass!



## 5 Is that all there is to us?

It is sometimes said that we are what we eat. Our bodies are made up of what we were born with and what we take into them, especially through eating.

Some people might say that you are only a collection of elements all combined with one another in various ways. You are just a mixture of chemicals!

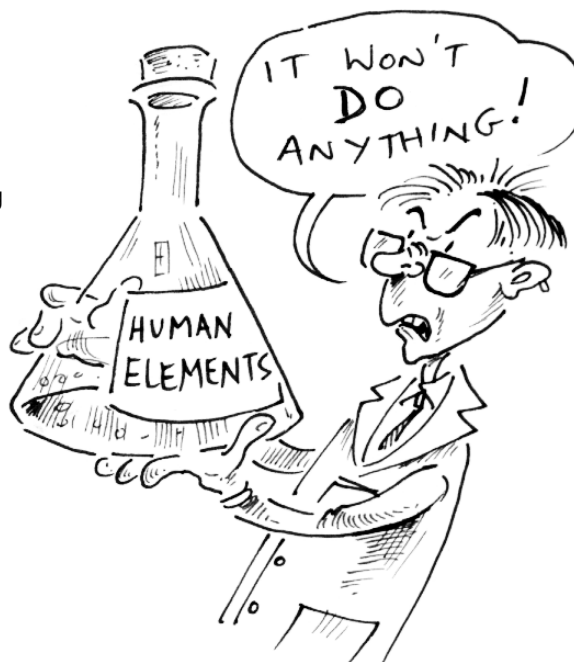
But of course you can do a lot more than anything a chemist can make by mixing and joining up the same elements.

10. How would you reply to a person who might say to you, 'I think you are nothing but a bunch of elements!'

11. In fact you could buy all the elements inside you for about £1.20. Is this your value? Explain what you think.

12. Do you agree with either (or both) of the following statements:

- (a) Humans are very complicated chemical machines;
- (b) Humans are nothing but very complicated chemical machines.



If you have ever been to a burial after a Christian funeral service, you may have heard these words:

“We commit his/her body to the ground:  
earth to earth,  
ashes to ashes,  
dust to dust.”

Think about the meaning of these words. They remind us that our bodies are made up of elements.

But is that all we are? And, at the end of our lives, is that all that is left?

People of various faiths believe that there is life after death. The Bible talks about it in this way:

“But someone may ask ‘How will the dead be brought back to life again? What kind of bodies will they have?’ What a foolish question. You will find the answer in your own garden! When you put a seed into the ground it doesn’t grow into a plant unless it ‘dies’ first. And when the green shoot comes up out of the seed, it is very different from the seed you first planted. For all you put into the ground is a dry little seed of wheat, or whatever it is you are planting, then God gives it a beautiful new body - just the kind he wants it to have; a different kind of plant grows from each kind of seed.”

(1 Corinthians chapter 15 verses 35 - 38, TLB)

