WHAT IS IT ALL MADE OFF?

At first, after the 'big bang', there was only hydrogen. The hydrogen burned in a fusion reaction and made helium. In stars, hydrogen and helium burn, and when a star is old it starts to make other elements.

More than 90% of the atoms in the universe are still hydrogen atoms. In the solar system, however, where 99% of all the atoms are in the sun, helium is the most common element. The Earth's atmosphere is made up of 78.1 % nitrogen, 20.9% oxygen, 0.9% argon, about 0.035% carbon dioxide, and small amounts of water vapour and other gases such as neon.

The Earth's crust, however, contains far more oxygen – nearly 47%: 28% is silicon, and the rest is mostly aluminium, iron, calcium, sodium, potassium and magnesium.

On average, nearly two thirds of the human body is water. Our cells are made from complex organic molecules such as proteins and lipids, but if we look only at the atoms, they are present in these proportions:

- hydrogen 63%
- oxygen 25.5%
- carbon 9.5%
- nitrogen 1.4%
- calcium 0.31%
- phosphorus 0.22%.

There are also smaller amounts of many other elements.

READING

Before you read

1 Look at *Effective reading*.

EFFECTIVE READING

When you know what information you need, you can look for it without reading through all of the text.

2 Look quickly and find where the text talks about the human body.

While you read

3 What is the most common element in the solar system? In the Earth's atmosphere? In your body?

After you read

4 What do these percentages represent?

0.31% *The proportion of calcium atoms in the human body.*

1 0.9% _____

2 99% _____

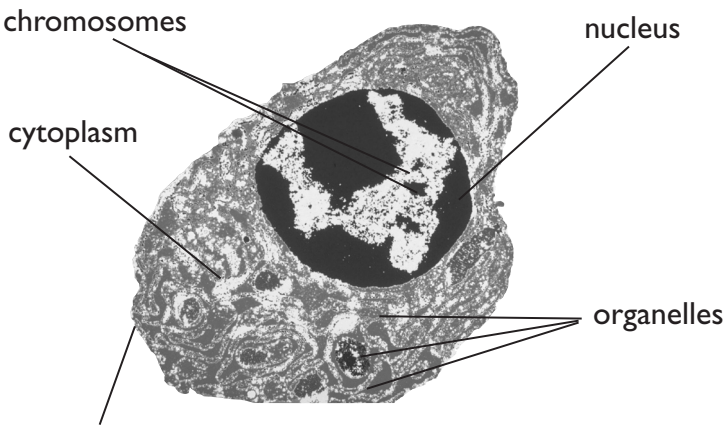
3 nearly 47% _____

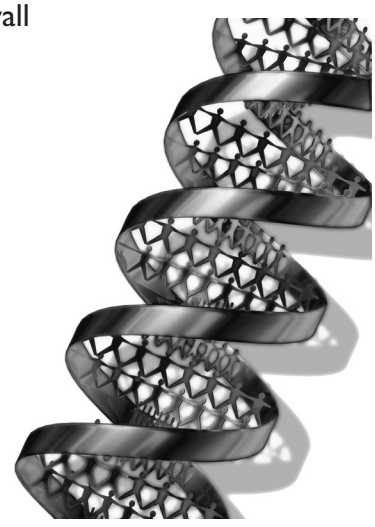
4 0.035% _____

5 63% _____

LISTENING

5 Look at the diagrams and listen.





DNA

6 Write *True* or *False*.

1 Every human cell has ninety-four chromosomes.
2 DNA is a sequence of four acids.
3 Genes contain instructions for making proteins.
4 When you have children, your chromosomes divide.
5 A man has two X chromosomes.

WRITING

7 Look at *Effective writing*.

EFFECTIVE WRITING

When you write up a scientific experiment, always follow this order:
1 Summary 2 Equipment 3 Method
4 Results 5 Conclusion

8 Write the headings.

_____

An experiment about the effect of stirring on how fast salt dissolves in water.

_____

2 glasses, 50g salt, 200ml water, teaspoon, watch.

_____

100ml of water was put in each glass. The time was recorded and 25g of salt was added to each glass. The control glass was not stirred. The test glass was stirred continuously.

_____

The salt in the test glass dissolved in 2 minutes. The salt in the control glass did not dissolve in 2 hours.

_____

Stirring reduces the time needed for salt to dissolv in water.

9 Write up this experiment:

2 glasses, 50ml vinegar, 10g sodium bicarbonate, 10g sugar.
25ml vinegar in each glass.
Control: add sugar: no reaction
Test: add sodium bicarbonate: lots of bubbles (effervesces)
Sodium bicarbonate (a base) produces a chemical reaction with vinegar (an acid) which releases carbon dioxide as bubbles.

SPEAKING

10 Complete the dialogue with the words. in the box.

four or five times There's always an error
to measure it with

Michael We need exactly 245g of sugar for Laura's recipe.

Archie We don't have anything (1) _____. Can we use the bathroom scales?

Michael I don't know: we don't want to make a mistake. How sensitive are they?

Archie I'll have a look. Well, they only measure kilograms and hectograms.

Michael So they have a sensitivity of 100 grams? I don't think that will be good enough.

Archie Oh, look! Isn't that for weighing things?

Michael Yes, look – these scales have a sensitivity of one gram. We can't make a mistake.

Archie (2) _____ when you measure things, Michael.

Michael But these scales are sensitive enough. We can weigh the sugar (3) _____ and take an average, if you like.

Archie I don't really think it matters that much, do you?

Listen and check. Now repeat.

USEFUL PHRASES ▼▼▼

How sensitive is it?
I don't think it matters. I'll have a look.
take an average

11 Look at the words in grey. Write two more words or phrases for each one.

12 Write the dialogue for new people with your ideas.
Practise the dialogue in your class.

VOCABULARY BUILDER

1 Find and circle these words.

bicarbonate
nucleus
chromosome
organelles
effervesce
phosphorus
experiment
proportion
gene
reaction
molecule
solar system
iron
scales
nitrogen
write up

G	P	R	O	P	O	R	T	I	O	N	S	S
E	L	E	Q	D	R	E	A	C	T	I	O	N
N	N	I	T	R	O	G	E	N	W	R	L	K
E	F	F	E	R	V	E	S	C	E	O	A	O
S	N	U	C	L	E	U	S	H	V	N	R	R
C	P	H	O	S	P	H	O	R	U	S	S	G
A	A	K	W	P	Z	C	J	O	I	U	Y	A
L	T	F	R	E	J	M	O	M	I	R	S	N
E	N	B	I	C	A	R	B	O	N	A	T	E
S	S	O	T	U	D	Y	B	S	H	L	E	L
M	O	L	E	C	U	L	E	O	C	N	M	L
M	G	R	U	P	T	Q	X	M	H	A	G	E
F	E	X	P	E	R	I	M	E	N	T	B	S

2 Now put the words into these sentences.

You use _____*scales*_____ to weigh things.

1 A _____ is a part of a _____ which your cells can "read" to make proteins.
2 When you add sodium _____ to vinegar, you can see it _____ .
3 The _____ of _____ atoms in the human body is 0.22%.
4 You always follow the same model when you _____ an _____ .
5 In a cell's cytoplasm, there is a _____ and several _____ .
6 A _____ is very small, but the _____ is very large.
7 _____ is a common metal, and _____ is a common gas.
8 If you put an acid together with a base, there is a chemical _____ .

3 Match the English words to their definitions.

a nucleus **b** effervesce **c** phosphorus **d** gene **e** molecule **f** iron **g** scales **h** nitrogen

1 A chemical element that starts to burn by itself when air touches it.
2 A gas with no colour or smell that exists in the air we breathe.
3 To produce a lot of small bubbles of air or gas.
4 This is something we use to weigh people or things.
5 A very small group of atoms.
6 The central part of an atom.
7 A hard metal that is a common element.
8 A section of DNA on a chromosome that is responsible for a particular characteristic.

COLLABORATIVE PROJECTS

1 Work in groups of four. Do an experiment to discover who has the fastest reaction times.

i) Test each member of the group five times. Take turns to be the tester. The tester holds a ruler vertically in the air, with the 0cm end downwards. The subject puts his or her hand below the ruler (not touching it).

ii) The tester says "I am going to drop the ruler in the next five seconds," but does not say anything immediately before dropping it.

iii) When the ruler drops, the subject catches it as quickly as possible. Carefully write down the measurement on the ruler against the subject's index finger each time. Record the scores in a table.

iv) Calculate the average (mean) score for each subject in the group.

v) Use the model in *Effective Writing* to write up the experiment. Write a report, and then present your findings to the class.

vi) For a longer project, use this first experiment as a control, and then test the effect of different times of day, sitting in different positions, different lighting, or drinking cola or coffee on your reaction times.

CONSOLIDATION

1 Complete the sentences with the correct alternative A, B or C.

1 _____ 90% of the atoms in the universe are hydrogen atoms.
A More the **B** More of **C** More than

2 Human cells _____ from complex organic molecules.
A are made **B** have made **C** been made

3 Chromosomes are made of DNA, _____ is a sequence of four bases.
A what **B** which **C** where

4 If a man's X chromosome is passed to his child, he _____ a daughter.
A had **B** is having **C** has

5 The tester says, "I _____ drop the ruler in the next five seconds."
A should **B** am going to **C** am used to

6 Stirring reduces the time needed for salt _____ in water.
A dissolving **B** solubility **C** to dissolve

2 Write *True* or *False*.

1 Hydrogen and helium burn in stars.
2 Helium is the most common element in the solar system.
3 On average, nearly half of the human body is water.
4 Every human cell has forty-six chromosomes.
5 The DNA sequence is a code which is different in every cell in your body.
6 There is always an error when you measure things.
7 When you write up an experiment, you end with a summary.
8 Sodium bicarbonate is a base, and so is vinegar.

Teacher's Notes and Answer Key

Answer Key

Reading

3 helium; nitrogen; hydrogen
4 1 The proportion of argon atoms in the Earth's atmosphere; 2 The proportion of atoms in the solar system that are in the sun; 3 The proportion of oxygen atoms in the Earth's crust; 4 The proportion of carbon dioxide molecules in the Earth's atmosphere; 5 The proportion of hydrogen atoms in the human body.

Listening

5 Our bodies are made of cells. A cell has a plasma wall made of lipids – complex molecules containing fatty acids – and it is full of cytoplasm.

The cytoplasm is mostly water, but contains several organelles and a nucleus.

In the nucleus, every human cell has forty-six chromosomes. Chromosomes are made of DNA, which is a sequence of four bases. That sequence is a code, which is the same in every cell in your body. The cell copies the code, and then "reads" it: the code contains instructions for building many different proteins. A part of a chromosome that the cell can read in this way is called a gene. When you have children, your chromosomes divide. Your children will have twenty-three of your chromosomes and twenty-three from their other parent. Two of these chromosomes decide if a child is a boy or a girl. Women have two X chromosomes, but men have one X and one Y. If the man's X chromosome is passed to his child, he has a daughter: if the child gets his Y chromosome, he has a son.

6 1 false – they have 46; 2 false – it's a sequence of four bases; 3 true; 4 true; 5 false – a man has one X and one Y.

Writing

8 Summary; Equipment; Method; Results; Conclusion
9 Summary An experiment about combining a base with an acid. Equipment 2 glasses, 50ml vinegar, 10g sodium bicarbonate, 10g sugar. Method 25ml vinegar was put in each glass. Sugar was added to the control glass. Sodium bicarbonate was added to the test glass. Results The control glass showed no reaction. The test glass effervesced. Conclusion Sodium bicarbonate (a base) produces a chemical reaction with vinegar (an acid) which releases carbon dioxide as bubbles.

Speaking

10 1 to measure it with; 2 There's always an error; 3 four or five times.

Vocabulary

G	P	R	O	P	O	R	T	I	O	N	S	S
E	L	E	Q	D	R	E	A	C	T	I	O	N
N	N	I	T	R	O	G	E	N	W	R	L	K
E	F	F	E	R	V	E	S	C	E	O	A	O
S	N	U	C	L	E	U	S	H	V	N	R	R
C	P	H	O	S	P	H	O	R	U	S	S	G
A	A	K	W	P	Z	C	J	O	I	U	Y	A
L	T	F	R	E	J	M	O	M	I	R	S	N
E	N	B	I	C	A	R	B	O	N	A	T	E
S	S	O	T	U	D	Y	B	S	H	L	E	L
M	O	L	E	C	U	L	E	O	C	N	M	L
M	G	R	U	P	T	Q	X	M	H	A	G	E
F	E	X	P	E	R	I	M	E	N	T	B	S

2 1 gene/chromosome; 2 bicarbonate/effervesce; 3 proportion/phosphorus; 4 write up/experiment; 5 nucleus/organelles; 6 molecule/solar system; 7 iron/nitrogen; 8 reaction. 3 1 c; 2 h; 3 b; 4 g; S e, 6 a; 7 f;

Collaborative Projects

- The class should form groups with a minimum of three people in each group.
- For each turn, one person conducts the experiment, another is the subject (the catcher) and the third student observes and records the results.
- Students should hold a 1 metre ruler in a vertical position (with 0cm at the base of the ruler). The subject should position their hand directly under the ruler, ready to catch it when it falls. The person conducting the experiment should warn the subject when he or she is about to let the ruler fall by saying '*I'm going to drop the ruler in the next five seconds'*, and then the ruler should be dropped. The student waiting catches the ruler and the observer takes note of the point at which the ruler was grasped, by writing the number which the student touched with his or her fingers.
- The experiment is repeated 5 times for each subject then the roles are swapped and the experiment is conducted again until each member has had a turn at catching the ruler and the results have been recorded.
- Students work together to calculate the mathematical average for each subject.
- In groups, students write up the experiment following the model in *Effective Writing*.