1. Chemical Elements – the Builders

How many materials are there?

There are millions upon millions of different materials, but all materials are made up from a building set of 'basic bits' that we call **elements.**

Scientists have identified about **100** elements so far, but more will probably be found.

What are all materials made from?

1. There are approximately 100 elements.

2. There are more m a t e r i a l s than e l e m e n t s because most materials are made up from a combination of elements.

What are elements made from?

1. Elements are made up from a t o m s .

2. Particles in an element are all the s a m e .
   Particles in a non element are n o t the same.

3. 2,500,000 atoms placed side by side, would fit across one **millimetre**?

What are elements like?

Elements are different from each other in many ways. They can look different or they can behave differently. The way elements look and behave are called **properties.**

The properties of an element scientists often look at first are:

- its appearance
- whether it is a solid, liquid or gas at room temperature (20°C)
- what temperature it boils and melts at
- whether it is a metal or non-metal.

Experiment Results

element	appearance	solid, liquid gas	boiling point	melting point	metal / non - metal
e.g copper	red / orange	SOLID	2567°C	1083°C	metal
mercury	silver	LIQUID	358°C	-39°C	metal
oxygen	colourless	GAS	-183°C	-218°C	non-metal

Conclusion: 3 ways in which elements can be different from each other are:

1. Appearance
2. State
3. Metal or non-metal

Boiling Point or Melting Point

any 3

2. The Periodic Table

1. The Periodic Table shows all the **elements** we know about. If a material is not an element it will not be on the Periodic table.

Stick your periodic table in here.

					H Hydrogen 1												He Helium 2
Li Lithium 3	Be Beryllium 4											B Boron 5	C Carbon 6	N Nitrogen 7	O Oxygen 8	F Fluorine 9	Ne Neon 10
Na Sodium 11	Mg Magnesium 12											Al Aluminium 13	Si Silicon 14	P Phosphorus 15	S Sulphur 16	Cl Chlorine 17	Ar Argon 18
K Potassium 19	Ca Calcium 20	Sc Scandium 21	Ti Titanium 22	V Vanadium 23	Cr Chromium 24	Mn Manganese 25	Fe Iron 26	Co Cobalt 27	Ni Nickel 28	Cu Copper 29	Zn Zinc 30	Ga Gallium 31	Ge Germanium 32	As Arsenic 33	Se Selenium 34	Br Bromine 35	Kr Krypton 36
Rb Rubidium 37	Sr Strontium 38	Y Yttrium 39	Zr Zirconium 40	Nb Niobium 41	Mo Molybdenum 42	Tc Technetium 43	Ru Ruthenium 44	Rh Rhodium 45	Pd Palladium 46	Ag Silver 47	Cd Cadmium 48	In Indium 49	Sn Tin 50	Sb Antimony 51	Te Tellurium 52	I Iodine 53	Xe Xenon 54
Cs Caesium 55	Ba Barium 56	La Lanthanum 57	Hf Hafnium 72	Ta Tantalum 73	W Tungsten 74	Re Rhenium 75	Os Osmium 76	Ir Iridium 77	Pt Platinum 78	Au Gold 79	Hg Mercury 80	Tl Thallium 81	Pb Lead 82	Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	Ra Radium 88	Ac Actinium 89															

Instead of writing the name all the time, each element is given a symbol.

Complete the table on the next page for the first 20 elements. Copy the symbols carefully- sometimes it is a capital letter and sometimes it is a small letter.

Element	Symbol
Hydrogen	H
Helium	He
Lithium	Li
Beryllium	Be
Boron	B
Carbon	C
Nitrogen	N
Oxygen	O
Fluorine	F
Neon	Ne
Sodium	Na
Magnesium	Mg
Aluminium	Al
Silicon	Si
Phosphorus	P
Sulfur	S
Chlorine	Cl
Argon	Ar
Potassium	K
Calcium	Ca

Use the Periodic Table to find out which of these substances are elements.

water, sulphur, silver, wood, iron, air, carbon, gold.

Circle the substances that are elements.

Stick another Periodic Table in here.

The Periodic Table of the elements

																	He Helium 2
												B Boron 5	**C** Carbon 6	**N** Nitrogen 7	**O** Oxygen 8	**F** Fluorine 9	**Ne** Neon 10
Li Lithium 3	**Be** Beryllium 4											**Al** Aluminium 13	**Si** Silicon 14	**P** Phosphorus 15	**S** Sulphur 16	**Cl** Chlorine 17	**Ar** Argon 18
Na Sodium 11	**Mg** Magnesium 12																
K Potassium 19	**Ca** Calcium 20	**Sc** Scandium 21	**Ti** Titanium 22	**V** Vanadium 23	**Cr** Chromium 24	**Mn** Manganese 25	**Fe** Iron 26	**Co** Cobalt 27	**Ni** Nickel 28	**Cu** Copper 29	**Zn** Zinc 30	**Ga** Gallium 31	**Ge** Germanium 32	**As** Arsenic 33	**Se** Selenium 34	**Br** Bromine 35	**Kr** Krypton 36
Rb Rubidium 37	**Sr** Strontium 38	**Y** Yttrium 39	**Zr** Zirconium 40	**Nb** Niobium 41	**Mo** Molybdenum 42	**Tc** Technetium 43	**Ru** Ruthenium 44	**Rh** Rhodium 45	**Pd** Palladium 46	**Ag** Silver 47	**Cd** Cadmium 48	**In** Indium 49	**Sn** Tin 50	**Sb** Antimony 51	**Te** Tellurium 52	**I** Iodine 53	**Xe** Xenon 54
Cs Caesium 55	**Ba** Barium 56	**La** Lanthanum 57	**Hf** Hafnium 72	**Ta** Tantalum 73	**W** Tungsten 74	**Re** Rhenium 75	**Os** Osmium 76	**Ir** Iridium 77	**Pt** Platinum 78	**Au** Gold 79	**Hg** Mercury 80	**Tl** Thallium 81	**Pb** Lead 82	**Bi** Bismuth 83	**Po** Polonium 84	**At** Astatine 85	**Rn** Radon 86
Fr Francium 87	**Ra** Radium 88	**Ac** Actinium 89															

H Hydrogen 1

METALS

NON-METALS

Choose a colour and shade in all the **metals.** Left of the purple line

Choose a colour and shade in all the **non metals.** Right of the purple line

Choose a colour and shade in all the **gases**

Choose another colour and shade in all the **liquids**

Add a key for each colour used.

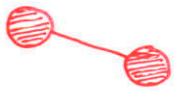
1. All metals are NOT solids.

2. All non-metals are NOT solids.

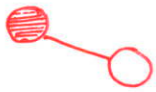
3. How do we get all the other Materials?

New materials are formed when **different** atoms join together.
These new materials are called **compounds**.

Notes: Draw a diagram of a model of an element.



Draw a diagram of a model of a compound.



Complete the following sentences. Add the word element or compound to complete them.

Elements only contain one **kind** of atom.
Compounds contain more than one kind of atom.

Do compounds look like the elements they are made from?

Set	Name	Colour	State solid/ liquid/gas	Element or compound
1	Nickel	silver	SOLID	ELEMENT
	Chlorine	pale green	GAS	ELEMENT
	Nickel chloride	green	SOLID	COMPOUND
2	Copper	orange-brown	SOLID	ELEMENT
	oxygen	colourless	GAS	ELEMENT
	copper oxide	black	SOLID	COMPOUND

e.g

Set	Name	Colour	State solid/ liquid/gas	Element or compound
3	Zinc	Silver	SOLID	ELEMENT
	bromine	orange	Liquid	ELEMENT
	Zinc bromide	White	SOLID	COMPOUND
4				
	etc.			

1. Compounds do not look like the elements from which they are made up?

2. Is it possible to get the names of the elements from which a compound is made by only looking at the **name** of the compound?
   YES

3. What do all the compounds' names have in common?
   end in 'ide'

4. Making Compounds

Notes:

Magnesium is a Silver metal and oxygen is a Colourless gas.

The elements magnesium and oxygen combine together to make a new compound called magnesium oxide.

The new compound is a white solid and does not look like the elements it is made from.

magnesium + oxygen ⟶ magnesium oxide

Making another Compound

Notes:

The iodine solution changed colour from brown to colourless.
This is because the two elements iodine and zinc have joined together to form the compound zinc iodide.

zinc + iodine ⟶ zinc iodide

Naming Compounds

You have probably noticed that the name of the compounds you have just made end in '**-ide**' . This is usually true for compounds of only two elements. The name of the metal stays the same and the name of the non-metal element changes to '**-ide**' .

e.g oxygen turns to oxide
iodine turns to iodide

Notes: Complete the table.

Element 1	Element 2	Name of Compound
sodium	bromine	sodium bromide
magnesium	chlorine	magnesium chloride
silver	oxygen	silver oxide
aluminium	iodine	aluminium iodide
calcium	oxygen	calcium oxide

We can also get the names of elements in a compound by looking at the name of the compound.

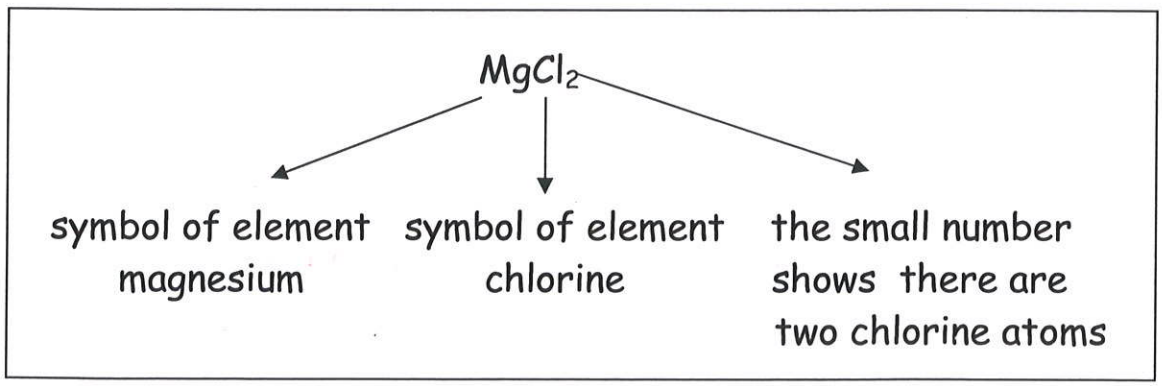
e.g. the compound iron oxide is made up from the elements iron and oxygen.

Notes: Complete the table.

Compound	Metal element	Non-metal element
lead chloride	lead	chlorine
copper fluoride	copper	fluorine
iron sulphide	iron	sulphur
lithium phosphide	lithium	phosphorus

5. Formulae of Compounds

We use symbols to show atoms, such as H for hydrogen or Cl for chlorine. We can also use symbols to show how atoms combine in compounds. When we combine symbols like this, we write a **formula**. Here is the formula for the compound magnesium chloride:



To write a formula you need to know which elements are in the compound, and how many atoms of each.

Compound	No. of Carbon atoms	No. of Hydrogen atoms	No. of Nitrogen atoms	No. of Oxygen Atoms	formula
Water	0	2	0	1	H_2O
Ethane	2	6	0	0	C_2H_6
Ethanoic acid	2	4	0	2	$C_2H_4O_2$
Glycol	2	6	0	2	$C_2H_6O_2$
Methane	1	4	0	0	CH_4
methylamine	1	5	1	1	CH_3NH_2

Working out formulae for compounds

a calcium oxide

CaO

b sodium iodide

NaI

c sodium oxide

Na_2O

d calcium iodide

CaI_2

e magnesium oxide

MgO

f magnesium chloride

$MgCl_2$

g aluminium chloride

$AlCl_3$

h aluminium oxide

Al_2O_3

i aluminium nitride

AlN

j magnesium nitride

Mg_3N_2

7. Solutions

Solid	Solid Left Behind?	Clear or Cloudy	Colour?
A	Yes	Cloudy	Green
B	Yes	Cloudy	White
C	No	Clear	Green
D	No	Clear	Colourless

The solids you have tested which form **clear** mixtures are called **solutions**. It does not matter whether they are **coloured** or **colourless**.

Remember we say a **solid** (or **liquid**), which forms a solution has dissolved.

A substance, which **dissolves** is said to be **soluble** and one which does **not dissolve** is said to be **insoluble**.

8. Speeding up Dissolving

Effect of Stirring

Stirring Speeds up dissolving.

Effect of Particle Size

The smaller the size of the particles the faster they dissolve.

Effect of Temperature

The hotter the water the faster solid C