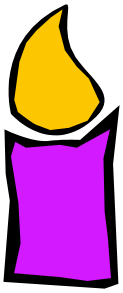
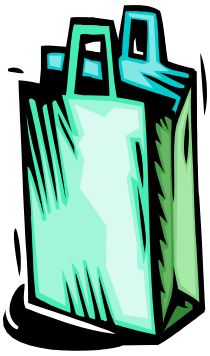
1. Chemical Elements – the Builders





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. It may seem surprising that millions of different materials can be made from such a small number of elements but the next activity will help you to understand.

What are all materials made from?

Let's imagine the letters of the alphabet represent elements.

If we take 2 letters, A and B, we can make one combination without using any letter more than once i.e. AB or BA (these are the same)

If we take 3 letters, A, B, C we can make four combinations i.e. AB, AC, BC, ABC.

Collect: A set of 5 cards

Activity:
1. How many combinations can you make with 4 letters A, B, C, D ?

2. How many combinations can you make with 5 letters A, B, C, D, E ?

By the time you get to 20 'letters or elements' the number of materials that can be made is about 1 million.

……a lot of different materials can be made with just a few elements.

Notes:
1. Approximately how many elements are there?
2. Explain why there are more materials than elements.

What are elements made from?

An element can look just like any other material, so what makes it an element? We can't see what is inside an element so we will use a scientific model.

Activity: Teacher Demonstration

Discussion: When the model is taken apart completely, what are you left with?

What do you notice about all the pieces?

In a real element, we call these smallest pieces **atoms**. All the atoms must be exactly the same for it to be an element. If the atoms are not the same it is not an element. Atoms are incredibly small. If atoms could be lined up side-by-side along the edge of a ruler, there would be 25 million (25,000,000) of them every centimetre!

Notes: Write answers to the following questions using complete sentences:

1. What is the name of the smallest particle that elements are made of?
2. What is the difference between the particles in an element and a non element?
3. How many 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 ($20^{o}C$)

- what temperature it boils and melts at
- whether it is a metal or non-metal.

Notes: Copy the table below into your notebook.
You will need to leave 10 lines under the headings.

element	appearance	solid, liquid gas	boiling point	melting point	metal / non - metal

Activity: 10 elements have been set out around the room with an information card.
Complete the table in notebook.

Notes: 1. What does a scientist mean by the properties of element?
2. Write down 3 ways in which elements can be different from each other.

2. The Periodic Table

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.

Activity: Watch the Video clip 'Elements of the Periodic Table'

Collect: A copy of the periodic table and stick it into your notebook.

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

Notes: Copy the following table and complete it 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
Lithium	Li

Notes: Use your Periodic Table to find out which of the substances below are elements:

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

Collect: A Periodic Table

Activity: Work in a group of four

Look at the table you completed from Lesson 1. Pick out all the elements you identified as metals. Find them on your Periodic Table.
Colour in each metal element in the same colour (shade lightly)
Choose another colour. Do the same for the **non-metals.**

Collect: Another Periodic Table

Look at the table you completed in Lesson 1. Pick out all the elements you identified as gases. Find them on your Periodic Table.
Choose a colour and shade in all the **gases** you have in your table from Lesson 1.
Choose another colour and shade in all the **liquids** you have in your table from Lesson 1.

Discussion: 1. Are 'all metals solids?'

2. Are 'all non-metals solids?'

Notes: Write answers to the questions in your jotter.

Your Teacher will help you to complete the Periodic Table.

3. How do we get all the other Materials?

The Mighty atom … two's company

Look at the four atomic models you have been given.
The balls in each model represent atoms. Atoms of the same element are the same colour.

Discussion: Which of your models are elements?
Why?

Different atoms are shown by different colours:

Colour	Element
Red	oxygen
Black	carbon
White	hydrogen
Green	chlorine
Blue	nitrogen

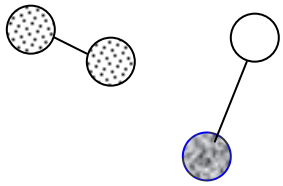
Activity: Look at the other two models.

Notes: The atoms of which elements are in each model?

Copy this information

New materials are formed when **different** atoms join together.

These new materials are called **compounds**.



Collect: A box of model atoms.

Activity: Make a model of an element
Make a model of a compound

Notes: Draw a diagram of each model.

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

_____ only contain one **kind** of atom.
_____ contain more than one kind of atom.

Do compounds look like the elements they are made from?

Notes: Copy the table below

Set	Name	Colour	State solid/ liquid/gas	Element or compound
1				
2				

Activity: 6 sets of chemicals are set up around the room. Each set is made up of 2 **elements** and 1 **compound**.

For each set complete the table.

Notes: Answer the following questions in sentences:

1. Do the compounds 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?
3. What do all the compounds' names have in common?

4. Making Compounds

You are going to make a compound from the elements magnesium and oxygen.

Collect:

Metal tongs	Gas jar oxygen
Bunsen burner	2 cm piece of Magnesium
Heatproof mat	

Activity:

1. Holding the magnesium with tongs, start it burning by holding it for a few seconds in the Bunsen flame.
2. Immediately remove the lid from the gas jar and hold the burning magnesium in the oxygen.
3. Allow the new compound to cool down and look at any changes.

Notes: Copy and complete

Magnesium is a _____ metal and oxygen is a _____ gas.

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

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

magnesium + oxygen $\longrightarrow$ magnesium oxide

Making another Compound

You are now going to make a compound from the elements zinc and iodine.

Collect: Test tube holder
Test tube and stopper
Iodine solution
Zinc powder

Activity:
1. Put 1 spatula of zinc powder into a test tube.
2. Add 1 cm depth of iodine solution.
3. Stopper the test tube and shake it carefully.
4. Place in a test tube rack and leave for 2 minutes.
5. Look for any change in colour.

Notes: Copy and complete

The iodine solution changed colour from _____ to _____.
This is because the two _____ iodine and zinc have joined together to form the _____ 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: Copy the table below.

Element 1	Element 2	Name of Compound
sodium	bromine	
magnesium	chlorine	
silver	oxygen	
aluminium	iodine	
calcium	oxygen	

Notes: Try to complete the table by suggesting the name of the compound made from the pairs of elements given in the table.

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.

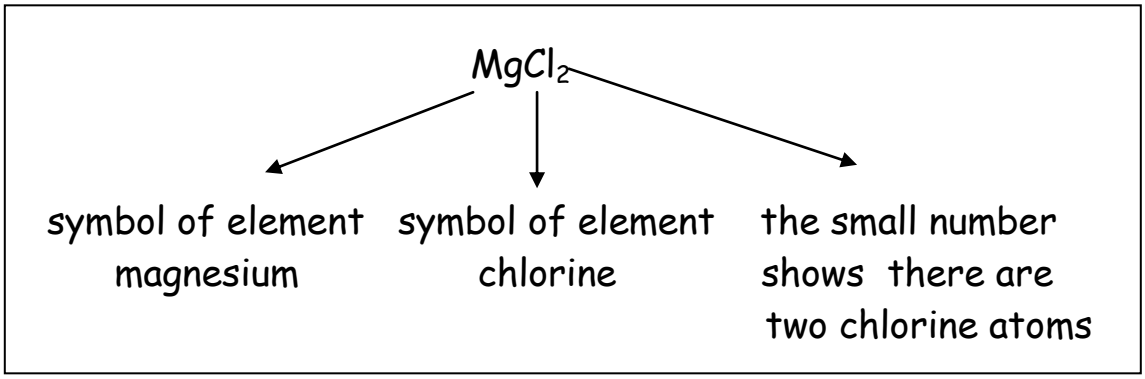
Notes: Copy and complete the following table

Compound	Metal element	Non-metal element
lead chloride		
copper fluoride		
iron sulphide		
lithium phosphide		

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:

Notes: Copy the information in the box below.



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

Notes: Copy the table below

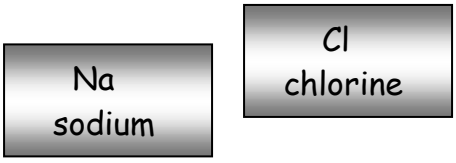
Compound	No. of Carbon atoms	No. of Hydrogen atoms	No. of Nitrogen atoms	No. of Oxygen Atoms	formula
Water					
Ethane					
Ethanoic acid					
Glycol					
Methane					
methylamine					

Activity: Look at each model. Count the number of each type of atom in the and write them in the table.

Notes; Complete the table by writing the formula for each model.

Working out formulae for compounds

Collect: a bag of cards



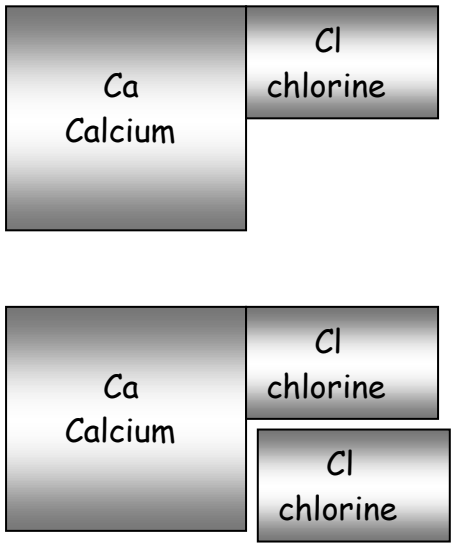
You are going to work out the formula for sodium chloride. (Remember when two elements form a compound the ending changes to ' ide'.

Activity: Find the sodium and chlorine cards and put them side by side.
You have a rectangle.
The formula is NaCl.
The name is sodium chloride.

You are going to work out the formula for calcium chloride.

Activity: Find the calcium and chlorine cards and put them side by side.

When you put a calcium card beside a chlorine card, you do not get a rectangle. You can get a rectangle if you use two chlorides.



The formula is $CaCl_2$ showing one calcium and two chlorines. The name is calcium chloride.

Activity: Use the cards to work out the formulae for the following compounds.

Remember that you must make a rectangle each time before you write a formula.

a	calcium oxide	b	sodium iodide
c	sodium oxide	d	calcium iodide
e	magnesium oxide	f	magnesium chloride
g	aluminium chloride	h	aluminium oxide
i	aluminium nitride	j	magnesium nitride

Notes: Write the name and formula in your notebook.

6. Compounds and Mixtures

Are Compounds and Mixtures the Same?

We already know the difference between elements and compounds.
Now we will look at the difference between mixtures and compounds.

Mixtures	**Compounds**
• The substances in a mixture are not joined together. • The substances in a mixture are easily separated. • Mixtures contain at least two different substances (elements, compounds or both) mixed up together.	• The atoms in a compound are chemically joined together. • The atoms in a compound are difficult to separate. • Compounds contain atoms from at least two different elements.

Notes: Draw a table to show the similarities and differences between mixture and compounds.

Collect: a set of 4 cards

Activity: Identify which **kinds** of substances are present in each mixture.

Notes: Describe the mixtures in each picture using the words atoms, elements and compounds.

Activity: Look at the diagram on the white screen.

Discussion: Explain how the diagram shows that air is a mixture.

Notes: Write the explanation in your notebook.

Time to Think

Here are some concepts and words connected with materials:

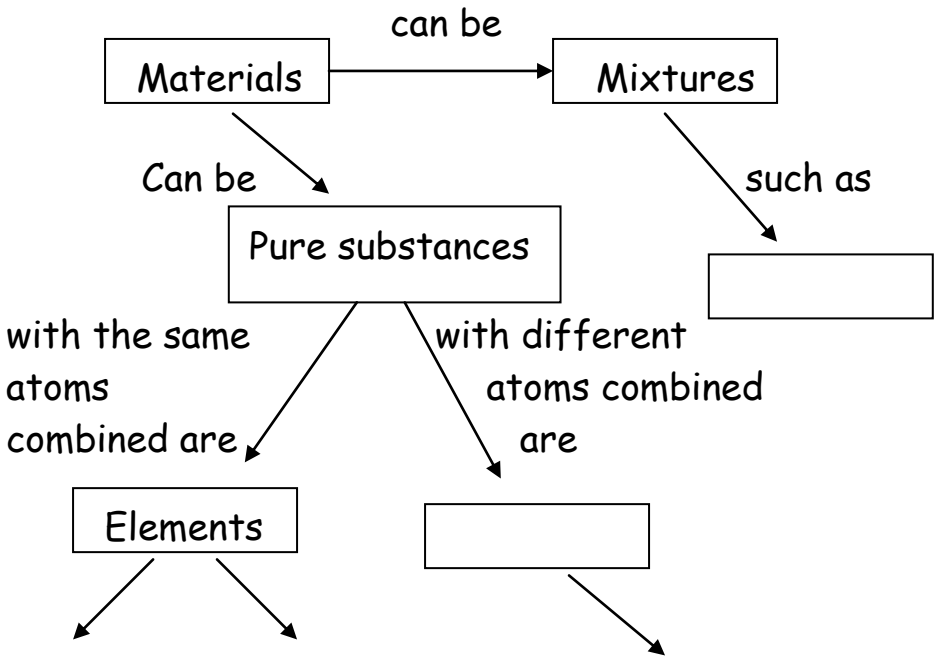
non-metals	elements
magnesium	compounds
chemical reaction	MgO
formulae	oxygen
molecules	symbols
seawater	air
metals	atoms
magnesium oxide	pure substances
mixtures	

Activity: Work in a group, make a concept map for materials using all
of the concepts and words listed above.

Follow these steps 1 – 4:

1. Pick out the main ideas
2. Sort the remaining words into groups belonging to the main ideas.
3. Draw the concept map, linking the words with arrows.
4. Write in a link on each arrow.

An example of how to start the concept map is shown below.



Be prepared to explain your concept map to the class.