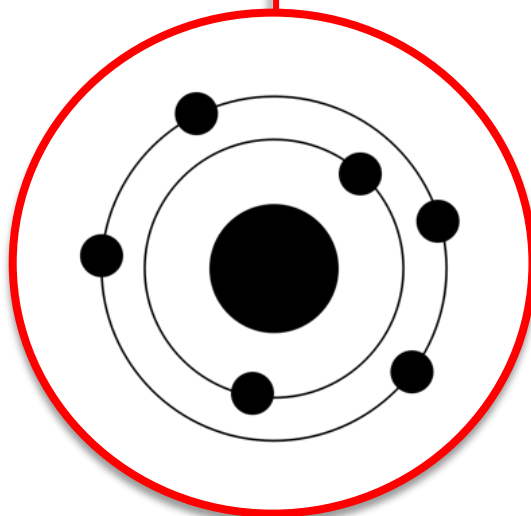


**YEAR 7
CHEMISTRY UNIT ONE**



In this topic you will learn about the fundamentals of chemistry.

You will learn about the difference between elements and compounds and what elements are made up of. You will learn about the differences between metals and non-metals and about the periodic table and what it tells us about the different elements.

You will also learn about what a chemical formula is and what happens in different chemical reactions.

This will build up on the work you did in primary school comparing and grouping materials based on their properties and the work you did on irreversible changes that can be carried out to make new substances.

This will help you to prepare for the work you will do in years 8, 9, 10 and 11 when you will learn more about elements, compounds, atoms and the periodic table and how to work with chemical formula. The work you do in this unit and the content you study will be the building blocks for your future work in chemistry.

Name:

Class:

Teacher:

Expected Performance Level:



ACTIVATE KNOWLEDGE

Elements are the building blocks for everything in the world.

Everything in the world is made up of elements – the booklet you are reading, the chair you are sitting on, the desk you are sitting at, the pen you write with – even you are made up of elements.

There are about 100 different elements, and they can all be found in a table called the periodic table.

The periodic table was created by a Russian scientist called Dmitri Mendeleev in 1869 and it is used by scientists all over the world. It has been described as "one of the most significant achievements in science" by the United Nations.

On the periodic table each element has a name and a symbol. The names for the elements are different depending on what language you speak – so for example the element silver is called argent in French and plata in Spanish – but elements have the same symbol no matter what language you speak.

This creates a universal language for scientists that everyone can understand – so the symbol for the element silver will be Ag whether you speak English, French or Spanish.

All living things contain the elements carbon, oxygen, hydrogen and nitrogen. 99% of your body is made up of just six elements, which are oxygen, hydrogen, nitrogen, carbon, calcium, and phosphorus.

- 1) What are the building blocks for everything in the world?

- 2) How many elements are there?

- 3) What is the name of the table where all the elements are found?

- 4) What was the name of the scientist who created this table?

- 5) The name of an element can be different depending on what language you speak. What is the same for an element no matter where you are in the world?

- 6) Which four elements do all living things contain?

- 7) What percentage of your body is made up of the elements oxygen, hydrogen, nitrogen, carbon, calcium, and phosphorus?



CONTENT

Elements and their Symbols

**One
Letter**

**Two
Letters**

Some elements have a symbol made up of _____ letter.
This letter is always a _____ letter

Some elements have a symbol made up of _____ letters.

The _____ letter of the symbol is always a capital letter.

The second letter of the symbol is always a _____ letter.

The symbols of elements _____ begin with a capital letter

The names and symbols of all the elements can be found on the _____ table. You have a copy of the periodic table in your journal.



RETRIEVAL ACTIVITY

	Question	Answer	Mark
1	What are the building blocks for everything in the world?		
2	What is the name of the table where all the elements are found?		
3	Around how many elements are there?		
4	What type of letter do the symbols of elements always begin with?		
5	If a symbol for an element is made up of two letters, will the second letter be a capital letter or a lower-case letter?		
6	True or false - the symbol for an element always starts with the first letter of the element's name?		
7	What is the symbol for the element hydrogen?		
8	What is the symbol for the element sodium?		
9	Which element has the symbol O?		
10	Which element has the symbol C?		
	Score:		



ACTIVATE KNOWLEDGE

In physics unit one you studied electrical energy transfer, conductors and insulators.

Complete the sentences below to review what you learned about electrical energy transfer and conductors.

- Energy is transferred electrically by tiny, charged particles called _____.
- The amount of charged particles that flow is called electrical _____.
- Conductors are materials that contain electrons that are able to _____.
- Insulators are materials that contain electrons that are _____ able to move.



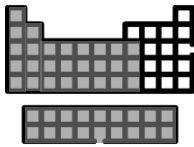
CONTENT

Metals and Non-Metals

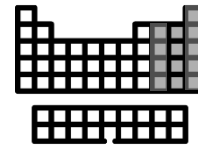
Metals

Non-metals

Metals are found on the _____ hand side of the periodic table



Non-metals are found on the _____ hand side of the periodic table



You have a periodic table on page three of this booklet.

To separate the metals from the non-metals draw a stepped line down from Boron.

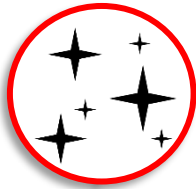
Shade the metals on the left-hand side of the line in one colour.

Shade the non-metals on the right-hand side of the line, and hydrogen, in another colour.

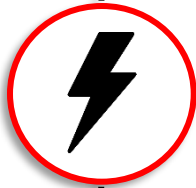
Make sure you include a key on your periodic table.

11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[286] Nh nihonium 113	[289] Fl flerovium 114	[289] Mc moscovium 115	[293] Lv livermorium 116	[294] Ts tennessine 117	[294] Og oganeson 118

PROPERTIES OF METALS



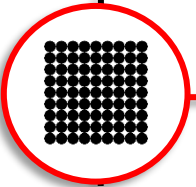
Metals have a shiny surface.



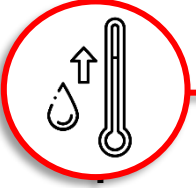
Metals are good conductors of electricity because electrons in the metal can move and carry a charge.



Metals are good conductors of heat because electrons in the metal can move and transfer heat energy.



All metals except mercury are solid at room temperature. Mercury is a liquid at room temperature.



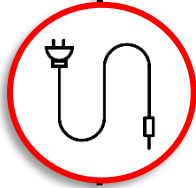
Most metals need to be heated to a very high temperature to make them change from a solid into a liquid.



Metals can be bent and shaped without breaking.



Metals make a ringing sound when they are hit.



Metals can be stretched out into wires without snapping or breaking.

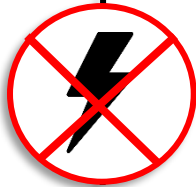


Most metals feel heavy for their size.

PROPERTIES OF NON-METALS



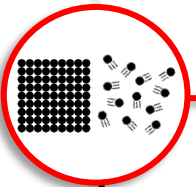
Non-metals have a dull surface.



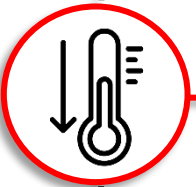
Non-metals are poor conductors of electricity because electrons in the non-metal cannot move.



Non-metals are poor conductors of heat because electrons in the non-metal cannot move.



Most non-metals are solids or gases at room temperature. The only non-metal that is liquid at room temperature is bromine.



Most non-metals don't need to be heated to a high temperature to make them change from solid to liquid.



Non-metals can break easily or shatter.



Most non-metals do not make a ringing sound when they are hit.



Most non-metals feel light for their size.



RETRIEVAL ACTIVITY

	Question	Answer	Mark
1	What are the building blocks for everything in the world?		
2	Are metals found on the left or the right side of the periodic table.		
3	Do metals have high melting points or low melting points?		
4	Do metals have a dull or shiny surface?		
5	Which is the correct symbol for the element sodium? NA na Na		
6	What word describes the property of metals that means they make a ringing sound when hit?		
7	What word describes the property of metals that means they can be stretched into wires?		
8	What word describes the property of metals that means they can be bent and shaped?		
9	What word describes the property of non-metals that means they break or shatter easily?		
10	What are the electrons in metals able to do that makes metals good conductors of heat and electricity?		
	Score:		



ACTIVATE KNOWLEDGE

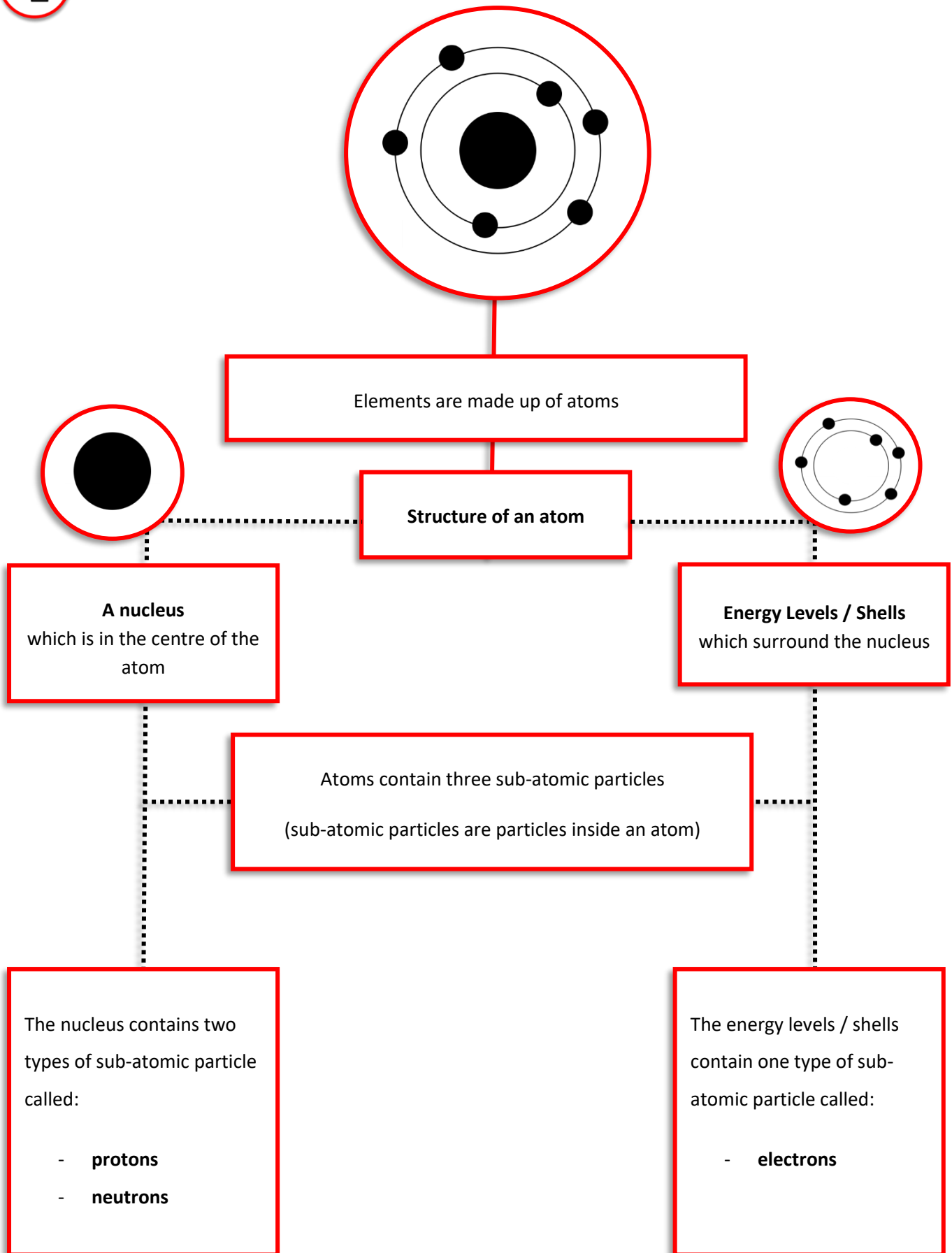
Use the periodic table to find the symbols of the following elements and say whether they are metals or non-metals.

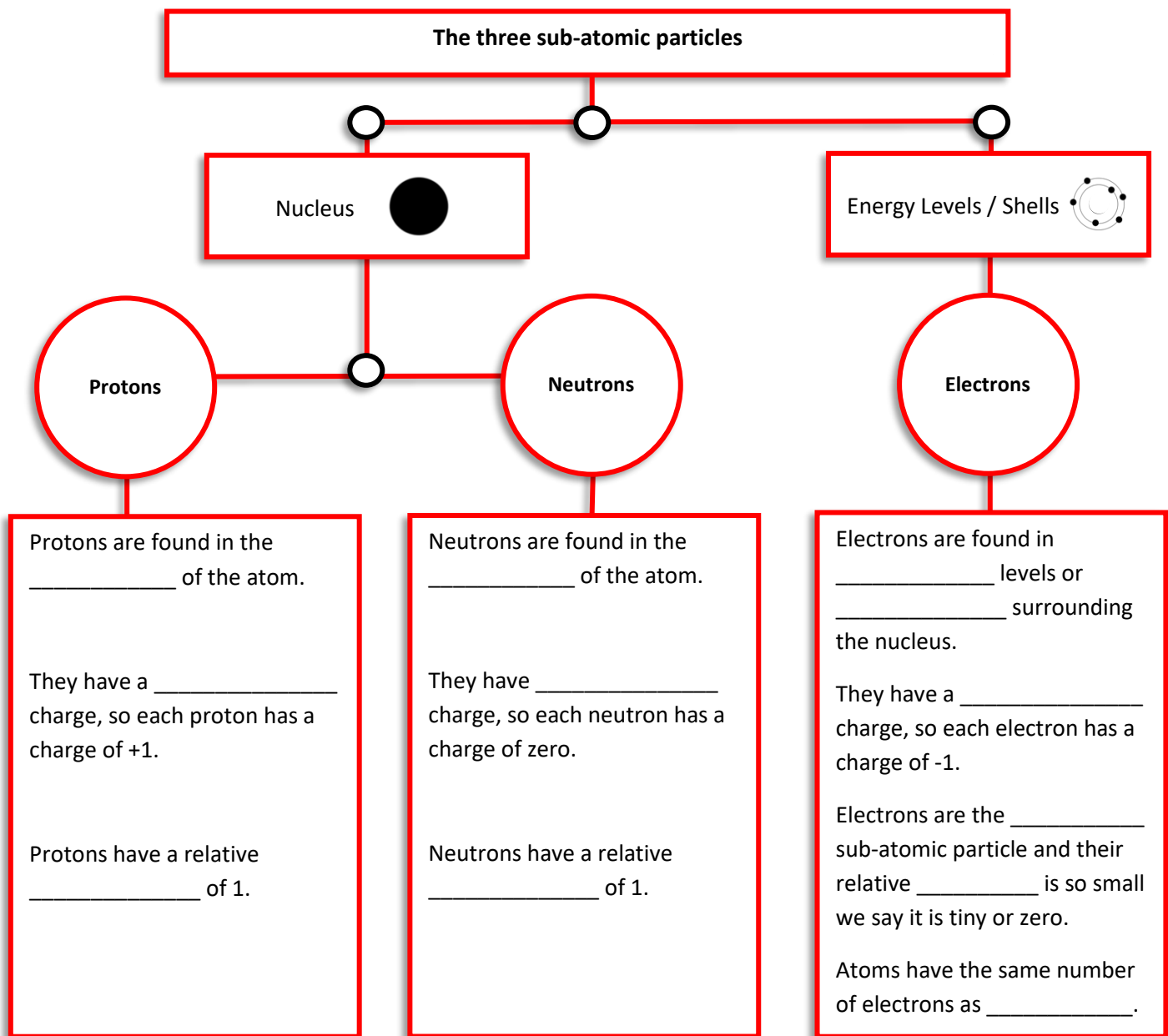
Remember to use capital letters and lower-case letters correctly.

Name	Symbol	Metal or non-metal?
Magnesium		
Copper		
Sulfur		
Zinc		
Helium		
Krypton		
Francium		



CONTENT





GUIDED PRACTICE

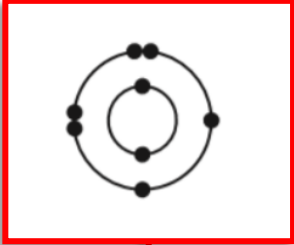
Complete the table to show the key features of the three sub-atomic particles:

Name of sub-atomic particle	Location in atom	Relative Mass	Relative Charge
Proton			
Neutron			
Electron			



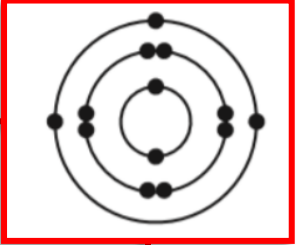
CONTENT

Different elements are made up of different types of atoms



Oxygen atom

The element oxygen only contains oxygen atoms.
The element aluminium only contains aluminium atoms.
Oxygen atoms are different to aluminium atoms.



aluminium atom

An element is a **substance made up of one type of atom**

The element carbon contains carbon atoms only.
The element magnesium contains magnesium _____ only.
The element iron contains _____ atoms only.
The element copper contains copper atoms _____.
The element neon contains _____.



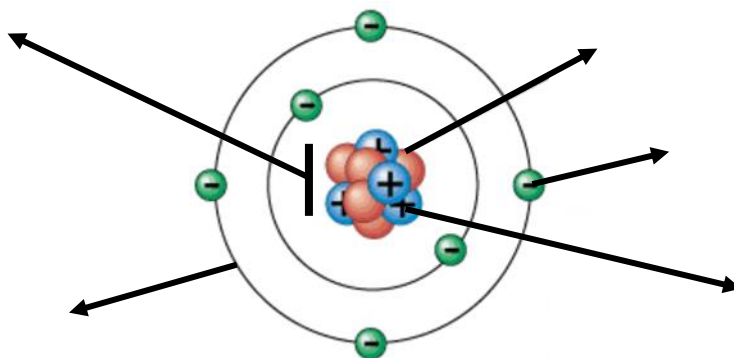
RETRIEVAL ACTIVITY

	Question	Answer	Mark
1	What is a substance made up of one type of atom?		
2	Where are protons found in an atom?		
3	Where are neutrons found in an atom?		
4	Where are electrons found in an atom?		
5	What is the relative mass of a proton?		
6	What is the relative mass of a neutron?		
7	What is the relative mass of an electron?		
8	What is the relative charge of a proton?		
9	What is the relative charge of an electron?		
10	What is the relative charge of a neutron?		
	Score:		



ACTIVATE KNOWLEDGE

Label the diagram of the atom below with as much detail as you can:



Would the mass of an atom be concentrated in the nucleus or energy shells? How do you know?



CONTENT

What do the numbers on the periodic table tell us about atoms?

You have this key on your periodic table:

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

This key tells us:

The number **above** the symbol on the periodic table is the **relative atomic mass** (mass of the atom).

The number **below** the name is the **atomic number** (the number of protons in the atom)

27
Al
aluminium
13

The element aluminium has the symbol _____
The relative atomic mass of aluminium is _____
The atomic number of aluminium is _____
An aluminium atom nucleus contains _____ protons

19
F
fluorine
9

The element fluorine has the symbol _____
The relative atomic mass of fluorine is _____
The atomic number of fluorine is _____
A fluorine atom nucleus contains _____ protons

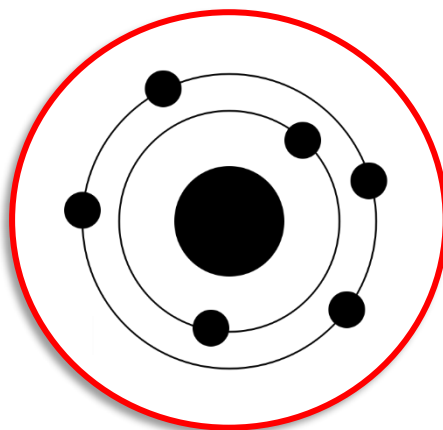
Elements in the periodic table are in _____ of their atomic number.

The atomic number of an atom will tell you what _____ the atom is.

The atomic number tells you how many _____ there are in the nucleus of the atom.

The number of protons in an atom cannot _____ and determines what element the atom is.

An atom will have the same number of protons as _____.



What is the relative atomic mass of an atom?

Protons have a relative mass of _____

Neutrons have a relative mass of _____

Electrons have a relative mass of _____

This tells us:

The **mass** of an atom is made up of the **protons and neutrons** in the nucleus.

Relative atomic mass = number of protons + number of neutrons

Number of neutrons = _____

An aluminium atom has:

a relative atomic mass of _____ and an atomic number of _____

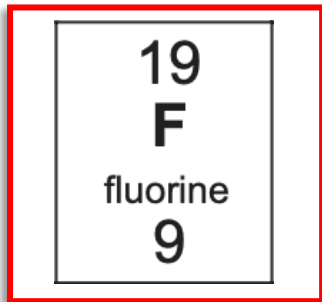
An aluminium atom has:

_____ protons

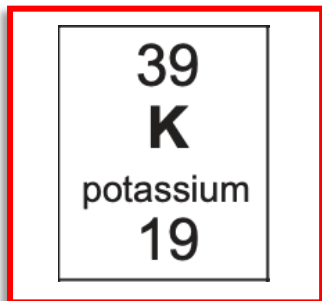
_____ electrons

_____ neutrons

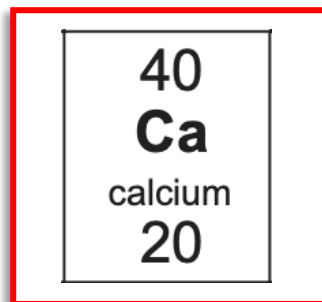
27
Al
aluminium
13



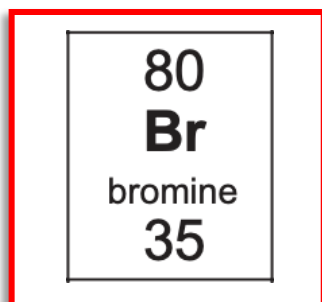
A fluorine atom has:
a relative atomic mass of _____ and an atomic number of _____
A fluorine atom has:
_____ protons
_____ electrons
_____ neutrons



A potassium atom has:
a relative atomic mass of _____ and an atomic number of _____
A potassium atom has:
_____ protons
_____ electrons
_____ neutrons



A calcium atom has:
a relative atomic mass of _____ and an atomic number of _____
A calcium atom has:
_____ protons
_____ electrons
_____ neutrons



A bromine atom has:
a relative atomic mass of _____ and an atomic number of _____
A bromine atom has:
_____ protons
_____ electrons
_____ neutrons



RETRIEVAL ACTIVITY

	Question	Answer	Mark
1	What is made up of one type of atom?		
2	Which two sub-atomic particles are found in the nucleus of an atom?		
3	Which sub-atomic particle is found in the shells surrounding the nucleus of an atom?		
4	What does the atomic number (the bottom number) on the periodic table tell you about an atom?		
5	How does the number of protons compare to the number of electrons in an atom?		
6	What are you calculating if you take away the atomic number from the relative atomic mass?		
7	Which side of the periodic table are metals on?		
8	What can move in metals that make them good conductors of heat and electricity?		
9	What is the relative charge of a proton?		
10	What is the relative charge of an electron?		
	Score:		



ACTIVATE KNOWLEDGE

Give the definition of an element:

Look at the different symbols below – circle the ones that show the correct symbols of elements:

Li CO He C MG Os KR B CU

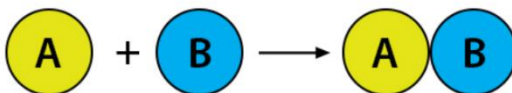
How did you decide which ones were element symbols?



CONTENT

What happens in a chemical reaction?

In a chemical reaction atoms are _____, and a
_____ substance is made.



The substances you start off with in a chemical reaction are called _____.

The substances you make in a chemical reaction are called _____.

The reactants turn into the products. This can be written as a word equation using an arrow.

The reactants are always on the left-hand side of the arrow and the products are always on the right-hand side of the arrow:

Reactants \rightarrow Products

In a chemical reaction elements can be chemically joined together.

A substance made up of **two or more elements chemically joined together** is called a

_____.

Example of a chemical reaction

The element carbon can react with the element oxygen to make the compound carbon dioxide

Carbon dioxide contains carbon and oxygen chemically joined together.

Carbon + Oxygen \rightarrow Carbon dioxide



The element copper reacts with the element chlorine to make the compound copper chloride.

Write a word equation for this reaction:

The element iron reacts with the element oxygen to make the compound iron oxide.

Write a word equation for this reaction:

The element zinc reacts with the element sulphur to make the compound zinc sulphide.

Write a word equation for this reaction:

The element lithium reacts with the element bromine to make the compound lithium bromide.

Write a word equation for this reaction:

The element sodium reacts with the element iodine to make the compound sodium iodide.

Write a word equation for this reaction:

The element calcium reacts with the element nitrogen to make the compound calcium nitride.

Write a word equation for this reaction:

The compound sodium chloride is made when the element sodium reacts with the element chlorine.

Write a word equation for this reaction:

The compound lead sulphide is made when the element lead reacts with the element sulphur.

Write a word equation for this reaction:

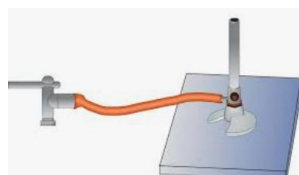


CONTENT

Making a compound

Put on your safety glasses and connect your Bunsen burner gas hose to a gas tap.

1



2

Place a heatproof mat under the Bunsen burner.

Make sure the airhole on the Bunsen burner is closed.

3

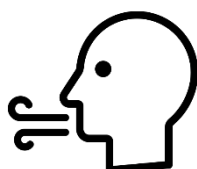
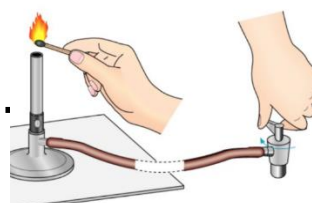


4

Light a splint and hold the lit splint just above the barrel of the Bunsen burner.

Turn the gas on by lifting and then turning the gas tap.

5

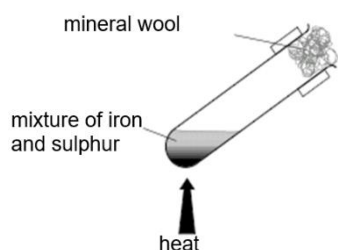


6

Blow the lit splint out, facing away from the Bunsen burner, and put it down on the heatproof mat.

Open the airhole on the Bunsen burner so that the flame turns blue.

7

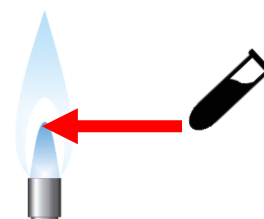


8

Pick up your test tube of iron and sulphur using a pair of tongs and heat it in the Bunsen flame. Make sure the test tube is pointing away from you.

Heat for five minutes, making sure the bottom of the test tube is in the hottest part of the flame – at the top of the inner blue flame.

9



10

Place the test tube down on your heatproof mat. Be careful it will be hot.



Elements are often named by the scientists who discover them. The names have to be unique and approved by the International Union of Pure and Applied Chemistry (IUPAC).

No-one has yet named an element after themselves, but many elements are named in tribute to places or important scientists, for example the element einsteinium is named after Albert Einstein. The element francium is named after France, the country where it was discovered.

Scientists sometimes get creative. Mythical names have also proved popular. The element promethium was named after a character from a Greek legend who stole fire from the gods to give to humans and was punished by being chained to rock so an eagle could feed on his liver. The name was meant to reflect the fact that discovering new elements often requires sacrifice.

The symbols for elements are based on the English, Latin or Greek name of the element. There are eleven elements represented in the periodic table by letters not in line with their English names:

- Sodium (Na – Natrium)
- Potassium (K – Kalium)
- Iron (Fe – Ferrum)
- Copper (Cu – Cuprum)
- Silver (Ag – Argentum)
- Tin (Sn – Stannum)
- Antimony (Sb – Stibium)
- Tungsten (W – Wolfram)
- Gold (Au – Aurum)
- Mercury (Hg – Hydrargyrum)
- Lead (Pb – Plumbum)

Nearly all of these elements were known in ancient times and therefore carry over their Latin names. Some of the names also led to other words that are common in the English language. For example, plumbum, Latin for Lead (Pb), is where we get the words plumber and plumbing, because lead was used in water supply pipes for centuries.

The names of compounds often give you information about which elements they contain. Their names often end in -ide or -ate. A compound ending in -ide will be made up of two elements chemically joined together, for example copper chloride is made up of the elements copper and chlorine.

A compound ending in -ate will always contain the element oxygen, for example sodium carbonate contains the elements sodium carbon and oxygen. The compound potassium nitrate contains the elements potassium, nitrogen and oxygen. The compound lithium sulphate contains the elements lithium, sulphur and oxygen.

1. Which elements will the compound tin oxide contain?

2. Which elements will the compound lithium bromide contain?

3. Which elements will the compound magnesium sulphide contain?

4. Which elements will the compound calcium carbonate contain?



CONTENT

Chemical Formula

The name of a compound doesn't tell you how many atoms of each element there are in the compound.

Scientists use chemical formula to show how many atoms of each element there are.

They place a small number to the **bottom right** of the element's symbol to show how many atoms there are.

If there is no number after an element's symbol then there is only 1 atom of that element.

The chemical formula of a **compound** will contain **more than one capital letter**.

The chemical formula of the compound iron sulphide is FeS.

This tells you iron sulphide contains two elements (because the formula has two capital letters)

It also tells you iron sulphide contains 1 atom of Fe (iron) and 1 atom of S (sulphur)

The chemical formula of the compound sodium carbonate is Na₂CO₃

This tells you sodium carbonate contains three elements (because the formula has three capital letters)

It also tells you sodium carbonate contains 2 atoms of Na (sodium), 1 atom of C (carbon) and 3 atoms of oxygen.

CO_2		Element or compound?	
		Number of different elements	
		Number of C atoms	
		Number of O atoms	
		Total number of atoms	

H_2		Element or compound?	
		Number of different elements	
		Number of H atoms	
		Total number of atoms	

H_2SO_4		Element or compound?	
		Number of different elements	
		Number of H atoms	
		Number of S atoms	
		Number of O atoms	
		Total number of atoms	



RETRIEVAL ACTIVITY

	Question	Answer	Mark
1	What is made up of one type of atom?		
2	What is made up of two or more elements chemically joined together?		
3	What happens to atoms in a chemical reaction?		
4	Is the substance O ₂ an element or a compound?		
5	Is the substance MgO an element or a compound?		
6	Which side of the periodic table are metals on?		
7	Suggest the name of the substance with the chemical formula MgO.		
8	What is the scientific name for the substances you start off with in a chemical reaction?		
9	What is the scientific name for the substances you make in a chemical reaction?		
10	What is the relative charge of a proton?		
	Score:		



ACTIVATE KNOWLEDGE

Look at the word equation below:



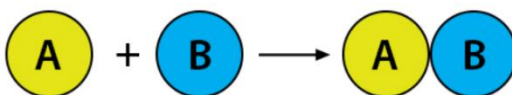
What does this word equation tell you?



CONTENT

What happens to mass in a chemical reaction?

In a chemical reaction atoms are _____, and a
_____ substance is made.



In a chemical reaction the reactants are turned into products by rearranging the atoms in the reactants.

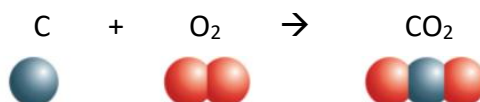
Reactants \rightarrow Products

Atoms **cannot be gained or lost** in a chemical reaction this means any atoms in the reactants must also be there in the products.

The element carbon can react with the element oxygen to make the compound carbon dioxide
Carbon dioxide contains carbon and oxygen chemically joined together.

Carbon + Oxygen \rightarrow Carbon dioxide

This can also be written as a symbol equation



This symbol equation tells us 1 atom of carbon reacts with 2 atoms of oxygen to make carbon dioxide.

The 1 atom of carbon and 2 atoms of oxygen in the reactants must also be present in the product.

If the atoms in the reactants must be present in the products this means the total mass of the reactants must be equal to the total mass of the products.

Carbon + Oxygen \rightarrow Carbon dioxide

5g + 3g \rightarrow _____

If 5g of carbon reacts with 3g of oxygen what mass of carbon dioxide would be produced?

The total mass of the reactants must be equal to the total mass of the products in a chemical reaction.

This is a law that must be obeyed in science.

It is called the **law of conservation of mass**.

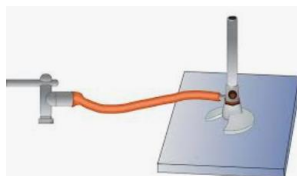


CONTENT

Making magnesium oxide

Place a piece of magnesium in a crucible and put the lid on top. Measure the mass of the crucible, magnesium and lid and record the mass.

1



2

Place your Bunsen burner on a heatproof mat, attach to a gas tap and make sure the airhole is closed.

Place a tripod and clay pipe triangle above the Bunsen burner.

3



4

Place the crucible, containing magnesium, with its lid on the clay pipe triangle.

Light the Bunsen burner and open the airhole so that you are using the blue heating flame.

5



6

Heat the crucible for 5 minutes lifting the lid slightly every 30 seconds using a pair of tongs.

The magnesium will react with oxygen in the air to make the compound magnesium oxide. Do not let any of the magnesium oxide escape.

7

Magnesium + Oxygen → Magnesium Oxide

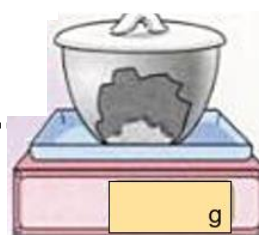


8

Leave the crucible to cool. Do not touch it because it will be hot.

Once it has cooled re-weigh the crucible, contents and lid. Record the mass.

9





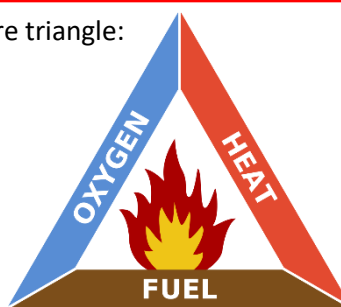
RETRIEVAL ACTIVITY

	Question	Answer	Mark
1	A chemical formula contains one capital letter. Will it be an element or a compound?		
2	What is the relative charge of a proton?		
3	What is the relative charge of an electron?		
4	What is the relative charge of a neutron?		
5	How many elements are in the formula CO ₂ ?		
6	How many atoms of oxygen (O) are in the formula CO ₂ ?		
7	How many atoms of carbon (C) are in the formula CO ₂ ?		
8	What is a substance made up of one type of atom?		
9	True or false. Metals are good conductors of heat and electricity?		
10	Which side of the periodic table are non-metals on?		
	Score:		



ACTIVATE KNOWLEDGE

This is the fire triangle:



What do you think the fire triangle shows?

What do you think happens if one part of the fire triangle is removed?



CONTENT

Combustion

Combustion is the scientific name for _____.

Combustion is carried out to release _____ from a _____
when it burns.

How does the size of a beaker a candle is placed in effect the length of time the candle burns for?

We are going to investigate how long a candle burns for when it is placed in different sized beakers.

Equipment list: 100ml beaker, 250ml beaker, 600ml beaker, 1000ml beaker, candle, stop clock

Method:

- 1) Place a 100ml beaker over a lit candle and immediately start the stop clock.
- 2) Record how long the candle burns for. (Stop the stop clock when the candle goes out.)
- 3) Repeat using 250ml, 600ml and 1000ml beakers.

Results Table:

Beaker size (ml)	Time for the candle to burn out (seconds)			Mean time for the candle to burn out (seconds)
	(Test 1)	(Test 2)	(Test 3)	
100				
250				
600				
1000				



RETRIEVAL ACTIVITY

	Question	Answer	Mark
1	What is the scientific name for burning?		
2	Which gas is needed for burning of a fuel to take place?		
3	As well as this gas what else is needed for a fuel to burn?		
4	What is released when any fuel burns?		
5	What is the relative mass of a proton?		
6	What is the relative mass of a neutron?		
7	What is the relative mass of an electron?		
8	What is a substance made up of 2 or more elements chemically joined together?		
9	How many atoms of S (sulphur) are there in the chemical formula H_2SO_4 ?		
10	How many atoms of H (hydrogen) are there in the chemical formula H_2SO_4 ?		
	Score:		



ACTIVATE KNOWLEDGE

Did you do any burning experiments in primary school? What did you find out?

What is missing from this fire triangle?





CONTENT

Combustion

Combustion is the scientific name for _____.

Combustion is carried out to release _____ from a _____
when it burns.

Combustion needs a _____ and oxygen

Combustion produces _____ and water when a fuel
burns in plenty of oxygen.

Combustion also releases _____ which is why the temperature increases
when a fuel burns.

Word equation for combustion (burning)

_____ + _____ → _____ + _____ (+ energy)

A fuel is a substance that releases useful _____, such as heat energy when it _____.

Today we are going to prove that when a fuel burns _____ and
_____ are produced and _____ energy is released

Products of Burning Fuels

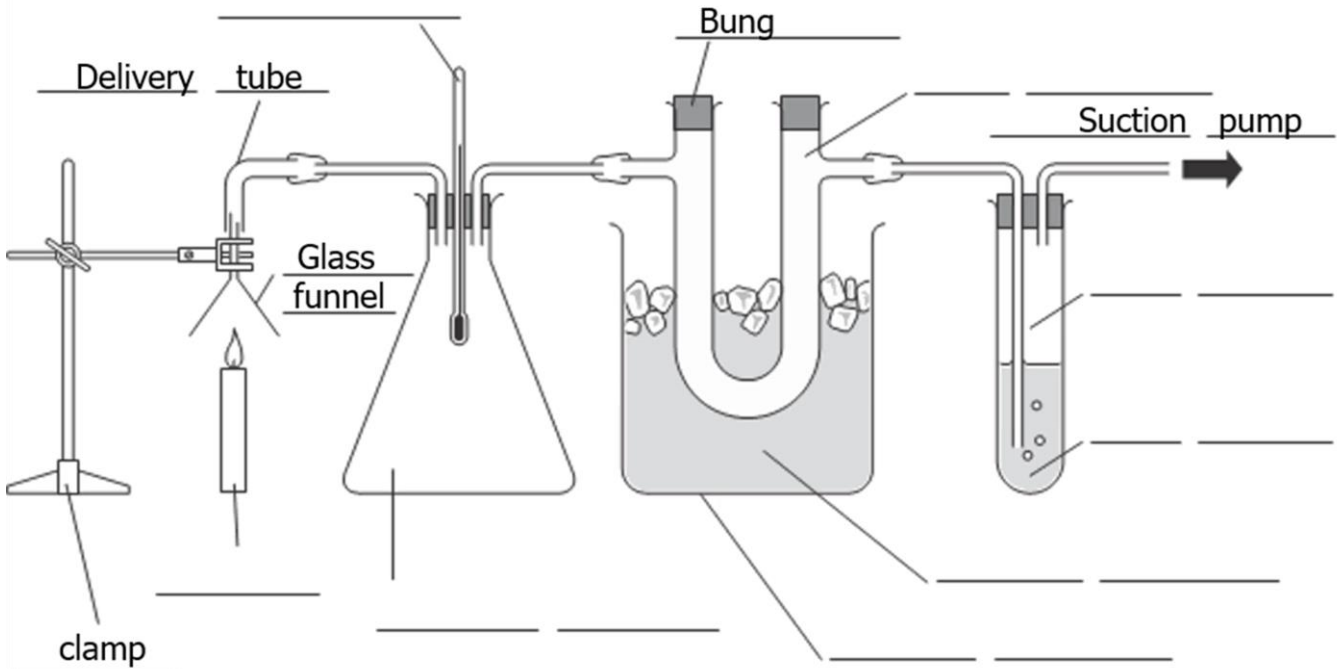
Label the diagram using words from the list below:

boiling tube
candle

conical flask
limewater

iced water
large beaker

thermometer
U-tube



Record your observations in the table below:

Observation	Before fuel is burnt	After fuel is burnt
Appearance of limewater		
Appearance of U-tube		
Thermometer		



RETRIEVAL ACTIVITY

	Question	Answer	Mark
1	Is the substance with the formula O ₂ an element or a compound?		
2	Carbon dioxide is produced when a fuel burns. Which elements will carbon dioxide contain?		
3	What chemical is used to test for carbon dioxide?		
4	What happens to this chemical to show carbon dioxide has been produced?		
5	What happens to the temperature when a fuel burns?		
6	Where in an atom are the electrons found?		
7	Where in an atom are the protons and neutrons found?		
8	What is the scientific name for burning?		
9	Which gas is needed for burning of a fuel to take place?		
10	What happens to a fire if you take away one side of a fire triangle?		
	Score:		



ACTIVATE KNOWLEDGE

What is missing from this fire triangle?

What is the word equation for the burning of a fuel?

Fuel + _____ → _____

What are the products when a fuel burns?



CONTENT

Fuels and Combustion

A fuel is a substance that releases useful _____, such as heat energy when it _____.

Word equation for combustion (burning)

_____ + _____ → _____ + _____ (+ energy)

The products of combustion (burning) are:

Carbon dioxide, which has the chemical formula CO_2 , is made up of _____ and oxygen.

Water, which has the chemical formula H_2O , is made up of _____ and oxygen.

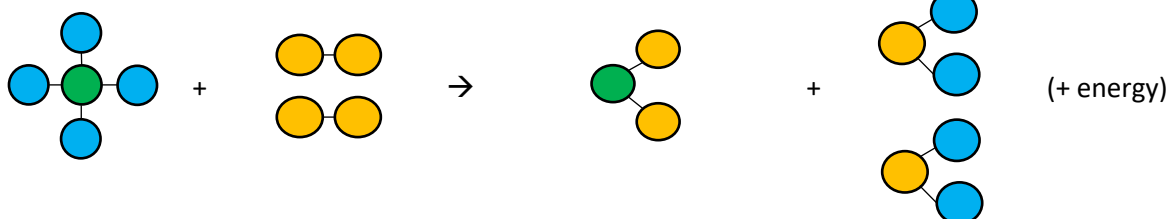
The oxygen comes from the _____ when the fuel burns.

The carbon and hydrogen come from the _____.

Fuels contain carbon and hydrogen

Fuel + Oxygen → Carbon Dioxide + Water (+ energy)

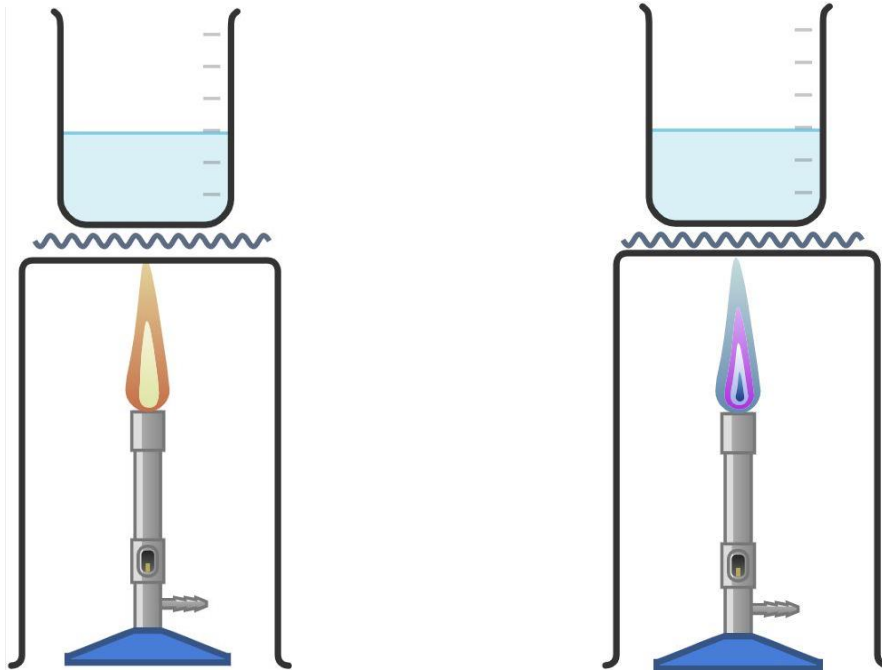
CH_4 + 2O_2 → CO_2 + $2\text{H}_2\text{O}$ (+ energy)



Products of Burning Fuels

Two identical clean beakers containing 100ml of room temperature water will be heated using identical Bunsen burners and tripods.

One is heated on the roaring flame with the air hole open, the other is heated on the safety flame with the air hole closed.



The fuel being burned is the gas from the gas tap. This fuel is called _____.

The flames are different because the Bunsen burner with a _____ flame has an open airhole. This means there is more _____ mixing with the fuel as it moves through the Bunsen burner, so the fuel can burn in plenty of oxygen. The Bunsen burner with an orange flame has a _____ airhole, this means there is _____ oxygen available for the fuel to burn in.

The beaker of water above the blue flame boiled _____. This is because more _____ energy is released when the fuel can burn in plenty of oxygen.

The beaker above the orange flame became covered in black _____. Soot is solid _____.

The beaker became covered in soot because there wasn't enough oxygen for the fuel to _____ properly.

As well as soot, if a fuel doesn't burn in enough oxygen a gas called carbon _____ can be produced. Carbon monoxide is a very dangerous gas. It has no taste, _____ or colour – so you cannot tell it is there, but if you breathe in too much carbon monoxide your _____ blood cells will carry the carbon monoxide instead of _____. This means _____ oxygen gets to your body cells.

Burning Houses

How does the amount of oxygen affect how long a model house burns for?

We are going to burn two model houses.

One will burn in the open and one will burn inside a large glass jar.

We will also use a carbon monoxide detector to see if carbon monoxide is produced.

Results Table:

Beaker size (ml)	Time house burned for (seconds)	Was carbon monoxide produced?
House burning in open air		
House burning inside glass jar		



RETRIEVAL ACTIVITY

	Question	Answer	Mark
1	True or false. The chemical formula of a compound has more than one capital letter.		
2	How many elements are in the substance with the chemical formula Fe ₂ O ₃ ?		
3	How many atoms are in the substance with the chemical formula Fe ₂ O ₃ ?		
4	Which sub-atomic particles are found in the nucleus of an atom?		
5	Which sub-atomic particles are found in shells surrounding the nucleus?		
6	How do you work out the mass number of an atom?		
7	What does the atomic number of an atom tell you about the atom?		
8	Which sub-atomic particle has a relative charge of +1?		
9	Which sub-atomic particle has a relative charge of -1?		
10	Which sub-atomic particle has a relative charge of zero?		
	Score:		



ACTIVATE KNOWLEDGE

What is missing from this fire triangle?



What is the word equation for the burning of a fuel?

Fuel + _____ → _____

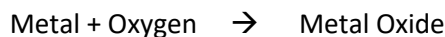
What gas in the air do fuels react with when they burn?



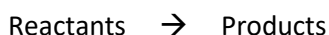
CONTENT

When a metal burns in air it reacts with oxygen.

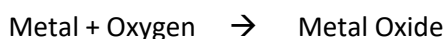
The metal reacts with oxygen to form a metal oxide. This can be shown with this general word equation:



Remember, the reactants (what you start with) goes on the left hand side of the arrow in a word equations, and the products (what you make) goes on the right hand side of the arrow.



The general word equation can be used to write the word equations when different metals react with oxygen:



You replace the word metal with the name of the metal.

For example, if you burn copper in air this will be the word equation:



If you burn tin in air this will be the word equation:



What happens when a metal burns in air and in pure oxygen?

We are going to burn two metals in air and then in pure oxygen.

Equipment list: sample of iron, sample of magnesium, Bunsen burner, heatproof mat, tongs, sample of pure oxygen

Method:

- 1) Look at the sample of the metal and note down what it looks like.
- 2) Set up a Bunsen burner on a heatproof mat
- 3) Hold the sample of metal using the tongs and carefully set fire to it using the Bunsen burner on the blue heating flame. (Do not look directly at the magnesium while it burns)
- 4) Make observations in your table to describe the appearance during and after burning.
- 5) You will then observe the same metals being burned in pure oxygen.
- 5) Make observations in your table to describe the difference when metals burn in air compared to pure oxygen

Observation Table

Metal	Iron	Magnesium
Appearance of the metal before heating		
Observations during heating		
Observations after heating		
What chemical have you made by burning the metal in air?		

You will then observe the metals burning in pure oxygen. What are the differences when a metal burns in pure oxygen compared to air?

Metal	Iron	Magnesium
Differences observed when the metal burned in pure oxygen compared to air		



RETRIEVAL ACTIVITY

	Question	Answer	Mark
1	What 3 things are needed for a fire to burn?		
2	What are the 2 products when a fuel burns in plenty of oxygen?		
3	When a metal burns in air what gas does it react with?		
4	What is produced when a metal burns in air?		
5	What is produced when iron burns in air?		
6	What is produced when magnesium burns in air?		
7	Write a word equation for iron burning in air and reacting with oxygen.		
8	Instead of air what could you burn metals in to give a much brighter flame?		
9	How many elements does the substance with the chemical formula SnO ₂ contain?		
10	How many atoms does the substance with the chemical formula SnO ₂ contain?		
	Score:		



ACTIVATE KNOWLEDGE

What is missing from this fire triangle?



What gas does a fire need to burn?

How do you think it would affect the fire if you provided more oxygen to it?



CONTENT

There are three gases that we can identify using gas tests.

When you look at a gas it can be difficult to tell which gas it is.

You can carry out a test to see if the gas is hydrogen, oxygen or carbon dioxide.

Testing for hydrogen.

Equipment

Test tube, hydrochloric acid, piece of magnesium, splint, test tube rack



Method

- 1) Add 2cm depth of hydrochloric acid to a test tube, and place in a test tube rack.
- 2) Add a piece of magnesium.
- 3) Place your thumb over the top of the test tube to keep the gas in the tube.
- 4) Remove thumb and quickly test with a lit splint.

Is it hydrogen?

To test for hydrogen you place a lit splint in the gas.

If you hear a squeaky pop the gas is hydrogen.

Testing for oxygen.

Equipment

Test tube, hydrogen peroxide, manganese oxide, splint, test tube rack



Method

- 1) Add 2cm depth of hydrogen peroxide to a test tube, and place in a test tube rack.
- 2) Add a small spatula of manganese oxide.
- 3) Place your thumb over the top of the test tube to keep the gas in the tube.
- 4) Remove thumb and quickly test with a glowing splint - a splint that has been blown out but is still glowing red.

Is it oxygen?

To test for oxygen you place a glowing splint in the gas.

If the splint relights the gas is oxygen.

Testing for carbon dioxide.

Equipment

Two boiling tubes labelled A and B, hydrochloric acid, calcium carbonate, limewater, bung and delivery tube, spatula, test tube rack



Method

- 1) Add 2cm depth of hydrochloric acid to boiling tube A, and place in a test tube rack.
- 2) Add 4cm depth of limewater to boiling tube B, and place in the test tube rack.
- 3) Add one spatula of calcium carbonate to test tube A.
- 4) Put the bung into the top of test tube A and place the end of the delivery tube into test tube B, making sure the delivery tube is in the limewater.

Is it carbon dioxide?

To test for carbon dioxide you use a chemical called limewater.

You need to bubble the gas through the limewater.

If it goes cloudy the gas is carbon dioxide.



RETRIEVAL ACTIVITY

	Question	Answer	Mark
1	Would you use a lit splint or glowing splint to test for hydrogen?		
2	What would you hear if your answer to Q1 was placed in hydrogen?		
3	Would you use a lit splint or glowing splint to test for oxygen?		
4	What would you observe if your answer to Q3 was placed in oxygen?		
5	What chemical is used to test for carbon dioxide?		
6	What will happen to your answer to Q5 if carbon dioxide is bubbled through it?		
7	What 3 things are needed for a fire to burn?		
8	What are the 2 products when a fuel burns in plenty of oxygen?		
9	What gas in the air do metals react with when they burn?		
10	What does it mean if a compound has a name ending in -ate?		
	Score:		



ACTIVATE KNOWLEDGE

You may have heard of the word **decomposition** or **decompose** before

What do you think of when you hear either of these words?

What do you think of when you hear the word **thermal**?



CONTENT

Thermal Decomposition

Thermal decomposition is using _____ to _____
_____ a substance



Gru has stolen the Crown Jewels from the Tower of London!

His MISSION now is to build a fortress to stop Vector stealing them from him, but Vector has a new weapon, THE HEAT RAY!

Gru has found two chemicals at the bottom of his lair.

Which one should he use to build the fortress so Vector cannot get in?

Gru needs your help to test the two different chemicals to find out which one would be the best one to use.

Your challenge is to find out which one will not break down when heated - and so prevent Vector from stealing back The Crown Jewels!

The 2 chemicals you are going to test are:

- calcium carbonate
- copper carbonate

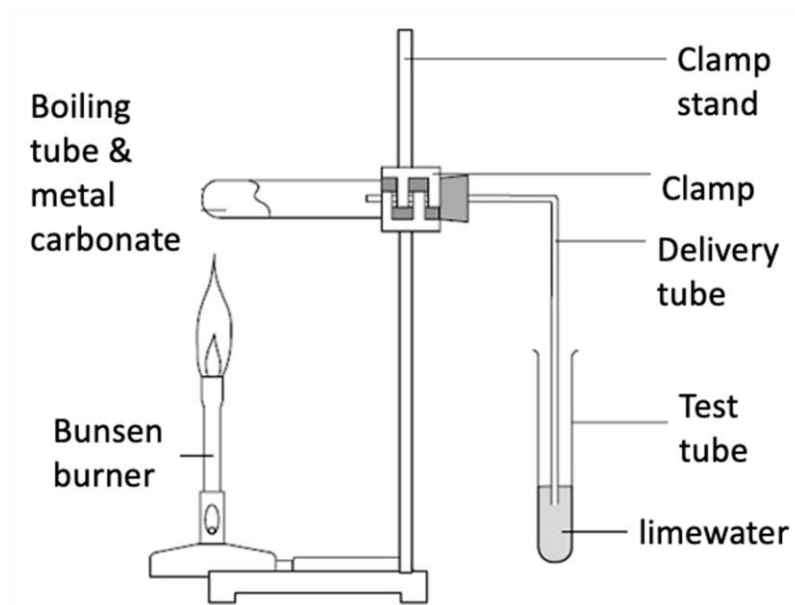
Does the chemical break down when it is heated?

Equipment list: boiling tube, test tube, bung and delivery tube, Bunsen burner, heatproof mat, stand and clamp, test tube rack

Method:

- 1) Put one spatula of the chemical you are testing into a boiling tube
- 2) Clamp the boiling tube so it is horizontal in the stand and clamp.
- 3) Half fill the test tube with limewater and place in the test tube rack.
- 4) Place the bung in the boiling tube and place the end of the delivery tube into the test tube, making sure the delivery tube is in the limewater.
- 5) Use a Bunsen burner, placed on a heatproof mat, to heat the chemical. The Bunsen burner should have a half open air hole for heating. Observe the limewater and record your observations.
- 6) Make sure you remove the delivery tube from the limewater **before** you stop heating the chemical

Diagram of equipment when it is set up:



Observation Table

Metal carbonate	Any changes observed when the metal carbonate was heated.	Was a gas produced?	Any changes observed to the limewater.	Did it breakdown on heating?
Copper Carbonate		Yes or No		Yes or No
Calcium Carbonate		Yes or No		Yes or No

Review

1) Which of the chemicals thermally decomposed and was broken down when heated?

2) If the limewater turned cloudy, which gas was being produced when the metal carbonate was broken down?

3) Which chemical would you recommend Gru uses to build his fortress?

4) Why?

What is happening when a metal carbonate is heated?

The metal carbonate thermally decomposes.

It is broken down by heating.

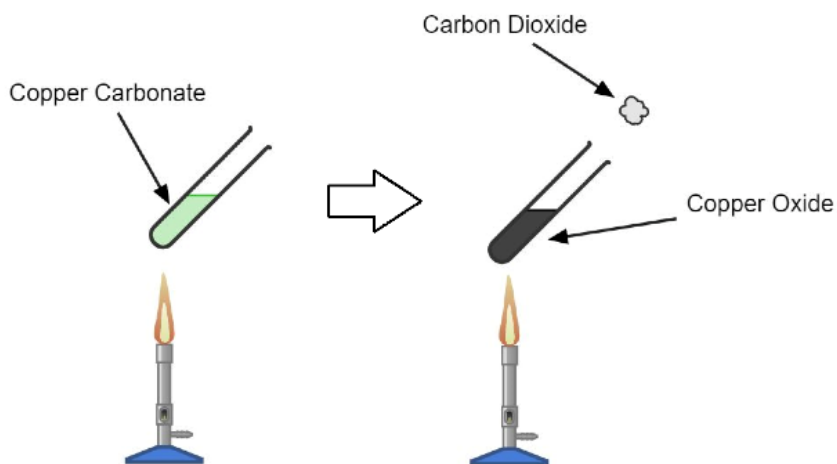
It breaks down into a metal oxide and carbon dioxide.

The general word equation for the reaction is:

Metal Carbonate \rightarrow Metal Oxide + Carbon Dioxide

Thermal Decomposition of Copper Carbonate.

This is what happens when copper carbonate is heated and breaks down.



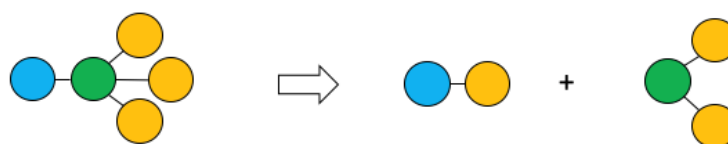
WORD EQUATION

Copper Carbonate \rightarrow Copper Oxide + Carbon Dioxide

SYMBOL EQUATION

$\text{CuCO}_3 (\text{s}) \rightarrow \text{CuO} (\text{s}) + \text{CO}_2 (\text{g})$

PARTICLE MODEL



This would be the equation if calcium carbonate was heated and thermally decomposed:

WORD EQUATION

Calcium Carbonate \rightarrow Calcium Oxide + Carbon Dioxide

SYMBOL EQUATION

$\text{CaCO}_3 (\text{s}) \rightarrow \text{CaO} (\text{s}) + \text{CO}_2 (\text{g})$

PARTICLE MODEL

