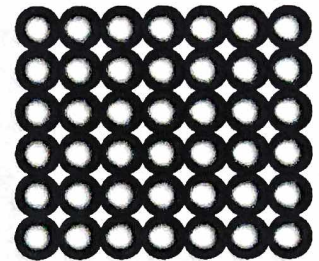


Everything is made up of particles that are too small to see. The three states of matter are SOLID, LIQUID and GAS. They all have different properties due to the arrangement and movement of their particles.

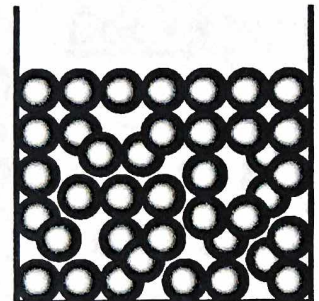
Solids.

The particles are held tightly together by strong forces. They make small vibrations but they stay in place. This gives solids a definite shape and volume. Solids are DENSE (heavy) and they can not be compressed (squashed) easily because the particles are already packed closely together.



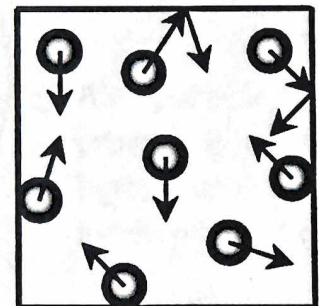
Liquids.

A liquid can flow because the particles can move past each other. The particles are still held closely together by strong forces. Liquids are DENSE and they can not be compressed easily. A liquid can change its shape but not its volume.



Gases.

There are only very weak forces between the particles which are far apart. The particles move around very quickly and bounce off each other. Gases have a low density (they are very light) and they do not have a definite shape or volume.

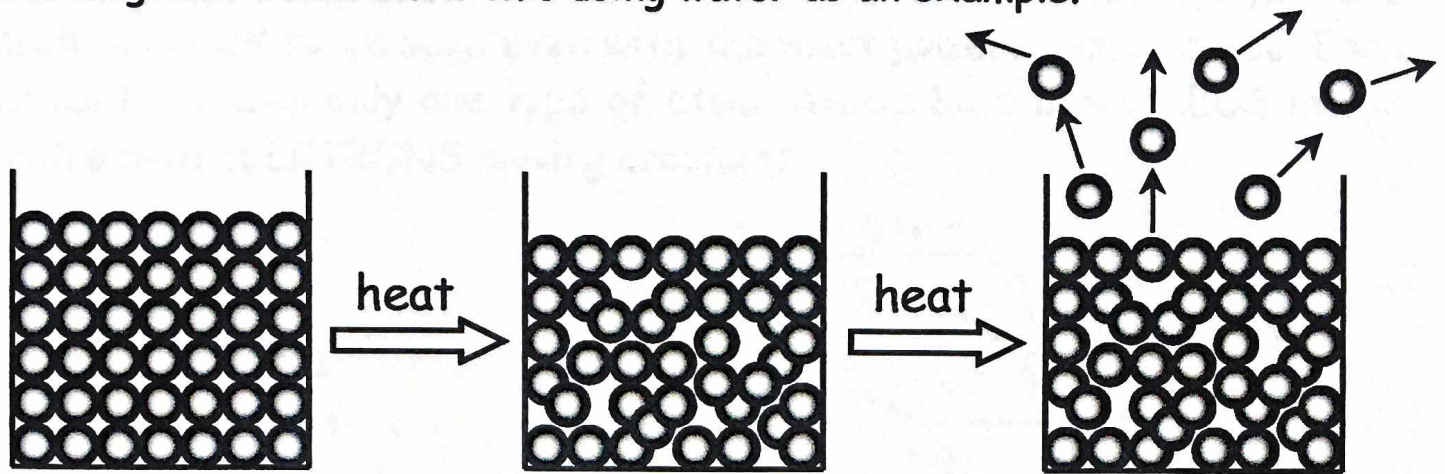


Exercise - Complete the spaces in the table below.

Property	Solids	Liquids	Gases
Density (heavy or light)	High density (heavy)		Low density (light)
How easy are they to compress (squash)?	Hard		Easy
Do they flow?		Yes	Yes
Do they keep the same shape?		No	
Do they keep the same volume?	Yes		



When a solid is heated it changes into a liquid state and then a gas state. When a gas is cooled it changes back into a liquid and then into a solid. The diagrams below show this using water as an example.



Solid - ice.

The particles are held firmly in place but they vibrate.

Liquid - water.

The particles gain more energy. The vibrations become stronger until they break apart.

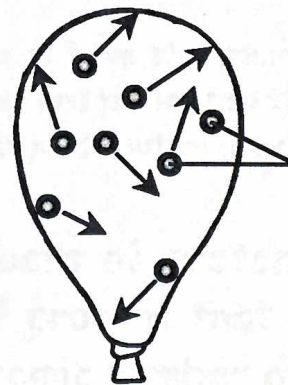
Gas - steam.

The particles have gained enough energy to break free. They are moving very quickly.

Gas pressure and diffusion.

If a gas is squeezed into a small space e.g. when air is pumped into a balloon, the particles bump against the walls. This causes a **PRESSURE**.

A gas will **DIFFUSE** (spread out) until it fills up any area that it is contained in. The gas particles diffuse until they are **EVENLY SPREAD OUT**.



Air particles move around quickly and bump against the inside of the balloon.

Exercise - Join up the words in the left-hand column with their meanings in the right-hand column.

DIFFUSION

A solid changing to a liquid.

ICE

The spreading out of particles.

MELTING

The solid state of water.

STATE OF MATTER

A solid, liquid or gas.

EVAPORATION

A gas changing to a liquid.

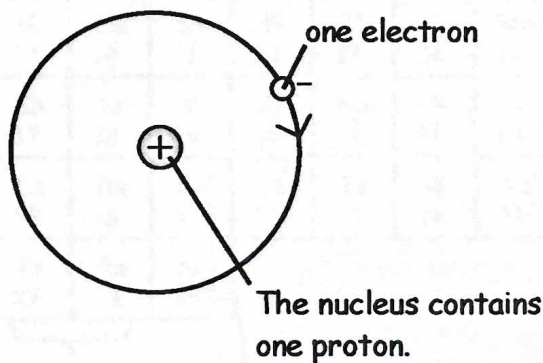
CONDENSING

A liquid changing to a gas.

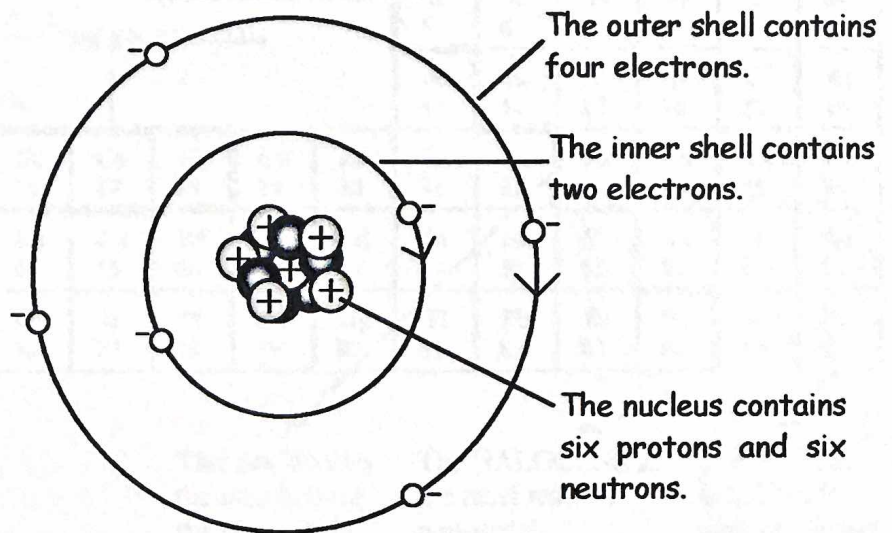


An element is a pure substance that cannot be broken down into anything simpler. Everything on Earth is made from about one hundred different elements. An **ATOM** is the smallest particle of an element. They are much too small to be seen even with the most powerful microscope. Each element contains only one type of atom. Atoms have a **NUCLEUS** in the centre with **ELECTRONS** moving around it.

hydrogen atom



carbon atom



- $\oplus$  = positively charged proton
- $\bullet$  = neutron (no charge)
- $\ominus$  = negatively charged electron

Atoms always have the same number of electrons and protons so that their overall charge is neutral (no charge).

Different elements have different numbers of protons in their atoms. The **ATOMIC NUMBER** is the number of protons that an atom contains. The smallest atom is hydrogen with an atomic number of one. Lead is one of the largest atoms with an atomic number of eighty two.

Exercise - Complete the missing words in the sentences below.

- 1) An \_\_\_\_\_ cannot be broken down into anything simpler.
- 2) The smallest particle of an element is called an \_\_\_\_\_
- 3) The \_\_\_\_\_ is in the centre of an atom.
- 4) Electrons have a \_\_\_\_\_ charge.
- 5) Protons have a \_\_\_\_\_ charge.
- 6) The atomic number is the number of \_\_\_\_\_ in an atom.



# W.S.41. The periodic table.

Name .....

All of the elements have been arranged into the PERIODIC TABLE. This contains seven rows of elements called PERIODS. These are arranged so that each column contains elements with similar properties. The table shows the symbol and ATOMIC NUMBER (number of protons) for every element.

Period	Group 1		Transition Metals										Group 3-7					Group 8
	1	2											3	4	5	6	7	0
1	H 1																	He 2
2	Li 3	Be 4	magnetic metals										B 5	C 6	N 7	O 8	F 9	Ne 10
3	Na 11	Mg 12	transition metals										Al 13	Si 14	P 15	S 16	Cl 17	Ar 18
4	K 19	Ca 20	Sc 21	Ti 22	V 23	Cr 24	Mn 25	Fe 26	Co 27	Ni 28	Cu 29	Zn 30	Ga 31	Ge 32	As 33	Se 34	Br 35	Kr 36
5	Rb 37	Sr 38	Y 39	Zr 40	Nb 41	Mo 42	Tc 43	Ru 44	Rh 45	Pd 46	Ag 47	Cd 48	In 49	Sn 50	Sb 51	Te 52	I 53	Xe 54
6	Cs 55	Ba 56	La 57	Hf 72	Ta 73	W 74	Re 75	Os 76	Ir 77	Pt 78	Au 79	Hg 80	Tl 81	Pb 82	Bi 83	Po 84	At 85	Rn 86
7	Fr 87	Ra 88	Ac 89															

Ce 58	Pr 59	Nd 60	Pm 61	Sm 62	Eu 63	Gd 64	Tb 65	Dy 66	Ho 67	Er 68	Tm 69	Yb 70	Lu 71
Th 90	Pa 91	U 92	Np 93	Pu 94	Am 95	Cm 96	Bk 97	Cf 98	Es 99	Fm 100	Md 101	No 102	Lr 103

The most reactive metals.

This line divides the metals from the non-metals.

The HALOGENS are the most reactive non-metals.

The NOBLE GASES are very unreactive.

## Exercise - Complete the missing words in the passage below.

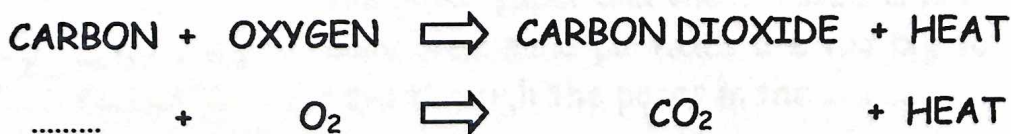
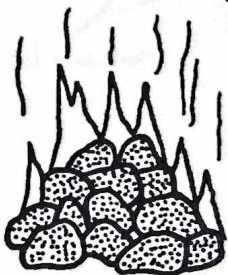
Each group in the periodic table contains elements that have similar ..... The atomic number gives the number of ..... that an element contains. The lightest element is ..... (H) which has an atomic number of one. The atomic number of ..... is eight. Sodium (Na) and potassium (K) are two very ..... metals. Iron (Fe) and nickel (Ni) are two of the ..... metals. The most reactive non-metals are called the ..... The ..... gases are very unreactive. Magnesium (Mg) and calcium (Ca) are both in group ..... of the periodic table. Nitrogen (N) and phosphorus (P) are both in group ..... of the periodic table.

- magnetic properties
- noble oxygen
- two protons
- hydrogen
- reactive
- five
- halogens

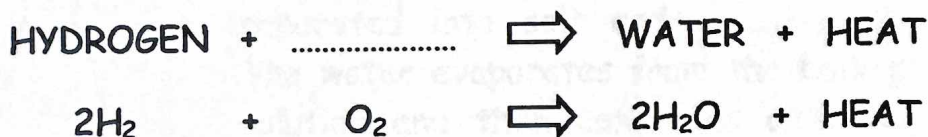
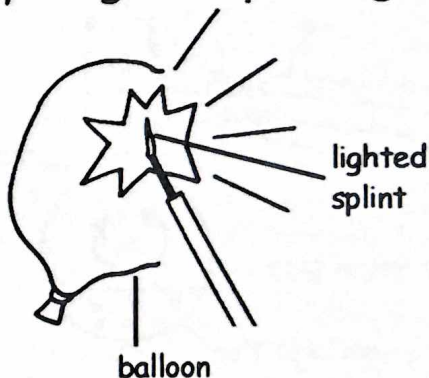
Elements join together by chemical reactions to form compounds. Compounds have different properties to the elements that formed them. In a chemical reaction new substances are formed and energy is taken in or given out. It is also difficult to make a reaction go backwards.

Exercise 1 - Fill in the missing words or symbols for the chemical reactions below.

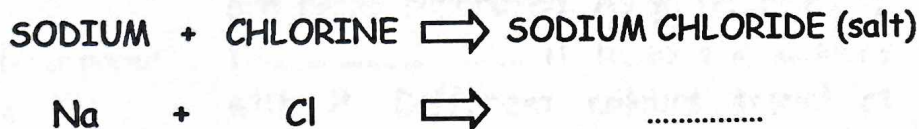
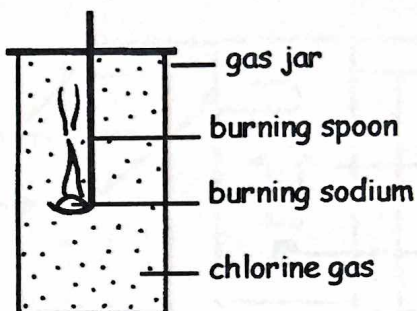
**Coal burning**



**Hydrogen exploding**



**Making salt**



Exercise 2 - For each of the changes below write down if it is a physical or chemical change.

When a firework explodes it is a \_\_\_\_\_ change.

When salt dissolves in water it is a \_\_\_\_\_ change.

When a cake is baked in an oven it is a \_\_\_\_\_ change.

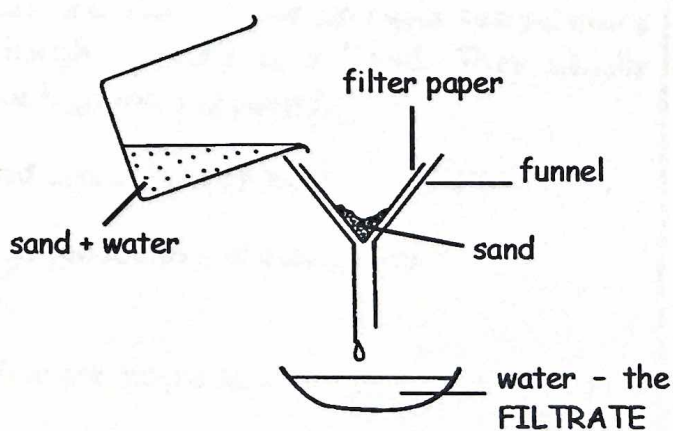
When ice melts it is a \_\_\_\_\_ change.



## W.s.43. Separating mixtures.

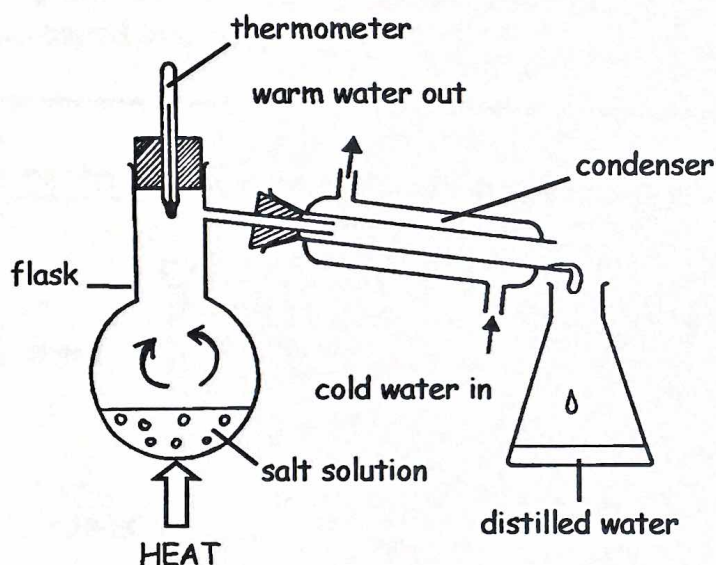
Name .....

A mixture contains a number of substances that are not chemically joined. The diagrams below show different ways of separating mixtures. Fill in the missing words in the paragraphs beside each method.



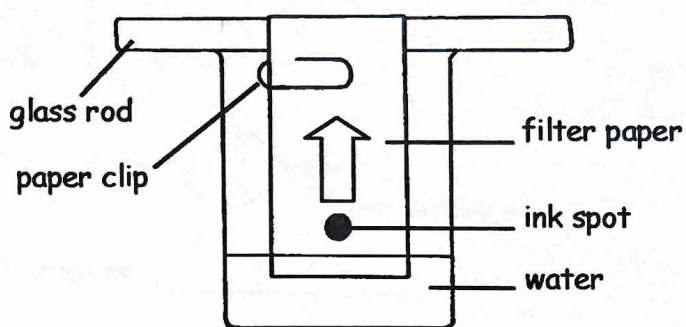
### Filtration.

This method separates small, solid particles from liquids. In the diagram a mixture of sand and water is being filtered. The ..... passes through the filter paper and the ..... is held back. The sand particles are too big to pass through the pores in the .....



### Distillation.

This method separates dissolved chemicals (SOLUTES) from the liquids that they are dissolved in (SOLVENTS). In the diagram salt solution is being separated into salt and ..... The water evaporates from the boiling solution and then condenses as it is ..... in the condenser. The salt is left behind in the .....



### Chromatography.

In the diagram the colours in pen ink are being separated. As water rises up the ..... it takes the colours with it. Different colours travel at different ..... If the ink contains more than one colour they will separate out along the paper.

**Exercise 2** - Join up each mixture below with the correct method for separating it.

muddy water

copper sulphate solution

peas and sand

iron filings and sawdust

distillation

filtration

magnetic attraction

sieving

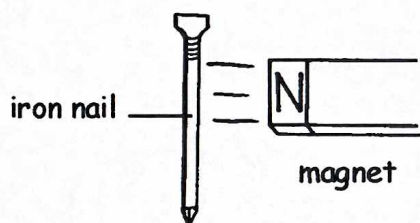
# W.S.44. Metals and non-metals.

Name .....

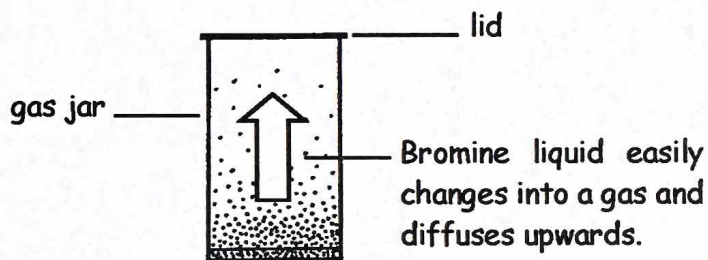
The elements can be divided into two main groups which are METALS and NON-METALS. The table below shows the properties of each group.

Metals	Non-metals
Most are shiny solids at room temperature although mercury is a liquid. They usually have high melting points.	They vary in their properties. They usually have low melting points and many are gases at room temperature.
Good conductors of heat.	Most are poor conductors of heat.
Good conductors of electricity.	Poor conductors of electricity except for graphite which is a form of carbon.
A few are magnetic (iron, cobalt and nickel).	None are magnetic.
They are often flexible (bendy) and can be hammered into shape.	They are often brittle (hard but break easily).

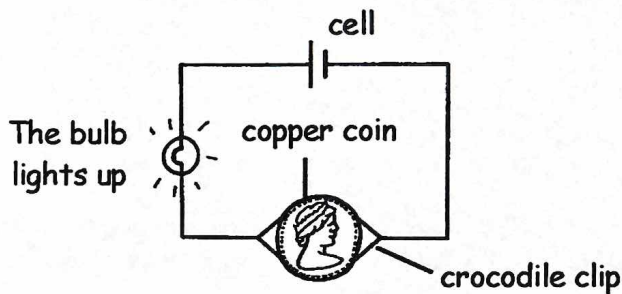
Exercise 1 - For each diagram below write down if the element is a metal or a non-metal.



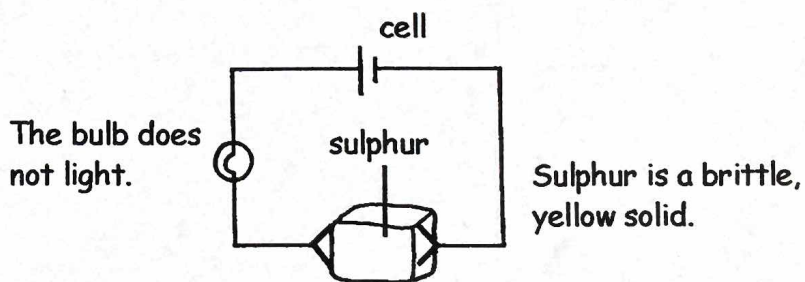
Iron is a \_\_\_\_\_



Bromine is a \_\_\_\_\_



Copper is a \_\_\_\_\_



Sulphur is a \_\_\_\_\_

Exercise 2 - Complete the sentences below.

- 1) M \_\_\_\_\_ is the only metal that is a liquid at room temperature.
- 2) G \_\_\_\_\_ is the only non-metal that is a good conductor of electricity.
- 3) The M \_\_\_\_\_ metals are iron, cobalt and nickel.
- 4) M \_\_\_\_\_ can be hammered into shape.