Name.________________

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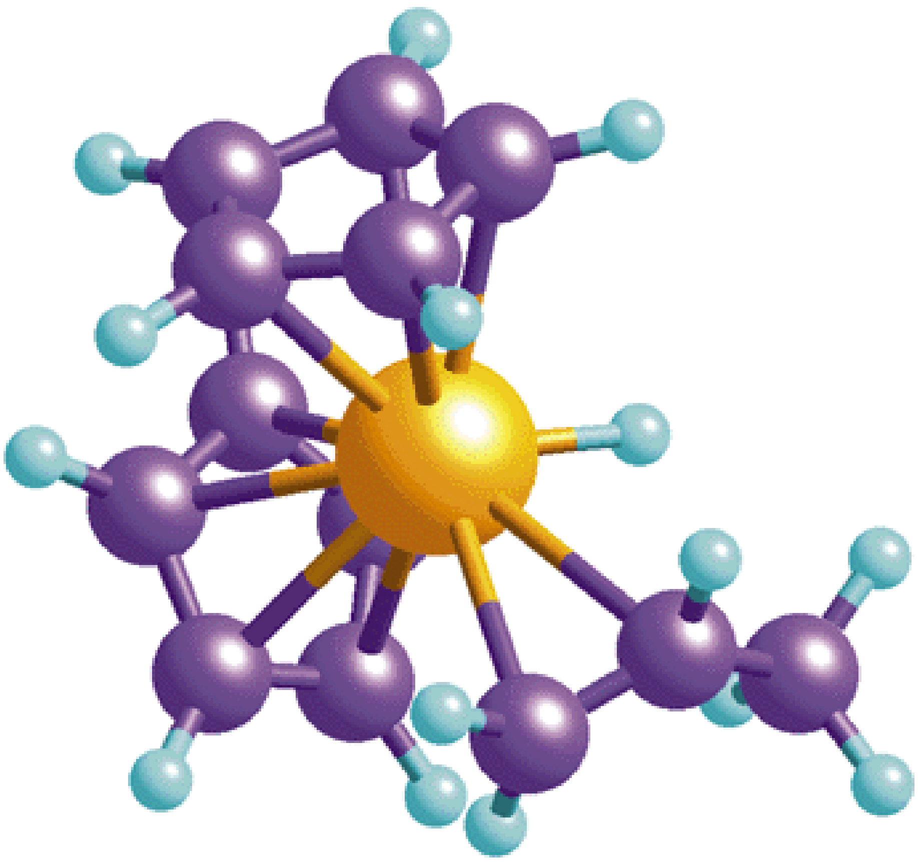
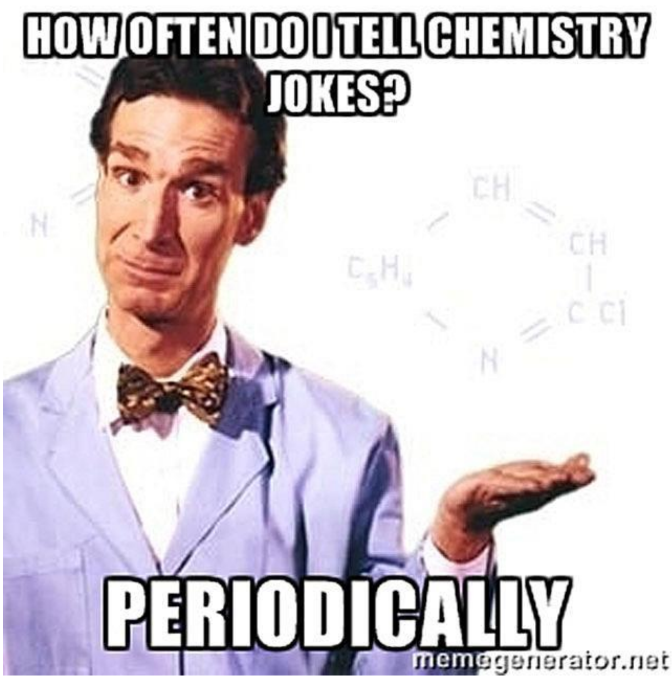
A-Level Chemistry Introduction Booklet.



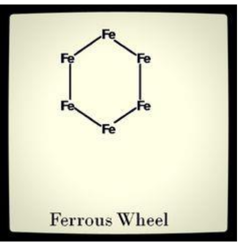
Welcome to A-Level Chemistry, you are now on the true path of knowledge.

In order that we can help you to help yourself on this course we have produced this booklet, it will give you a basic start in some of the fundamental ideas of the first few units that are taught in your first year in Chemistry. Some of it will be brand new and some you will remember from GCSE, it's not meant to be a boring task book but reading through the notes and completing the exercises will help you avoid the pitfalls that get A-level chemists at the start of the course. GOOD LUCK and happy Chemisting!

Contents



Use this a scribbling / working out/ praying /cursing /doodling page



The Periodic Table of the Elements

Key

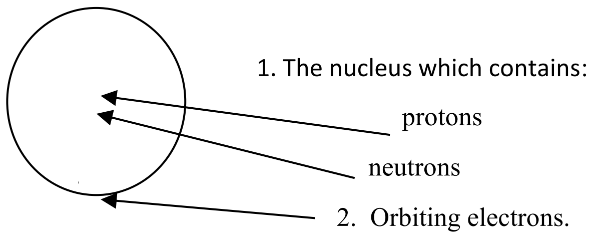
relative atomic mass
symbol
name
atomic (proton) number

1 (1)	2 (2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	3 (13)	4 (14)	5 (15)	6 (16)	7 (17)	0 (18)
							1.0 **H** hydrogen 1										4.0 **He** helium 2
6.9 **Li** lithium 3	9.0 **Be** beryllium 4											10.8 **B** boron 5	12.0 **C** carbon 6	14.0 **N** nitrogen 7	16.0 **O** oxygen 8	19.0 **F** fluorine 9	20.2 **Ne** neon 10
23.0 **Na** sodium 11	24.3 **Mg** magnesium 12											27.0 **Al** aluminium 13	28.1 **Si** silicon 14	31.0 **P** phosphorus 15	32.1 **S** sulfur 16	35.5 **Cl** chlorine 17	39.9 **Ar** argon 18
39.1 **K** potassium 19	40.1 **Ca** calcium 20	45.0 **Sc** scandium 21	47.9 **Ti** titanium 22	50.9 **V** vanadium 23	52.0 **Cr** chromium 24	54.9 **Mn** manganese 25	55.8 **Fe** iron 26	58.9 **Co** cobalt 27	58.7 **Ni** nickel 28	63.5 **Cu** copper 29	65.4 **Zn** zinc 30	69.7 **Ga** gallium 31	72.6 **Ge** germanium 32	74.9 **As** arsenic 33	79.0 **Se** selenium 34	79.9 **Br** bromine 35	83.8 **Kr** krypton 36
85.5 **Rb** rubidium 37	87.6 **Sr** strontium 38	88.9 **Y** yttrium 39	91.2 **Zr** zirconium 40	92.9 **Nb** niobium 41	96.0 **Mo** molybdenum 42	[98] **Tc** technetium 43	101.1 **Ru** ruthenium 44	102.9 **Rh** rhodium 45	106.4 **Pd** palladium 46	107.9 **Ag** silver 47	112.4 **Cd** cadmium 48	114.8 **In** indium 49	118.7 **Sn** tin 50	121.8 **Sb** antimony 51	127.6 **Te** tellurium 52	126.9 **I** iodine 53	131.3 **Xe** xenon 54
132.9 **Cs** caesium 55	137.3 **Ba** barium 56	138.9 **La** * lanthanum 57	178.5 **Hf** hafnium 72	180.9 **Ta** tantalum 73	183.8 **W** tungsten 74	186.2 **Re** rhenium 75	190.2 **Os** osmium 76	192.2 **Ir** iridium 77	195.1 **Pt** platinum 78	197.0 **Au** gold 79	200.6 **Hg** mercury 80	204.4 **Tl** thallium 81	207.2 **Pb** lead 82	209.0 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac** † actinium 89	[267] **Rf** rutherfordium 104	[268] **Db** dubnium 105	[271] **Sg** seaborgium 106	[272] **Bh** bohrium 107	[270] **Hs** hassium 108	[276] **Mt** meitnerium 109	[281] **Ds** darmstadtium 110	[280] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

* 58 – 71 Lanthanides	140.1 **Ce** cerium 58	140.9 **Pr** praseodymium 59	144.2 **Nd** neodymium 60	[145] **Pm** promethium 61	150.4 **Sm** samarium 62	152.0 **Eu** europium 63	157.3 **Gd** gadolinium 64	158.9 **Tb** terbium 65	162.5 **Dy** dysprosium 66	164.9 **Ho** holmium 67	167.3 **Er** erbium 68	168.9 **Tm** thulium 69	173.1 **Yb** ytterbium 70	175.0 **Lu** lutetium 71
† 90 – 103 Actinides	232.0 **Th** thorium 90	231.0 **Pa** protactinium 91	238.0 **U** uranium 92	[237] **Np** neptunium 93	[244] **Pu** plutonium 94	[243] **Am** americium 95	[247] **Cm** curium 96	[247] **Bk** berkelium 97	[251] **Cf** californium 98	[252] **Es** einsteinium 99	[257] **Fm** fermium 100	[258] **Md** mendelevium 101	[259] **No** nobelium 102	[262] **Lr** lawrencium 103

Atomic Structure and Mass Spectrometry

The atom consists of two parts:



In a neutral atom, the number of protons and electrons are the same.

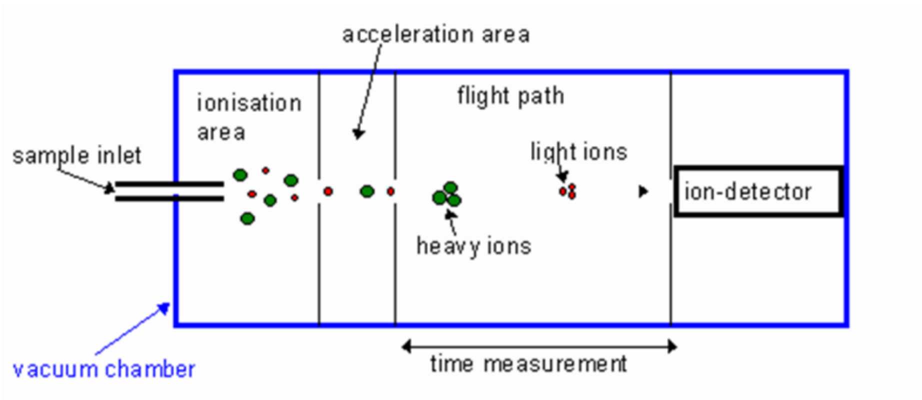
The basic properties can be summarised as follows:

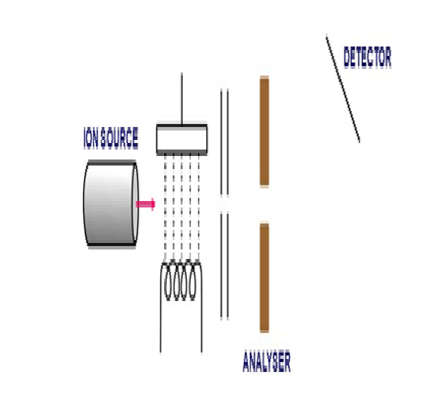
Particle	Charge	Mass
Proton	+1 unit	Approx 1 unit
Neutron	No charge	Approx 1 unit
Electron	-1 unit	Approx 1/1840 units (very small)

Mass Spec -- stages

1. Ionisation
   Creates positive ion
2. Acceleration
   Negatively charged plate attracts ions.
   Hole puts ions into a stream.
3. Detection
   Electrons attracted to positive ions.
   TOF – time of flight – used to work out mass.

The mass spectrometer is an instrument used for measuring the masses of atoms and molecules. It can also be used to measure the relative abundance of different isotopes and to predict the structure of more complex molecules.





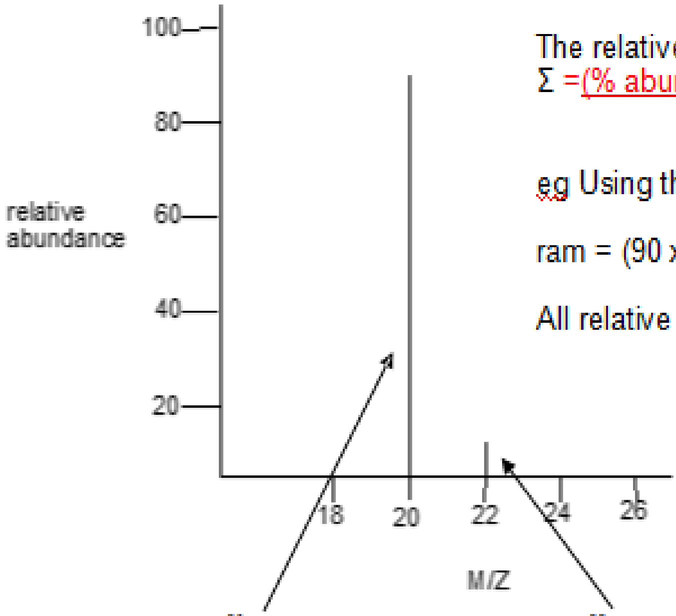
The degree of deflection depends on the mass and the charge; the greater the mass, the less the deflection, and the greater the charge, the greater the deflection. It can be shown that the deflection is inversely proportional to the m/e ratio.

The greater the number of particles landing at a single point on the detector, the greater the electric current and the larger the peak. Thus the relative abundance of different isotopes can be measured. Since the position at which an ion appears on the detector depends on its mass, different isotopes appear at different points on the detector. The magnitude of the peak gives the relative abundance of the isotope.

Thus the relative atomic mass of the element can be calculated from its mass spectrum.

An example of a simple mass spectrum is shown below:

Mass spectrum of Ne



The relative atomic mass can be calculated by the formula:

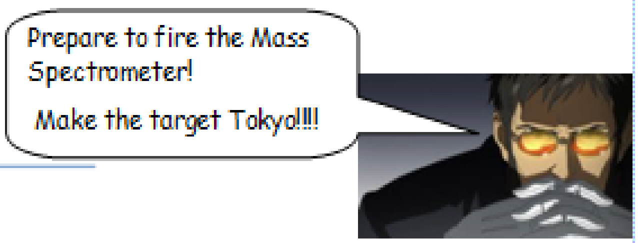
$$\Sigma = \frac{(\text{\% abundance of each isotope x mass of each isotope})}{100}$$

eg Using the mass spectrum of neon :

ram = (90 x 20 + 10 x 22)/100 = 20.2

All relative atomic masses have been found in this way.

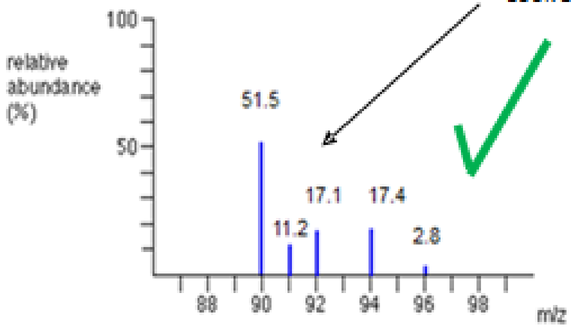
The peak at 20 is $^{20}Ne^{+}$, and the peak at 22 is ^{22}Ne

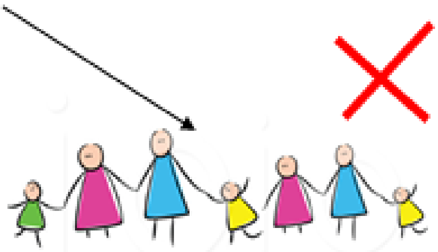


Question

How many isotopes does this element have?
What element is it?

Look at the relative abundances of the isotopes





Calculate the RAM

$$\Sigma \frac{(\text{percentage abundance of each isotope x mass of each isotope})}{100}$$

Step 1: Find the total mass of these 100 typical atoms:
(51.5 x 90) + (11.2 x 91) + (17.1 x 92) + (17.4 x 94) + (2.8 x 96) = 9131.8

Step 2: find the average mass of these 100 atoms :
9131.8 / 100 = 91.3 (to 3 sig fig).

91.3 is the relative atomic mass of **zirconium**.

Remember this!!!

IF ITS NOT GIVEN AS A PERCENTAGE SIMPLY DIVIDE BY THE SUM OF THE RELATIVE ABUNDANCES INSTEAD!

Write down definitions for the following three important terms

Atomic number

____

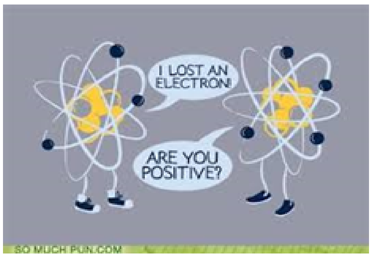
Mass Number

____

Relative Atomic Mass

____

Using what you should already know about the atom draw and label an atom in the space below that contains 2 protons, 2 neutrons and 2 electrons



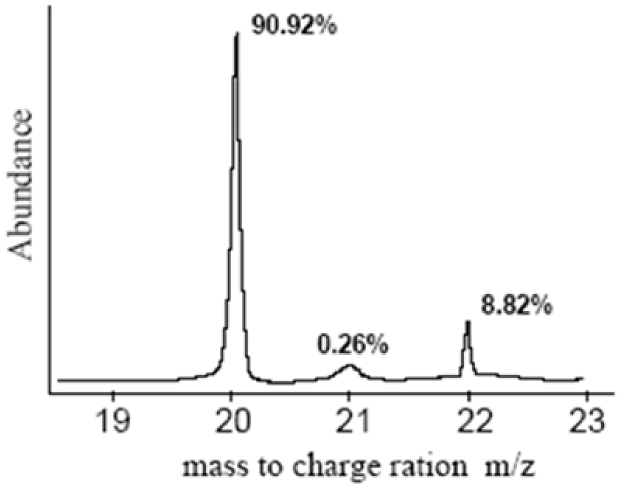
Name the atom you have drawn ______________

COMPLETE THE TABLE BELOW

	PROTONS	NEUTRONS	ELECTRONS	ATOMIC NO.	MASS NO.	SYMBOL
A	7				14	
B		16		15		
C			10	8	16	
D	35		36		79	
E		30				
F						Al

You do realise that this is the easy part. So, why not sit back listen to some smooth jazz with a cup of espresso and contemplate how good life is for now!!!

Calculate the Relative Atomic Mass of Neon from the following spectra.



The percentage makeup of naturally occurring potassium is 93.11% ^{39}K, 0.12% ^{40}K and 6.77% ^{41}K
Calculate the relative atomic mass of potassium

NOTES/QUESTIONS

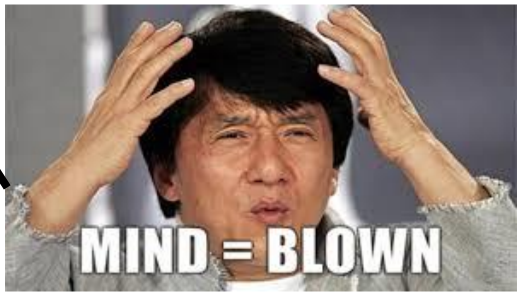
Make a note of anything you need to ask here such as "Why am I doing this to myself?" or "Somebody help me"

Electronic Structure

At this point you will now realise that some of GCSE chemistry is not actually true. We have not lied to you, you just couldn't handle the truth until now.

In an atom, electrons fly around the nucleus in shells or energy levels, the further from the nucleus the higher the quantum number of the shell and the higher the energy. However each shell is divided in to sub shells S ,P ,D in each sub shell there are a certain number of orbitals in which electron pairs spin in opposite directions (electron arrangement at Gcse doesn't seem that bad now does it)

This table shows the no. of electron that fit in each shell



Shell	Sub Shell	Total no. of electrons
1	1s	2
2	2s 2p	2 + (3x2)=8
3	3s 3p 3d	2+(3x2)+(5x2)=18
4	4s 4p 4d 4f	2+(3x2)+(5x2)+(7x2)=32

This table shows the subshells and electrons in the first 4 energy levels

The order of filling orbitals is in order of energy.

1s → 2s → 2p → 3s → 3p → 4s → 3d → 4p

e.g. Calcium (20 electrons) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$

<u>Electrons fill up the orbitals singly before pairing up much like seats on a bus!</u>

The arrangements can also be written in other ways below shows the box method with arrows showing electrons

	1s		2s				2p		3s				3p		4s
Ca	↑↓		↑↓			↑↓	↑↓	↑↓		↑↓		↑↓	↑↓	↑↓	↑↓

Or it can be written shorthand with the symbol of the noble gas which comes before the element to show the full shells e.g Calcium would be [Ar] $4s^2$

Or using the box method Ca: [Ar] 4s ↑↓

Note the unusual structures of chromium and copper.

The difference in energy between the 3d and 4s electrons is very small, and in chromium the energy required to promote and electron from 4s to 3d is recovered in the reduced repulsion which results from the fact that they are no longer paired. Thus the $4s^1 3d^5$ structure in Cr is preferred.

In copper, the 3d orbitals are actually lower in energy than the 4s orbital, so the $4s^1 3d^{10}$ structure in Cu is preferred. Now try and Complete the following using a mix of the methods:

Chlorine

Iron (NB 3d is written before 4s)

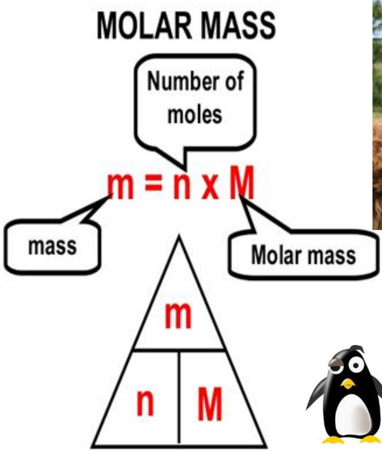
Sulphur

Aluminium

Bromine

Potassium

Amount of Substance



All substances are made up of particles. In order to make it easy for chemists to work with particles that have different sizes and masses we use the mole.
This is a quantity and is defined by Avogadro's number (6.02×10^{23}) You can pretty much have mole of anything: Penguins, llamas or atoms and molecules. It will always have the same amount in it whatever the size or shape it is.
There is another handy thing about moles as well, the mass of one mole of any substance is its Atomic mass or Formula mass in grams.
So one mole of carbon has a mass of 12g, as the atomic mass of carbon is 12.

How many moles are there in 44 g of CO_2? How many molecules is this?

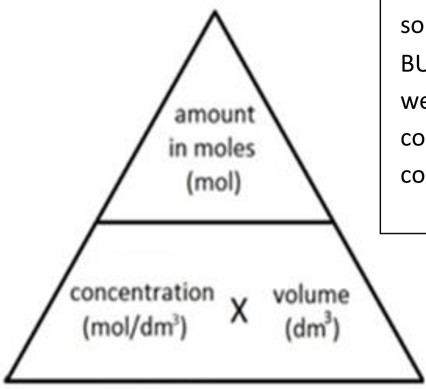
How many moles are there in 79 g of $Al_2(SO_4)_3$?

What is the mass of 2.5 moles of Na_2O?

What is mass of 2.34 moles of Platinum?

How many moles are there in 79 g of Fe_2O_3? How many atoms is this?

(No of Particles = No. of Moles x Avogadro's Number)

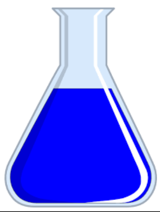


Concentrations of solutions are slightly different, because for a $1 Mol/dm^3$ solution you need to have 1 mole dissolved in 1 dm^3 or 1 litre.
BUT because don't always make up solutions with one litre or decimetre cubed we need to be able to work out how much stuff to put in to get the concentration or how many moles are in a vol of solution of a certain concentration. (This helps with the mysteries of titration)

Exercise 1 – convert the following volumes into dm^3 (show your working)

To convert $cm^3 \rightarrow dm^3$, divide by 1000	to convert $m^3 \rightarrow dm^3$, multiply by 1000

a) $250 cm^3$
b) $125 cm^3$
c) $1.5 m^3$
d) $50 cm^3$
e) $1000 cm^3$



Exercise 2 – Use the equation to work out the <u>concentration</u> of the following solutions (show your working)

10g of magnesium chloride in $1dm^3$ of solution

1.5g of potassium iodide in $150cm^3$ of solution

2.3g of lithium chloride in $500cm^3$ of solution

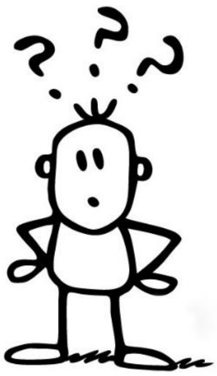
Exercise 3 – Use the equation to work out the <u>mass</u> required to make the following solutions (show your working)

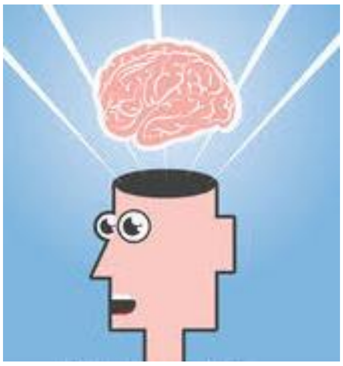
$0.5dm^3$ of a $2mol/dm^3$ solution of silver nitrate

$250cm^3$ of a $0.15\ mol/dm^3$ solution of sodium chloride

$10cm^3$ of a $0.4\ mol/dm^3$ solution of sodium carbonate

$500cm^3$ of a $5\ mol/dm^3$ solution of magnesium sulphate

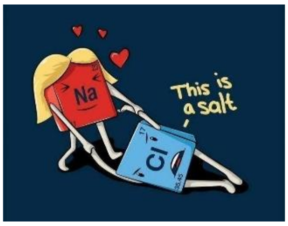




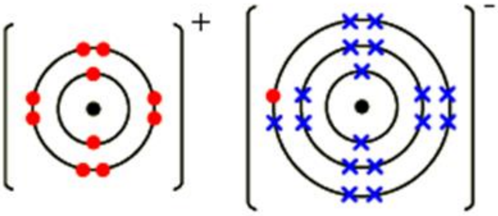
Bonding

Atoms like to stick together depending what atoms you have at the time depends on how they stick together, at the end of the day it's all about the electrons and what they are doing.

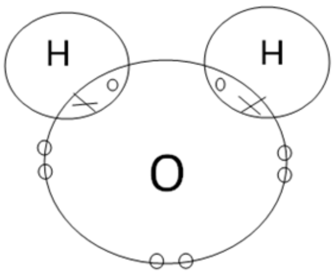
There are 3 types of Bonding and 3 types of intermolecular force, lets start with bonding first: you should be able to fill in the facts – remember this was GCSE



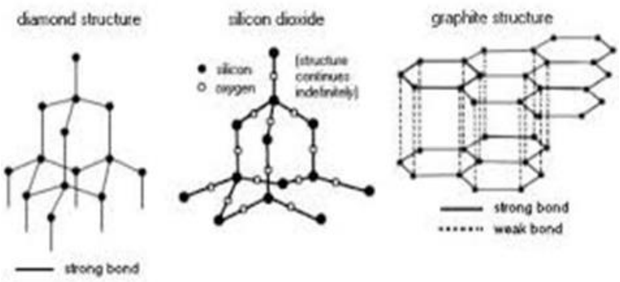
IONIC BOND

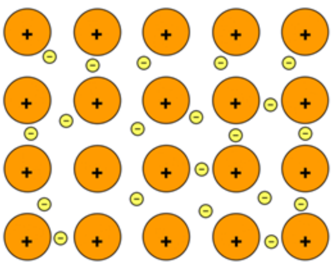


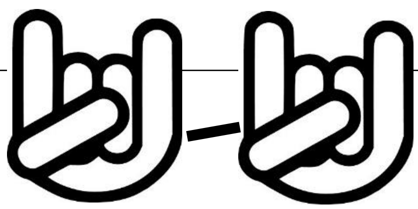
sodium ion, Na^{+} $[2,8]^{+}$ chloride ion, Cl^{-} $[2,8,8]^{-}$



WATER H_2O



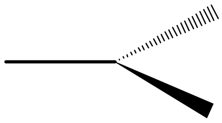
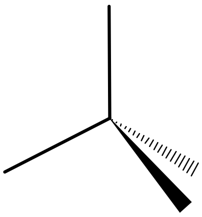
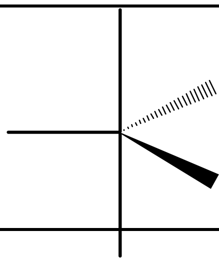
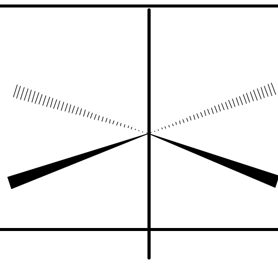
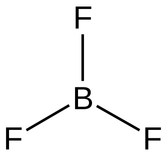
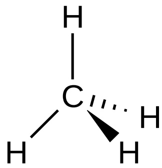
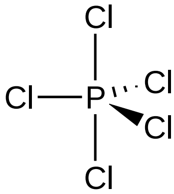
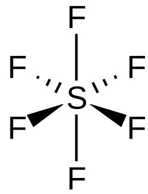
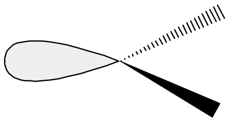
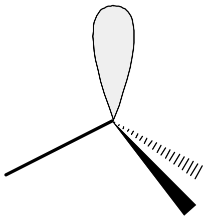
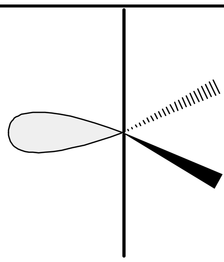
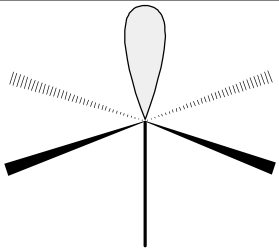
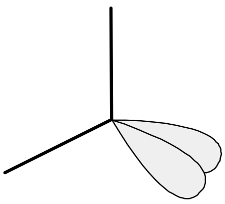
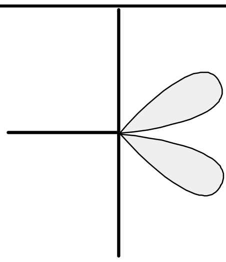
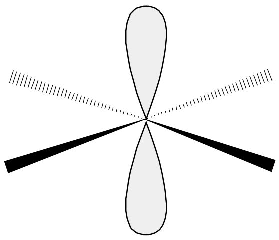




METALL-IC bond

Shapes of Molecules- *How lucky are you??*

Molecules and ions come in all sorts of shapes and sizes, they are not all flat and boring, <u>it's the number of electron pairs on the outer shell that decides the shape of the molecule.</u> Electron pairs exist as charge clouds, these are regions where you have a <u>really big</u> chance of finding an electron pair because they are negative they will always repel each other so they want to stay as far away as possible from each other. <u>Lone pairs repel the most so angles between bond pairs are often reduced.</u>

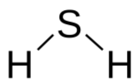
Electron	2	3	4	5	6
Basic shape					
Example	Cl—Be—Cl				
Other example	CO_2,	CH_3^+,	$AlCl_4^-$,		PCl_6^-
Name	linear	trigonal planar	tetrahedral	trigonal bipyramidal	octahedral
Bond angle(s)	180	120	109.5	120/90	90
One lone pair					
angle			107	87, 102	
Name		angular	trigonal pyramidal		square pyramid
Example		CCl_2,	NH_3,	SF_4,	ClF_5,
Two lone pairs					
Name of structure			angular	T-shaped	square planar
angle			104.5	88	90
Example			H_2O,	ClF_3,	BrF_4^-,

A POLLYCULE

Example:

Predicting the shape of Hydrogen Sulphide:

1. The central atom is **sulphur**.
2. Sulphur is in group 6, so there **are 6 electrons** in the outer shell
3. There are 2 hydrogen atoms bonded to it, so there are (6+2 (from the hydrogens)) **8 electrons** in the outer shell
4. The number of electron pairs is 8/2 = **4 pairs**
5. So the sulphur has 4 electron pairs and has made 2 bonds- **therefore there are 2 bond pairs and 2 lone pairs –** this means H_2S will have a bent shape.



Here you go, Predict and draw the shapes of the following molecules include the bond angles 😊

Perhaps not smooth jazz now , may I suggest techno!! or even thrash metal?

PF_3

Cl_2O

NCl_3

BrF_4^-

CLF_3

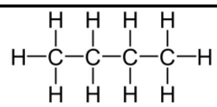
PCl_4^+

Organic Nomenclature

You have already come across the insanity that is organic chemistry but in a more dilute form as in the alkanes, alkenes and fractional distillation, fortunately for you the gateway to knowledge is about to open in the most fantastic of ways. Hydrogen and Carbon together can combine to form more compounds than any other elements in the periodic table and somehow we have to name them along with the compounds that have other elements added in as well!!!!

You will concentrate on naming the following groups: Alkanes, Alkenes, Halo-alkanes and Alcohols

Before that though some definitions and stuff! You may head to a DARK place soon but don't worry most people get through organic chemistry

Formula	What it shows	Example (butane)
General	An algebraic formula that describes any member of a series	C_nH_{2n+2}
Empirical	Simplest whole no. ratio of atoms	C_2H_5
Molecular	The actual ratio of atoms of each element	C_4H_{10}
Structural	Shows the atoms carbon by carbon	$CH_3CH_2CH_2CH_3$
Skeletal	Shows the bond of the carbon skeleton only with any functional groups	
Displayed	Shows all atoms and all bonds	

Prefix and suffix for naming

series	Prefix or suffix	example
Alkane	-ane	Propane C_3H_8
Branched Alkane	Alkyl-	Methylpropane $CH_3CH(CH_3)CH_3$
Alkene	-ene	Propene C_3H_6
Halo-alkane	Fluoro-/Chloro-/ Bromo- /Iodo-	Chloropropane $CH_3CH_2CH_2Cl$
Alcohol	-ol	Propanol $CH_3CH_2CH_2OH$

Overall method of nomenclature

Identify the longest carbon chain- careful it might be bent (see table on next page, where the example is)

Main functional group – These usually form the suffix of the molecule – For example an –OH group will mean the molecule will end in –ol. A C=C group will mean the molecule name will end in –ene.

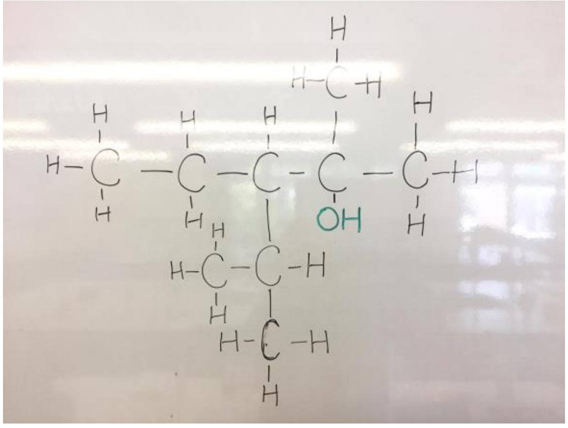
Number the chain – Make the carbon with the main functional group the lowest number. For example alkenes and alcohol groups are classed as main functional groups. A branch isn't considered as influential in nomenclature as, say –OH is.

Before the suffix – write the number the functional group is on. For example, if an –OH is on the third carbon, the molecule would end ~-3-ol. What if you have two or more –OH groups? Just add carbon number and then di, tri or tetra to the molecule name. For example ~hexa-2, 3, 4-triol, or ~penta-2,4-diol.

Side chains – They are less important than functional groups as mentioned – but number them and then put them into alphabetical order. i.e. Ethyl comes before methyl; regardless of whether it is on the 2nd, 3rd, 4th, etc carbon. E.g. You could have – **7-ethyl-3-methyl**……. And <u>not</u> **3-methyl-7-ethyl**……..

Identical chains – If there is more than one identical chain then you write – di, tri, tetra before that part of the name. **HOWEVER→** Ignore this prefix when doing step number 5, because otherwise you'll begin to get a migraine trying to name these organic molecules.

Examaple: Lets name the following organic compound

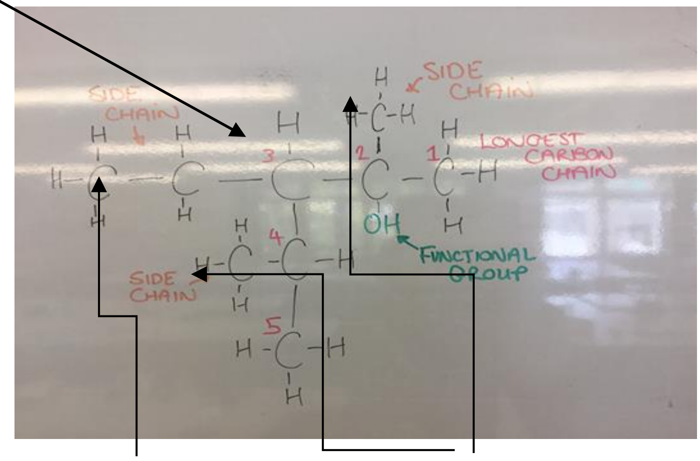


Holy covalent bonding batman!

It's not the best photo but you can still see it OK, so let's follow the system!

You can see the longest chain is numbered in red

There are five carbons in this chain



Ethyl

methyl

No. of carbon	prefix
1	Meth-
2	Eth-
3	Prop-
4	But-
5	Pent-
6	Hex-

So the prefix is pent-

The functional group is an OH which makes this an alcohol with the suffix -OL

So, so far we have **PENTANOL**. But the OH is on the second carbon in (always keep your numbers as low as possible and number from the functional group). We therefore have **PENTAN-2-OL.**

Right, now for the side chains: there are 2 methyl groups and 1 ethyl group,

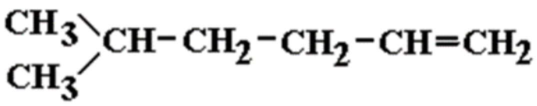
The methyl groups are on carbons 2 and 4 while the ethyl is on carbon 3

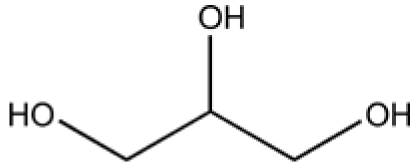
Alphabetically e comes before m, so the ethyl comes first-

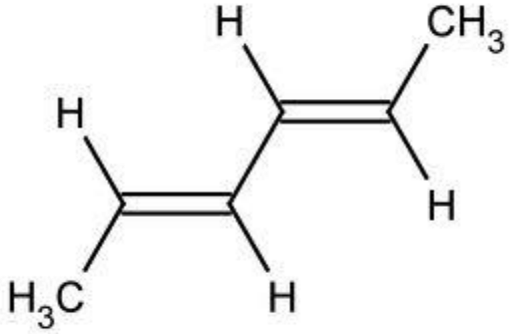
So now we have 3 ethyl 2,4 dimethyl

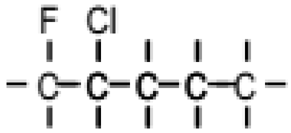
Finally let us assemble the two parts together-
3 ethyl 2, 4 dimethyl PENTAN-2-OL

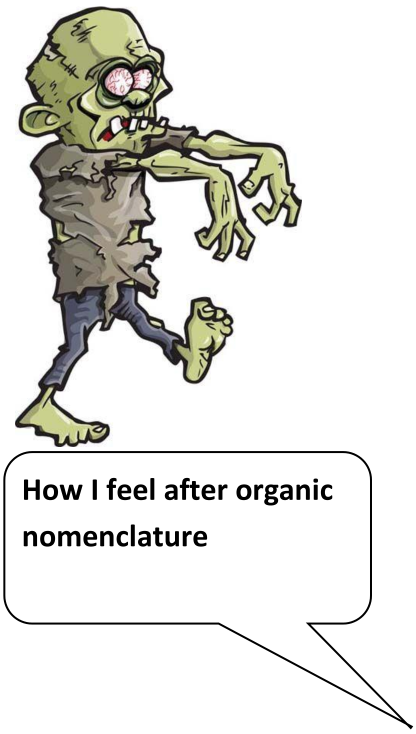
Di is two, tri is three, tetra is four ,Penta is five, Hexa is six

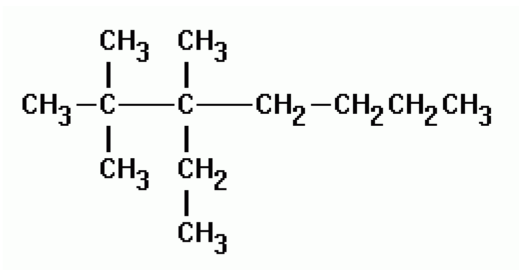


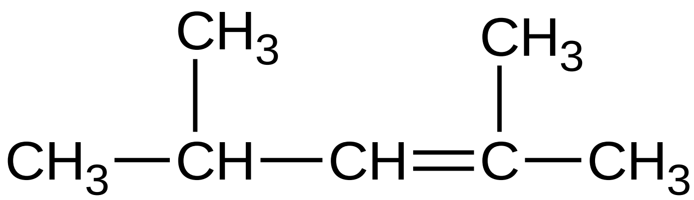




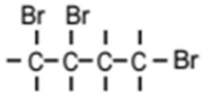








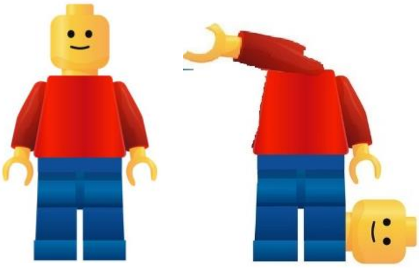
$CH_3CHFCHFCH_2CH_3$



Isomerism

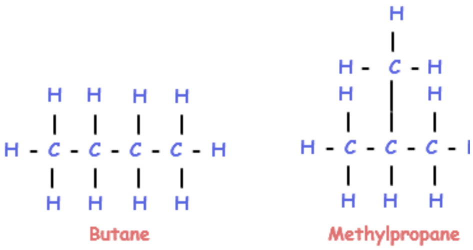
Isomers have the same molecular formula but the atoms are in a different arrangement in space, we are going to look at **Structural Isomers**

Structural isomers have different structural arrangements of atoms, it's a bit like messing around with lego blocks – you can have the same number of blocks but you can put them together in loads of different ways



There 3 types of **structural isomer**

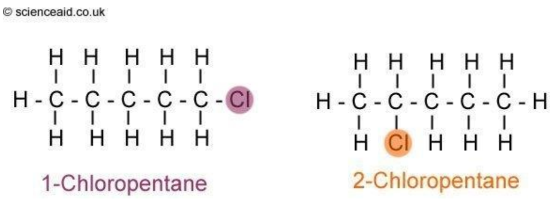
arrangements of the carbon skeleton, some are straight



Both have the formula C_4H_{10}

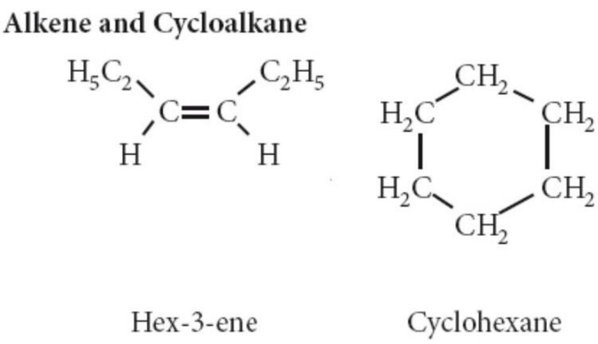
-

Positional isomers- have the same skeleton and same groups or atoms attached but the atom or group is attached to a different carbon



the chlorine is attached to a different carbon we can show this by changing the number

Functional group-have the same atoms arranged in different functional groups



Notice the double bond has gone both still have the formula $\mathbf{C_6H_{12}}$

Your Turn……..

Draw out the chain isomers of **C_6H_{14}**

Draw out the positional isomers and chain isomers of **$C_5H_{11}Cl$**

Draw out the functional group isomer of **C_4H_8 and C_5H_{10}**

Periodicity

This is just boring , nothing fun at all here , just move on

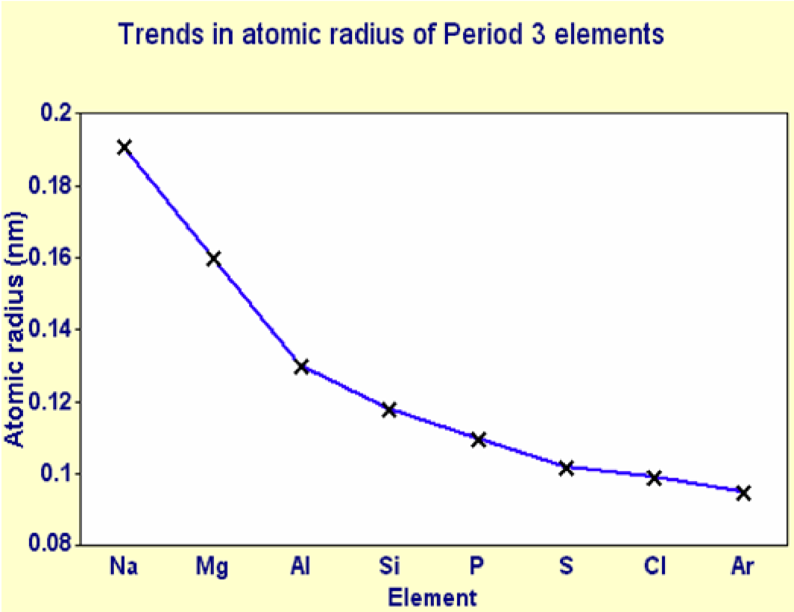
The Periodic Table is made up by placing the elements in the order of their ATOMIC NUMBER, this leads to them arranging themselves into

ROWS (PERIODS) and
COLUMNS (GROUPS)

The periodic table is further split into blocks; in each different block the elements are filling, or have just filled, particular orbitals

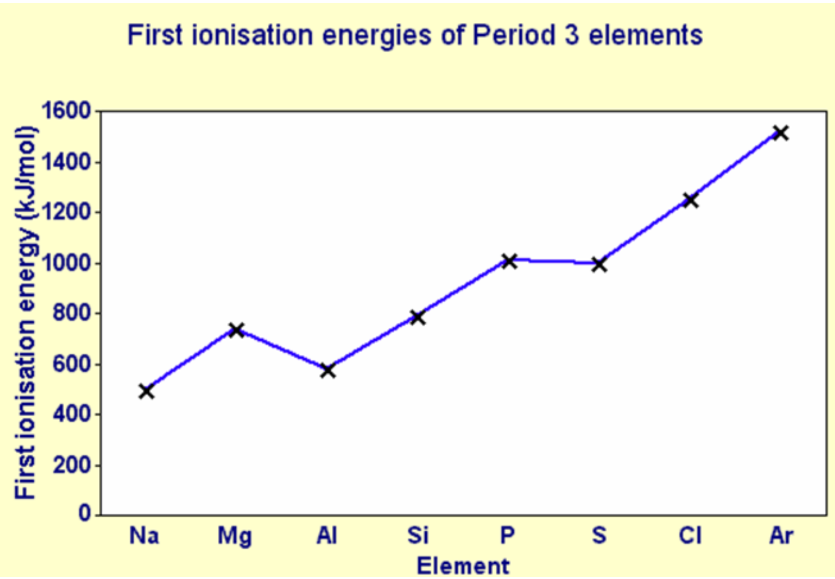
Because the outer shell arrangement of electrons repeats itself through the table we notice that there are patterns which emerge across the table –this is periodicity.

We will look at 3 of these trends:



Atomic Radius

As you move across period 3 the radius decreases this is because of the increasing charge in the nucleus of the atom but the same number of shells of electrons



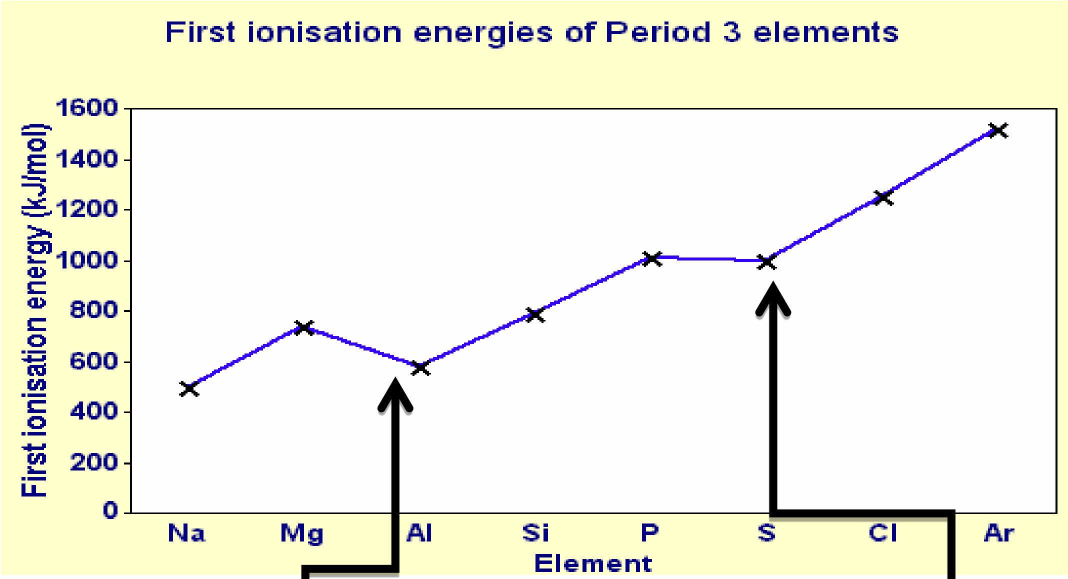
First Ionisation Energy

"The energy required to remove ONE MOLE of electrons (to infinity) from ONE MOLE of gaseous atoms to form ONE MOLE of gaseous positive ions."

This INCREASES across a period as the Nuclear charge increases by one each time.

Each extra electron, however, is going into the same main energy level so is subject to similar shielding and is a similar distance away from the nucleus.

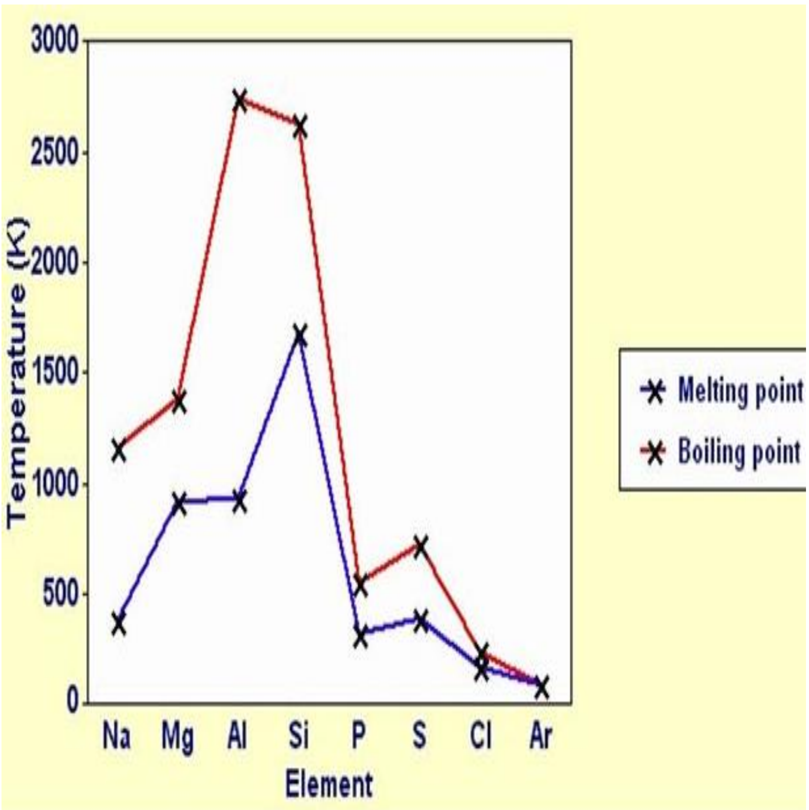
Electrons are held more strongly and are harder to remove.



Welcome to the dark place , abandon all hope !!

There is a DROP in the value for aluminium because the extra electron has gone into a 3p orbital. The increased shielding makes the electron easier to remove.

There is a DROP in the value for sulphur. The extra electron has paired up with one of the electrons already in one of the 3p orbitals. The repulsive force between the electrons means that less energy is required to remove one of them.



<u>Melting and Boiling point</u>

General increase then decrease as the metals lose more outer electrons the bonds become stronger .

Si is fully covalently bonded and so has a high melting and boiling point

P to Cl – these are simple covalent molecules with weak van der waals forces which are dependent on the size of the molecule

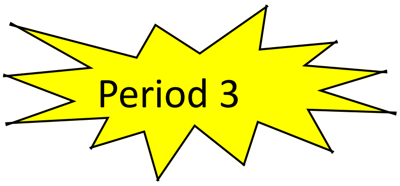
Ar is mono atomic

The oxides of the elements of period 3 also show certain trends

Element	Formula of oxide	Structure	Reaction of oxide with water	Acid/base nature
Sodium*	Na_2O	Giant Ionic	$Na_2O + H_2O \rightarrow 2NaOH$	Strongly basic
Magnesium*	MgO	Giant Ionic	Slight: $MgO + H_2O \rightarrow Mg(OH)_2$	Weakly basic
Aluminium	Al_2O_3	Giant Ionic		Amphoteric
Silicon	SiO_2	Giant Covalent (Metalloid)		Very weakly acidic
Phosphorous*	P_4O_{10}	Molecular Covalent	$P_4O_{10} + 6\ H_2O \rightarrow 4\ H_3PO_4$	Strongly acidic
Sulphur*	SO_2 SO_3	Molecular Covalent	 $SO_3 + H_2O \rightarrow H_2SO_4$	Strongly acidic
Chlorine	no direct reaction but: Cl_2O_7	Molecular Covalent	$Cl_2O_7 + H_2O \rightarrow 2\ HClO_4$	Strongly acidic
Argon	no oxides			

Create a mind map on periodicity and the trends in p3 (if you have any mind left)

this is not a mind map by the way, it just looks cool.



The End.....(for now)