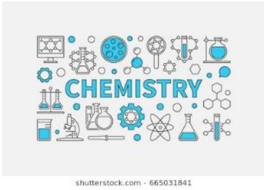
Year 12 Summer project



Task 1:

Watch the following video on performance enhancing drugs and answer the questions in the box. In the first few lessons you will learn about a machine called Time of flight Mass spectrometer that can detect different molecules from a sample.

https://www.youtube.com/watch?v=4rUpX3QSPmw

1. List at least 3 performance enhancing drugs in the youtube video

2. Name a machine that is used to detect performance enhancing drugs

3. Summarise the process of time of flight mass spectroscopy in detecting different molecules in a sample. Use the following website to help you: https://www.chemguide.co.uk/analysis/masspec/howitworks.html

<u>Task 2:</u>

- Read the background knowledge for each section and example for each of the 3 sections
- Using this knowledge complete the practice exercises/ questions
- You will need to use the **<u>periodic table below</u>** and a calculator

You have covered all of these concepts (at least briefly) in Chemistry GCSE, this practice exercise allows you to revisit and get really good at the key skills you need to have in order to succeed in our first topic at Chemistry A-level**.**

Below is table detailing the practice tasks

	Topic	Task	Completed
1	Atoms	Read it	
	Atoms	Practice	
2	Chemical Formulae	Read it	
	Chemical Formulae	Practice	
3	Naming of compounds	Read it	
	Naming of compounds	Practice	

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

Section 1: Atoms

All matter is made of particles. At one time, it was thought that the tiniest particle was the *atom,* which comes from the Greek word meaning 'indivisible'.

We now know that atoms can be split and that there are particles smaller than atoms, subatomic particles, electrons, protons and neutrons. You will need to know about these particles, which make up the different kinds of atoms.

However, you must understand that chemistry is all about rearrangements of atoms *that do not themselves* change.

Atoms are *very* small. The hydrogen atom, the smallest and lightest of all atoms, has a diameter of about 10^8 mm. 1 g of hydrogen atoms contains about 6 x 10^{23} atoms. It is very difficult to 'see' an individual atom and find its mass.

An *atom* is the smallest, electrically neutral, particle of an element that can take part in a chemical change.

A *molecule* is the smallest, electrically neutral, particle of an element or compound that can exist on its own.

An *ion* is an atom, or group of atoms, which carries an electric charge.

You need to know these definitions by heart, but you also need to be able to recognise the formulae of atoms and molecules. Li, O, Cl, C are all formulae which represent atoms. Some but not all of these can exist on their own. Oxygen, for example, unless combined with something else always exists as oxygen *molecules*, O_2, which contain two atoms. Water contains only one atom of oxygen but here it is combined with two hydrogen atoms.

Make sure that you really understand these ideas:

- a single oxygen atom, O, cannot exist on its own
- a single oxygen atom can exist when combined with something else, but then it is part of a molecule
- an oxygen molecule has two oxygen atoms, O2
- a few elements exist as single atoms: for these elements, an atom is the same as a molecule.

Structure of the atom

The atom is composed of electrons, neutrons and protons. You will need to remember the relative mass of, and the electric charge on, each.

Particle	**Relative mass (Carbon —12 scale)**	**Relative charge (on scale electron charge = −1 unit)**
Proton	1	+1
Electron	1/1840	−1

Neutron	1	0

The atom is mostly empty space. It has a solid core or *nucleus*, the centre that contains the protons and neutrons. The electrons circulate round the nucleus in specific *orbits* or *shells*.

We can picture the hydrogen atom — the simplest of all atoms with one electron and one proton in the nucleus — by considering a pea placed in the centre of a football pitch, to represent the nucleus with its proton. On this scale the electron will revolve in a circular orbit round the goalposts. Between the electron and the nucleus is empty space.

Atoms are the particles whose symbols are found in the periodic table of elements given in all your examination papers and also in *Section 12* of this workbook. You can see that there are only about 100 of them. The middle part of the atom, the nucleus, contains one or more protons. It is the number of protons that make the atom what it is. An atom with one proton is always a hydrogen atom; one with two protons a helium atom and so on.

There are more substances than the 100 or so different kinds of atom. These other substances are made by combining atoms (in various ways) to make molecules.

When a chemical reaction takes place the atoms are rearranged to create different molecules but no atoms can be made or destroyed. To show this you have to find a method of counting the atoms that are part of a chemical reaction and its products.

The mass of an individual atom is very small and it is more convenient to measure atomic masses as *relative* masses.

The definition of ***Relative Atomic Mass*** $\mathbf{A_r}$ as follows.

> **The mass of a single atom on a scale on which the mass of an atom of carbon—12 has a mass of 12 atomic mass units. The *relative* atomic mass does not have units.**

The definition of ***Relative Molecular Mass*** $\mathbf{M_r}$ (also referred to as ***molar mass***) is:

> **The mass of a single molecule on a scale on which the mass of an atom of carbon—12 has a mass of 12 atomic mass units.**

The relative molecular mass of a molecule is calculated by adding together the relative atomic masses of the atoms in the chemical formulae.

Definition of **Relative Formula Mass:** In many ways this is more accurate than Relative Molecular Mass. Many salts, even in the solid state, exist as ions rather than molecules. Although the formula of sodium chloride is normally given as NaCl, it is not a simple molecule but a giant lattice and it is more accurately written as $(Na^+Cl^-)_n$. Since this compound does not have molecules, it cannot have relative 'molecular' mass. However, the principle is the same: add the relative atomic masses of sodium (23) and chlorine (35.5) to give 58.5, the relative formula mass of NaCl.

Remember: that relative atomic mass, molecular mass and formula mass have no units.

Examples: Calculation of Molar Mass from relative atomic mass data

Before you start these questions make sure you read *Section 4*: *The mole* of this workbook.

When you carry out experiments you will weigh chemicals in grams. Molar Mass has the same numerical value as *Relative Molecular Mass.* It is calculated by adding together the relative atomic masses of the elements in the molecule. The total is expressed in units of grams per mol or g mol^{-1}.

Example 1

Calculate the Molar Mass of sulfuric acid H_2SO_4

This molecule contains

2 atoms of **hydrogen** each of mass 1	= 2 x 1	= 2 g mol^{-1}
1 atom of **sulfur** of mass 32.1	= 1 x 32.1	= 32.1 g mol^{-1}
4 atoms of **oxygen** of mass 16	= 4 x 16	= 64 g mol^{-1}
	Total mass	**= 98.1 g mol^{-1}**

Example 2

Calculate the Molar Mass of lead nitrate $Pb(NO_3)_2$

Care! This molecule contains **TWO** nitrate groups.

1 atom of **head** of mass 207.2	= 1 x 207.2	= 207.2 g mol^{-1}
2 atoms of **nitrogen** of mass 14	= 2 x 14	= 28 g mol^{-1}
6 atoms of **oxygen** of mass 16	= 6 x 16	= 96 g mol^{-1}
	Total mass	**= 331.2 g mol^{-1}**

Example 3

Calculate the Molar Mass of $CuSO_4.5H_2O$

Care! This molecule has 5 molecules of water attached to each molecule of copper sulfate.
Many students make the mistake of thinking that there are 10 hydrogens and only 1 oxygen.

In $CuSO_4$	1 atom of **copper** of mass 63.5	= 1 x 63.5	= 63.5 g mol^{-1}
	1 atom of **sulfur** of mass 32.1	= 1 x 32.1	= 32.1 g mol^{-1}
	4 atoms of **oxygen** each of mass 16	= 4 x 16	= 64 g mol^{-1}
In $5H_2O$	5 x 2 atoms of **hydrogen** each of mass 1	= 10 x 1	= 10 g mol^{-1}
	5 x 1 atoms of **oxygen** each of mass 16	= 5 x 16	= 80 g mol^{-1}
		Total mass	**= 249.6 g mol^{-1}**

Calculations of this type are generally written as follows.

$CuSO_4.5H_2O$ = [63.5 + 32.1 + (4 x 16) + 5{(2 x 1) + 16}] = 249.6 g mol^{-1}

Exercise 1: Calculation of the Molar Mass of compounds

Calculate the Molar Mass of the following compounds. You will find data concerning relative atomic masses on the periodic table of elements at the start of the tasks.

1	H_2O
2	CO_2
3	NH_3
4	C_2H_5OH
5	C_2H_4
6	SO_2
7	SO_3
8	HBr
9	H_2SO_4
10	HNO_3
11	NaCl
12	$NaNO_3$
13	Na_2CO_3

14 NaOH

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15 Na_2SO_4

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16 $KMnO_4$

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17 K_2CrO_4

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18 $KHCO_3$

---

19 KI

---

20 $CsNO_3$

---

21 $CaCl_2$

---

22 $Ca(NO_3)_2$

---

23 $Ca(OH)_2$

---

24 $CaSO_4$

---

25 $BaCl_2$

---

26 $AlCl_3$

---

27 $Al(NO_3)_3$

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28 $Al_2(SO_4)_3$

Section 2: Chemical formulae

A chemical formula is a useful shorthand method for describing the atoms in a chemical. Sometimes you will see the formula used instead of the name, but you should **not** do this if you are asked for a name.

The chemical formula of an element or compound tells you:

- which elements it contain, eg $FeSO_4$ contains iron, sulfur and oxygen
- how many atoms of each kind are in each molecule, eg H_2SO_4 contains two atoms of hydrogen, one atom of sulfur and four atoms of oxygen in each molecule
- how the atoms are arranged, eg C_2H_5OH contains a group of atoms known as the ethyl group $-C_2H_5$, and a hydroxyl group -OH
- the masses of the various elements in a compound, eg 18 g of water, H_2O, contains 2g of hydrogen atoms and 16 g of oxygen since the relative atomic mass of hydrogen is 1 (x 2 because there two hydrogen atoms) and that of oxygen is 16.

You should not learn a large number of chemical formulae by heart. However, it is useful to know a few of them and then be able to work out the rest.

You can work out the formulae of compounds containing metals from the charges on the ions.

- Metals in group 1 always have charge +1 in their compounds.
- Metals in group 2 always have charge +2 in their compounds.
- Metals in group 3 always have charge +3 in their compounds.
- Ions of group 7 elements have charge −1.
- Ions of group 6 elements have charge −2.
- Ions of group 5 elements have charge −3.

In the compound, the number of positive and negative charges is equal so that the overall charge is zero.

Some metals form more than one ion, and this is shown by a roman numeral in the name. Iron(II) chloride contains Fe^{2+} ions so the compound is $FeCl_2$. Iron(iii) chloride contains Fe^{3+} ions so the compound is $FeCl_3$.

Some ions have formulae which you cannot deduce from the periodic table, and you will need to learn these:

- OH^- hydroxide
- NO_3^- nitrate
- CO_3^{2-} carbonate
- SO_4^{2-} sulfate
- NH_4^+ ammonium.

Compounds which do not contain metals have covalent bonds. The number of bonds a nonmetal can form depends on the number of electrons in its outer shell.

As a rule:

- carbon forms 4 bonds
- nitrogen forms 3 bonds
- phosphorus can form 3 or 5 bonds
- oxygen and sulfur form 2 bonds
- halogens form 1 bond.

Here are a few examples.

- **Sodium sulfate**

  The formula of a sodium ion is Na^+

  The formula of a sulfate ion is SO_4^{2-}

  There must be two sodium ions, each with charge 1+, to balance the two – charges on sulfate.

  The formula with two Na^+ and one SO_4^{2-} is written Na_2SO_4

- **Calcium hydrogen carbonate** The formula of a calcium ion is Ca^{2+}

  The formula of a hydrogen carbonate ion is HCO_3^-

  There must be two hydrogen carbonate ions, each with charge 1−, to balance the two + charges on calcium.

  The formula with one Ca^{2+} and two HCO_3^- is written $Ca(HCO_3)_2$

Note: A bracket *must* be placed around a group or ion if it is multiplied by 2 or more *and/or* composed of more than one element. For example,

$MgBr_2$ no bracket required
$Ca(OH)_2$ bracket *essential* as $CaOH_2$ is incorrect.

- Often you can cancel the numbers on the two formulae, eg:

  $Ca_2(CO_3)_2 = CaCO_3$

  However, you should **not** do this for organic compounds. For example, C_2H_4 has 2 atoms of carbon and four of hydrogen so it cannot be cancelled down to CH_2.

- Copper(I) oxzide means use copper with charge 1, ie Cu_2O. Lead(II) nitrate means use lead with charge 2, ie $Pb(NO_3)_2$.

The periodic table can help you find the charge on an element and the number of bonds it can make, and hence the formula of its compounds.

Although you can use the table to work out the formulae of many compounds it is important to realise that all formulae were originally found through experimentation.

On the next page you will find a table of the more common elements and ions that you may have met at GCSE level. Also included are some that you will meet in the first few weeks of your Advanced Level course or that are mentioned in some of the calculations in this workbook. These are in italics.

Symbols and charges of common elements and ions

Elements	Symbol	Charge on ion	Ions	Symbol	Charge on ion
Aluminium	Al	+3	Ammonium	NH_4	+1
Barium	Ba	+2	Carbonate	CO_3	−2
Bromine	Br	−1	Hydrogencarbonate	HCO_3	−1
Calcium	Ca	+2	Hydrogen-sulfate	HSO_3	−1
Chlorine	Cl	−1	Hydroxide	OH	−1
Cobalt	Co	+2	Nitrate	NO_3	−1
Copper	Cu	+1 and 2	Nitrite	NO_2	−1
Hydrogen	H	+1	Sulfate	SO_4	−2
Iodine	I	−1	Sulfite	SO_3	−2
Iron	Fe	+2 and 3	Chlorate(I)	ClO	−1
Lead	Pb	+2 and 4	Chlorate(V)	ClO_3	−1
Magnesium	Mg	+2	Vanadate(V)	VO_3	−1
Manganese	Mn	+2 and 4	Manganate(VII)	MnO_4	−1
Mercury	Hg	+1 and 2	Chromate(VI)	CrO_4	−2
Nitrogen	N	3 and 5	Dichromate(VI)	Cr_2O_7	−2
Oxygen	O	−2			

Potassium	K	+1			
Silver	Ag	+1			
Sodium	Na	+1			

The number of covalent bonds normally formed by an element

Element	Number of bonds
Hydrogen	1
Halogens (F, Cl, Br, I)	1
Oxygen	2
Sulfur	2 or more
Nitrogen	3
Phosphorus	3 or 5
Carbon	4
Silicon	4

Exercise 2: Writing formulae from names

Use the data in the table *Symbols and charges of common elements and ions* to write the formulae of the following.

1	Sodium chloride
2	Sodium hydroxide
3	Sodium carbonate
4	Sodium sulfate
5	Sodium phosphate
6	Potassium chloride
7	Potassium bromide
8	Potassium iodide
9	Potassium hydrogen carbonate
10	Potassium nitrite
11	Magnesium chloride
12	Magnesium nitrate
13	Magnesium hydroxide
14	Magnesium oxide
15	Magnesium carbonate

Name: ___________________

16 Calcium oxide

17 Calcium chloride

18 Calcium sulfate

19 Calcium carbonate

20 Barium chloride

21 Barium sulfate

22 Aluminium chloride

23 Aluminium oxide

24 Aluminium hydroxide

25 Aluminium sulfate

26 Copper(II) sulfate

27 Copper(II) oxide

28 Copper(II) chloride

29 Copper(II) nitrate

30 Copper(I) oxide

31 Copper(I) chloride

32 Zinc nitrate

Name: _________________

Section 3: Naming of compounds

At Advanced GCE Level you will meet many compounds that are new to you and a lot of these will be organic compounds. In this section, you will look at the naming of compounds you may already have met at GCSE Level. Many of these compounds are named using simple rules. However, there are some that have 'trivial' names not fixed by the rules. It is important that you learn the names and formulae of these compounds. Later in the course, you will learn the rules for naming most of the organic compounds you will meet.

Naming inorganic compounds

The name of an inorganic compound must show which elements are present and, where confusion is possible, the oxidation state (or charge) of the elements concerned.

1 You need to remember that if there are only two elements present then the name will end in **-ide**

Oxides contain an element and oxygen, eg

Na_2O is **Sodium Oxide**

CaO is **Calcium Oxide**

Chlorides contain an element and chlorine, eg

$MgCl_2$ is **Magnesium Chloride**

$AlCl_3$ is **Aluminium Chloride**

Bromides and **Iodides** have an element and either bromine or iodine, eg

KBr is **Potassium Bromide**

ZnI is **Zinc Iodide**

Hydrides contain an element and hydrogen and **Nitrides** an element and nitrogen, eg

LiH is **Lithium Hydride**

Mg_3N_2 is **Magnesium Nitride**

Other elements also form these types of compounds and the name always ends in **-ide**. The exceptions to this are **hydroxides** which have the **-OH** group, and **cyanides** which have the **-CN** group, eg

NaOH is **Sodium Hydroxide**

$Ca(OH)_2$ is **Calcium Hydroxide**

KCN is **Potassium Cyanide**

2 If the elements concerned have more than one oxidation state (or charge) this may need to be shown. For example as iron can have charge +2 or +3, the name **Iron Chloride** would not tell you

which of the two possible compounds **$FeCl_2$** or **$FeCl_3$** is being considered. In this case the oxidation state (or charge) of the iron is indicated by the use of a roman II or III in brackets after the name of the metal. In this case **Iron(II) Chloride** for **$FeCl_2$** or **Iron(III) Chloride** for **$FeCl_3$**. Other examples are:

$PbCl_2$ is **Lead(II) Chloride**

$PbCl_4$ is **Lead(IV) Chloride**

$Fe(OH)_2$ is **Iron(II) Hydroxide**

$Mn(OH)_2$ is **Manganese(II) Hydroxide**

3 For compounds containing two **non-metal** atoms the actual number of atoms of the element present are stated, eg:

CO is **Carbon <u>Monoxide</u>** where mon- means one

CO_2 is **Carbon <u>Dioxide</u>** where di- means two

SO_2 is **Sulfur Dioxide.** This could be called **Sulfur(IV) Oxide**

SO_3 is **Sulfur Trioxide**. This could be called **Sulfur(VI) Oxide**

PCl_3 is **Phosphorus Trichloride**. This could be called **Phosphorus(III) Chloride**

PCl_5 is **Phosphorus Pentachloride**. This could be called **Phosphorus(V) Chloride**

CCl_4 is **Carbon Tetrachloride**

$SiCl_4$ is **Silicon Tetrachloride**.

4 Where a compound contains a **metal,** a **non-metal** and **oxygen** it has a name ending in **-ate** or **-ite**. You need to remember the names and formulae of the groups listed in the table *Symbols and charges of common elements and ions*. To cover the ideas we will look at the following groups.

Carbonate **$-CO_3$**

Sulfate **$-SO_4$**

Nitrate **$-NO_3$**

A compound of sodium, carbon and oxygen would be Na_2CO_3 and would be called **Sodium Carbon<u>ate</u>**. For example:

$NaNO_3$ is **Sodium Nitrate**

$Mg(NO_3)_2$ is **Magnesium Nitrate**

Name: _________________

$Fe_2(SO_4)_3$ is **Iron(III) Sulfate**

$FeSO_4$ is **Iron(II) Sulfate**.

5 As most **non-metals** can have more than one oxidation state (or charge). For example sulfur can form **sulfates** and **sulfites.** The ending -**ite** is used when an element forms more than one such compound. In all cases the -**ite** is used for the compound with the lower number of oxygen atoms. **Sulfate** can also be referred to as **sulfate(VI)** and **sulfite** can also be referred to as **sulfate(IV).** In the case of nitrogen with oxygen the compounds would be **nitrate** and **nitrite** or **nitrate(V)** and **nitrate(III).**

Other elements can form compounds involving oxygen in this way. These include **Chlorate(V), Chromate(VI), Manganate(VII)** and **Phosphate(V).** For example:

KNO_2 is **Potassium Nitrite** or **Potassium Nitrate(III)**

Na_2SO_3 is **Sodium Sulfite** or **Sodium Sulfate(IV)**

K_2CrO_4 is **Potassium Chromate(VI)**

$KMnO_4$ is **Potassium Manganate(VII)**

$KClO_3$ is **Potassium Chlorate(V)**.

In summary

Common name	Systematic name	Formulae
Sulfate	Sulfate(VI)	$-SO_4$
Sulfite	Sulfate(IV)	$-SO_3$
Nitrate	Nitrate(V)	$-NO_3$
Nitrite	Nitrate(III)	$-NO_2$
Chlorate	Chlorate(V)	$-ClO_3$
Hypochlorite	Chlorate(I)	$-ClO$

Great care needs to be taken when using these systematic names, because the properties of the two groups of compounds will be very different. In some cases use of the wrong compound in a reaction can cause considerable danger. For this reason you should always read the label on a bottle or jar and make sure it corresponds exactly to what you should be using.

6 When a compound is being considered it is usual to write the metal down first, both in the name and the formula. The exceptions to this are in organic compounds where the name has the metal first but the formula has the metal at the end, eg

CH_3COONa is **Sodium Ethanoate**.

Name: _________________

7 The elements nitrogen and **hydrogen** can join together to form a group called the **ammonium** group. This must not be confused with the compound **ammonia.** The **ammonium** group has the formula **NH_4^+** and sits in the place generally taken by a metal in a formula.

NH_4Cl is **Ammonium Chloride**

$(NH_4)_2SO_4$ is **Ammonium Sulfate**

NH_4ClO_3 is **Ammonium Chlorate(V)**.

8 There are a small number of simple molecules that do not follow the above rules. You will need to learn their names and formulae**.** They include:

Water which is H_2O

Sulfuric Acid which is H_2SO_4

Nitric Acid which is HNO_3

Hydrochloric Acid which is HCl **Ammonia**

which is NH_3

Methane which is CH_4.

9 Organic compounds have their own set of naming and you will need to learn some of the basic rules. The names are generally based on the names of the simple hydrocarbons. These follow a simple pattern after the first four:

CH_4 is **Methane**

C_2H_6 is **Ethane**

C_3H_8 is **Propane** C_4H_{10}

is **Butane**.

After butane the names are based on the prefix for the number of carbons, C_5-**pent**, C_6 **- hex** and so on.

Organic compounds with 2 carbons will either start with **Eth-** or have **-eth-** in their name, eg

C_2H_4 is **<u>Eth</u>ene**

C_2H_5OH is **<u>Eth</u>anol**

CH_3COOH is **<u>Eth</u>anoic Acid**

C_2H_5Cl is **Chloro<u>eth</u>ane**.

Name: ________________

Exercise 3: Names from formulae

Use the notes in this section, the data in the table *Symbols and charges of common elements and ions* and the copy of the periodic table to write the names of the following formulae.

1	H_2O
2	CO_2
3	NH_3
4	O_2
5	H_2
6	SO_2
7	SO_3
8	HCl
9	HI
10	HF
11	CH_4
12	H_2S
13	HBr
14	H_2SO_4

Name: _________________

15	HNO_3
16	$NaCl$
17	$NaNO_3$
18	Na_2CO_3
19	$NaOH$
20	Na_2SO_4
21	$CaCl_2$
22	$Ca(NO_3)_2$
23	$Ca(OH)_2$
24	$CaSO_4$
25	$BaCl_2$
26	$AlCl_3$
27	$Al(NO_3)_3$
28	$Al_2(SO_4)_3$
29	$FeSO_4$
30	$FeCl_2$

Name: _________________

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31 $FeCl_3$

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32 $Fe_2(SO_4)_3$