Gr 9 Chemistry 2025

Keeping a good up to date notebook is key. These notes are a guide as to what exactly you must know and be able to do. Assessments are based on these notes

Contents

TABLE 3: THE PERIODIC TABLE OF ELEMENTS

TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE

gases

liquids

Alkali metals | Alkali earth metals | metalloids | Transition Metals | Halogens | Nobel gases | Magnetic | Rare Earth Metals

KEY/*SLEUTEL*

Atomic number / *Atoomgetal*: 29

Electronegativity / *Elektronegatiwiteit*: 1,9

Symbol / *Simbool*: Cu

Approximate relative atomic mass: 63,5

Each cell: atomic number, symbol, approximate relative atomic mass (electronegativity).

(I)	(II)											(III)	(IV)	(V)	(VI)	(VII)	(VIII)
1 H 1 (2,1)																	2 He 4
3 Li 7 (1,0)	4 Be 9 (1,5)											5 B 11 (2,0)	6 C 12 (2,5)	7 N 14 (3,0)	8 O 16 (3,5)	9 F 19 (4,0)	10 Ne 20
11 Na 23 (0,9)	12 Mg 24 (1,2)											13 Aℓ 27 (1,5)	14 Si 28 (1,8)	15 P 31 (2,1)	16 S 32 (2,5)	17 Cℓ 35,5 (3,0)	18 Ar 40
19 K 39 (0,8)	20 Ca 40 (1,0)	21 Sc 45 (1,3)	22 Ti 48 (1,5)	23 V 51 (1,6)	24 Cr 52 (1,6)	25 Mn 55 (1,5)	26 Fe 56 (1,8)	27 Co 59 (1,8)	28 Ni 59 (1,8)	29 Cu 63,5 (1,9)	30 Zn 65 (1,6)	31 Ga 70 (1,6)	32 Ge 73 (1,8)	33 As 75 (2,0)	34 Se 79 (2,4)	35 Br 80 (2,8)	36 Kr 84
37 Rb 86 (0,8)	38 Sr 88 (1,0)	39 Y 89 (1,2)	40 Zr 91 (1,4)	41 Nb 92	42 Mo 96 (1,8)	43 Tc (1,9)	44 Ru 101 (2,2)	45 Rh 103 (2,2)	46 Pd 106 (2,2)	47 Ag 108 (1,9)	48 Cd 112 (1,7)	49 In 115 (1,7)	50 Sn 119 (1,8)	51 Sb 122 (1,9)	52 Te 128 (2,1)	53 I 127 (2,5)	54 Xe 131
55 Cs 133 (0,7)	56 Ba 137 (0,9)	57 La 139	72 Hf 179 (1,6)	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	81 Tℓ 204 (1,8)	82 Pb 207 (1,8)	83 Bi 209 (1,9)	84 Po (2,0)	85 At (2,5)	86 Rn
87 Fr (0,7)	88 Ra 226 (0,9)	89 Ac															

58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

L1: Grade 8 Revision (textbook: study p75-78)

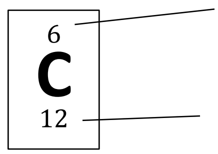
Definitions/Keywords:

- **atoms –** smallest units that elements are made of. *(imagine cutting a millimetre into 10 million parts)*
- **element** – pure substance, made up of only one type of atom that cannot be split up into simpler substances by chemical reactions. There are about a 100 and listed on the **Periodic Table**.
- **group –** a column in the Periodic Table for the Main Groups I - VIII
- **period –** a row in the Periodic Table
- **compound –** is when two or more elements are chemical bonded together. Their properties are nothing like the elements they are made of. They can be decomposed into their elements. They can be **molecules** or **salts**.
- **molecule –** is when two or more <u>non-metal</u> atoms at chemically bonded together.
  e.g. <u>elements</u> like H_2 , O_2 and Cl_2 = hydrogen, oxygen & chlorine

  or <u>compounds</u> like H_2O = water & CO_2 = carbon dioxide
- **salts –** when a <u>metal bonds with a non-metal</u>
  e.g. NaCl = sodium chloride & Fe_2O_3 = iron oxide (rust)

<u>Sub-atomic Particles & Atomic Structure</u>

Study the symbol for carbon:



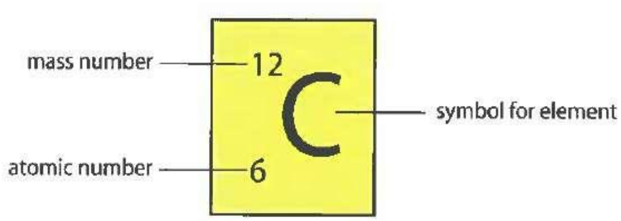
atomic no. = no. protons in nucleus (p^+)

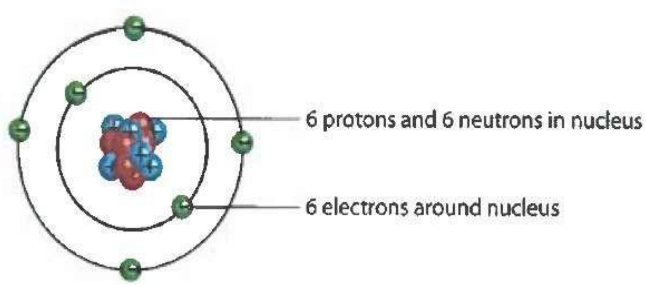
= no. electrons (e^-) in a neutral atom

mass no. = $p^+ + n^o$

- It's symbol can be shown as any of the 3 examples, $^{12}_{6}C$, $^{6}_{12}C$ or $\overset{12}{\underset{6}{C}}$ depending which textbook you read.
- Atoms are made of smaller particles called **subatomic** particles.
- The nucleus is made of **protons (p^+)** which are positively charged and **neutrons (n^o)** which are neutral (i.e. have no charge). The **mass number** = no. protons + no. neutrons.
- The nucleus is very tiny compared to the rest of the atom and yet it contains more than 99% of the mass of the atom. *Seems unbelievable but there is strong evidence. A bit too complicated to explain yet for Gr9.*
- **Electrons (e^-)** are negatively charged. They are arranged in energy levels around the nucleus like the layers of an onion. The first layer can only contain 2 electrons. The next few layers can contain 8 electrons. Notice how these layers correspond with the periods (rows) on the Periodic Table.
- Atoms are neutral and therefore have an equal number of protons (p^+) and electrons (e^-).
- The **atomic number** is equal to the number of protons (and electrons in a neutral atom) which gives its position on the periodic table.

SEE p76

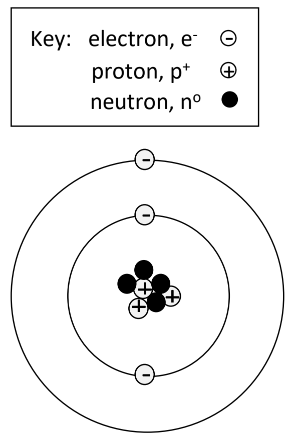




***Task 1**: (finish for HW)*

1. *Colour code the **Periodic Table** per the diagram shown in class. Paste it in your notebook. There's also a Periodic Table at the back of the text book.*
2. *Be able to identify those classified as metals, non-metals and metalloids (semi-metals) and their relative position on the Periodic Table.*
3. *Label the groups: I = Alkali metals, II = Alkali-earth metals, VII =Halogens, VIII = Nobel Gases, Transition Metals & Rare Earth Metals.*
4. *In your note book list the names and symbols of the 1st 20 elements plus Cr, Fe, Co, Ni, Cu, Zn, Br, Ag, I, Pt, Au, Hg, Pb, U in a table like the one below. Memorize the names and symbols.*
   Also use their atomic & mass numbers to list their number of subatomic particles.

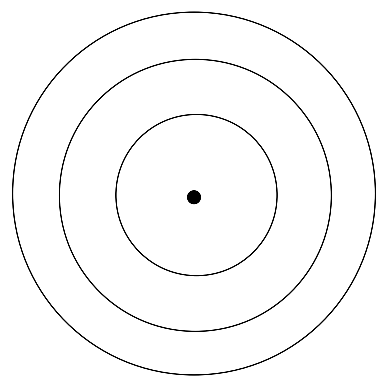
Atomic no.	***Symbol***	***Name***	***Mass no.***	***no.*** p^+	***no.*** e^-	***no.*** n^o
1	*H*	*Hydrogen*	*1*	*1*	*1*	*0*
2	*He*					
3	*Li*					
etc…						



5. *Draw the structure of the atom of the element* 3 Li 7
   (Note this nucleus is hugely exaggerated in size)

6. *Draw the electron configuration of an atom of the element* 11 Na 23
   Just use a dot (●) for the nucleus

   It has $2e^-$ in 1st layer, $8e^-$ in 2nd layer and $1e^-$ in 3rd layer.
   It's like the periods (rows) in the Periodic Table.



L2: Naming Compounds (study p81-82)

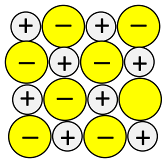
1. Two elements – second element ends in **ide** e.g. MgF_2 = magnesium fluor<u>ide</u>.
2. For molecules (non-metals) it may have a **prefix** of: **mono = 1 , di = 2 , tri = 3 , tetra = 4 , penta = 5**

   e.g. CO = carbon monoxide, CO_2 = carbon dioxide, CCl_4 = carbon tetrachloride.
3. If 3rd element is oxygen it usually ends in **ate** e.g. Na_2CO_3 = sodium carbonate.

Task: 2

1. Read steps for naming compounds p81 & 82.
2. Do Activities 6, 7 & 8 (finish for HW).

L3: Writing formulae for salts



In salts a **metal** (M) **bonds with a non-metal** (Nm). The metal (M) gives electron(s) to the non-metal (Nm) to form oppositely charged **ions** M^+ and Nm^-

e.g. table salt = sodium chloride = NaCl = Na^+Cl^-

These oppositely charge ions attract each other and form a 3-D crystal lattice structure.

The position on the table allows us to determine the number of electrons transferred.
The Nobel Gas elements are all stable. They do not react with anything, do not form chemical bonds.
Their electron configuration is stable. Their energy levels are full.
When bonds do form between atoms they swop or share electrons until this stable electron configuration is achieved.

e.g. In Na^+Cl^- the Sodium has <u>lost</u> 1 e^-. So it has 10 e^- and 11 p^+, i.e. 1 extra positive charge forming a Na^+ ion.
This is now called a positively charge ion (cation) and shown as, Na^+ (the $^+$ shown as a superscript)

Similarly, the Chlorine atom <u>gains</u> an electron forming the negatively charged chloride ion (anion), Cl^- .

Group I	II	III	IV	V	VI	VII	VIII
Form 1+ ions	2+	3+		3-	2-	1-	0
H^+							He
Li^+	Be^{2+}		C^{4-} or C^{4+} eg. CH_4 & SiO_2 usually form molecules	N^{3-}	O^{2-}	F^-	Ne
Na^+	Mg^{++}	Al^{3+}		P^{3-}	$S^=$	Cl^-	Ar
K^+	Ca^{2+}						

The final formula is neutral i.e. the same number of positives and negatives.
Examples:

1. Magnesium chloride: Mg^{2+} and Cl^-. There must be 2 Cl^- ions for every 1 Mg^{2+}. So formula is $Mg^{2+}Cl^-_2$
2. Aluminium bromide: Al^{3+} and Br^-. " " 3 Br^- :" " 1 Al^{3+}. " " $Al^{3+}Br^-_3$

<u>**Task 3**</u>**:**Write formulae for the following:

1. Sodium oxide	2. Lithium nitride
3. Calcium fluoride	4. Aluminium chloride
5. Magnesium phosphide	6. Beryllium nitride
7. Aluminium oxide	8. Hydrogen oxide

L4: Writing Formulae cont… <u>Stock Notation</u>

- Most of the **Transition metals** form 2+ ions e.g. zinc ion = Zn^{2+} . So, zinc chloride formula is $Zn^{2+}Cl^{-}_2$
- When NOT 2+, we use the stock notation to denote the charge. So, iron (III) = Fe^{3+}
- Some can exist in more than one ionic state e.g. iron (I) = Fe^{+} or iron (II) = Fe^{2+} or iron (III) above
- Iron rusts to form iron (III) oxide = $Fe^{3+}_2O^{2-}_3$ usually written Fe_2O_3
- We use the charges on the ions to determine the formula, but it is usually written without the charges

Polyatomic Ions

Na_2CO_3 = sodium carbonate has Na^+ & CO_3^{2-} ions. So, we need 2 sodium ions for every carbonate ion.
This applies to all polyatomic ions

1-	2-	3-
NO_3^- nitrate	CO_3^{2-} carbonate	PO_4^{3-} phosphate
HCO_3^- bicarbonate or hydrogen carbonate	SO_4^{2-} sulphate	
HSO_4^- bisulphate or hydrogen sulphate		1+
OH^- hydroxide		NH_4^+ ammonium

If multiple polyatomic ions are needed in the formula then brackets must be used.
e.g. calcium hydroxide = $Ca^{2+}(OH^-)_2$

<u>**Task 4**</u>: For a video of this method, click on this link: https://tinyurl.com/ybd7ardf
Write formulae for the following and give its common name when it has one:

Name	Formula	Common name
1. Sodium bicarbonate	$Na^+HCO_3^-$	Koeksoda, baking soda, bicarb (makes cakes rise)
2. Magnesium nitrate	$Mg^{2+}(NO_3^-)_2$	** needs brackets around the polyatomic ion
3. Sodium hydroxide	Na^+OH^-	Caustic soda – sold as drain cleaner. Dissolves grease
4. Ammonium chloride	$NH_4^+Cl^-$	Used as flux when soldering – cleans surface & lets solder flow.
5. Iron (III) sulphide	$Fe^{3+}_2S^{=}_3$	-
6. Zinc oxide	$Zn^{2+}O^{=}$	What the surface of galvanized steel becomes. Better than paint.
7. Silver (I) sulphate	$Ag^+_2SO_4^{2-}$	-
8. Ammonium phosphate	$(NH_4^+)_3PO_4^{3-}$	used in fertiliser.

L5: Chemical Reactions and Balancing Equations (p86-87)

reacts to form

Reactants / Reagents ⟶ **Products**

During a reaction, **chemical bonds** are **broken** between atoms (reagents), this **requires energy**, & **new bonds** are **formed** between atoms (products), this **releases energy**.

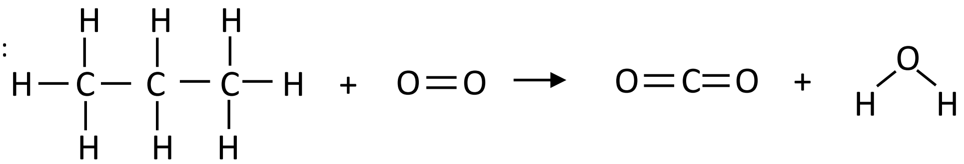
The total number of atoms remains the same. They are just rearranged into new substances.

Consider Combustion of propane gas:

Word equation: propane gas + oxygen → carbon dioxide and water

Symbols: C_3H_8 + O_2 → CO_2 + H_2O + HEAT

Structure:



count the number of atoms on both sides of equation. They're NOT equal.

So, we add more carbon dioxide molecules until there are 3C-atoms both sides. Now we add extra water molecules until there are 8H-atoms both sides. Counting the 6+4 O-atoms in the products requires having 10)-atoms in the 5 O_2 molecules in the Finally we add more O_2 molecules untilthus producing more products and so on until the number of atoms is the same on both sides.

C_3H_8	+	O_2	→	CO_2	+	H_2O
		O_2		CO_2		H_2O
		O_2		CO_2		H_2O
		O_2				H_2O
		O_2				

Now count them again.

We say:

1 molecule of propane reacts with 5 molecules of oxygen to form 3 molecules of carbon dioxide and 4 molecules of water

and can be written as **1** C_3H_8 + **5** O_2 → **3** CO_2 + **4** H_2O

This is called **balancing** the equation. The **1** need not be written.

Task 5:

- Do Activities 12 & 13 p87 in Textbook.

You will get lots more practice in the remaining sections

L6-10 & Prac Reactions with Oxygen (combustion) (p89-97)

Combustion is a rapid reaction with oxygen and produces lots of heat and light. Usually we see a flame or glowing like coals in fire.

- You will get to observe certain metals and non-metals reacting with oxygen.
- In each case we must link the observation with a balance chemical equation.
- Each time we will test the product formed to see whether it is acidic or alkaline (base).

Rusting - some metals like iron (Fe) react slowly with oxygen to for **iron oxide**, (Fe_2O_3), which is **brown** in colour and commonly called **rust**.

Task 6: ***Rusting Practical Investigation*** *Activity 4 p94 textbook*

- *Your teacher will set up the test tubes + an extra sixth one half filled with clear vinegar.*
- *You will then observe them every class time and monitor the rusting process over a number of weeks*
- *Take a full page in your notebook for this investigation. Apart from the textbook questions answer the following*

In your notebook:

1.1 Write an investigative question.

1.2 Write a hypothesis.

2. Record your Observation in a Table

Answer questions 3 & 4 of the textbook.

Rust Prevention

We are mostly interested in preventing rusting.

Task 6b

1. *Discuss the most effective ways of preventing steel from rusting.*
2. *Summarize the common ways listed on p95 in your notebook.*

L 7 - 9 Combustion Reactions (SBA Prac) (p90-92 for metals & p96-97 for non-metals)

***Task 7**: Practical observation of combustion of metals and non-metals*

Your teacher may get to demonstrate these reactions (if equipment is available) and / or you can watch them on a video available on the arhs.vip site or YouTube https://studio.youtube.com/video/BcdCc7TwlEA/edit (liking and subscribing increases the chance of more videos being made)

Observe the following elements reacted with Oxygen – remember it is a diatomic molecule $O_{2(g)}$

1. Sodium, Na.
2. Potassium, K.
3. Magnesium, Mg.
4. Iron, Fe.
5. Carbon, C.
6. Sulphur, S.
7. Hydrogen, H.

metals (1–3)

non - metals (4–7)

Method:

1. A **gas jar** is filled with pure oxygen by the **downward displacement of water**.
2. The element is held in a **deflagrating spoon** and heated by a gas burner. It is then inserted in the pure oxygen in the gas cylinder.

- Make careful observations.

3. The oxide product is then dissolved in water and tested with **litmus indicator** to see if it is acidic or alkaline (basic).

Litmus turns **red/pink** in **acid** and Litmus turns **blue** in **base (alkaline solution)**.

In your notebook:

Make a note of each of the above reactions linking the observations with a balanced chemical equation. It's best to make a large table with the following columns.

	Element & symbol	Observation & balanced chem equation	Nature product: colour, phase (s), (l), (g), soluble?	Litmus colour change	Acid or base (alkaline solution)
1	Sodium, Na	Burns with orange flame & smoke $4Na + O_2 \rightarrow 2Na_2O$	grey solid, very soluble	turns blue	strong base
2	etc…				

Conclusion: **Metal oxides** generally are **bases (**forming **alkaline solutions** when **soluble)**
Non-Metal oxides are **acids**.

***Task 8**: Do Activity 3 p92.*

SBA Prac Mark (40% of Term 2 Mark): The Practical under Test Conditions

You will be shown a video of all these observations and required to complete the Worksheet under Test conditions. The chemical equations will NOT be shown. You can prepare for this like a test.

RESULTS TABLE

	Element & symbol	Observation & balanced chem equation	Nature product: colour, phase (s), (l), (g), soluble?	Litmus colour change	Conclusion: Acid or Base / (alkaline solution)
1	Sodium, Na	Burns with orange flame & see smoke in most of them so ignore noting a comment $4Na + O_2 \rightarrow 2Na_2O$	grey solid, very soluble	turns from pink to blue	strong base
2	Potassium, K	Burns with lilac flame $4K + O_2 \rightarrow 2K_2O$	grey solid, very soluble	turns from pink to blue	strong base
3	Magnesium, Mg	burns with v. bright white flame. In air also. ** $Mg + O_2 \rightarrow 2MgO$	white solid, slightly soluble	turns pink to blue (slowly)	weak base
4	Iron, Fe	bursting orange flame (like a sparkler) $4Fe + 3O_2 \rightarrow 2Fe_2O_3$	brown solid (rust) insoluble	no change 'cos insoluble	all metal oxides considered bases. Does NOT form alkaline solution
5	Carbon, C	orange flame like charcoal and wood burning $C + O_2 \rightarrow CO_{2(g)}$	colourless gas, slightly soluble (have to shake the gas jar)	blue to pink (slowly)	weakly acidic (like all fizzy drinks)
6	Sulphur, S	Blue flame $S + O_2 \rightarrow SO_{2(g)}$	colourless gas, very soluble	blue to pink	acidic (cause of acid rain)
7	Hydrogen, H	'popping sound' (test tube) loud explosion (bottle) + lotsa heat $2H_{2(g)} + O_2 \rightarrow 2H_2O_{(g)}$	-	no colour change	neutral

** Previously used in flash photography

Conclusions:

1. Metal oxides are bases and form alkaline solutions when they dissolve thus turning Litmus blue
2. Non-metal oxides are acidic and turn Litmus pink

L11 Acids, Bases & pH scale (p99-126)

The **pH scale** ranges from **0 – 14** and tells how **acidic or basic** a water-soluble substance is.

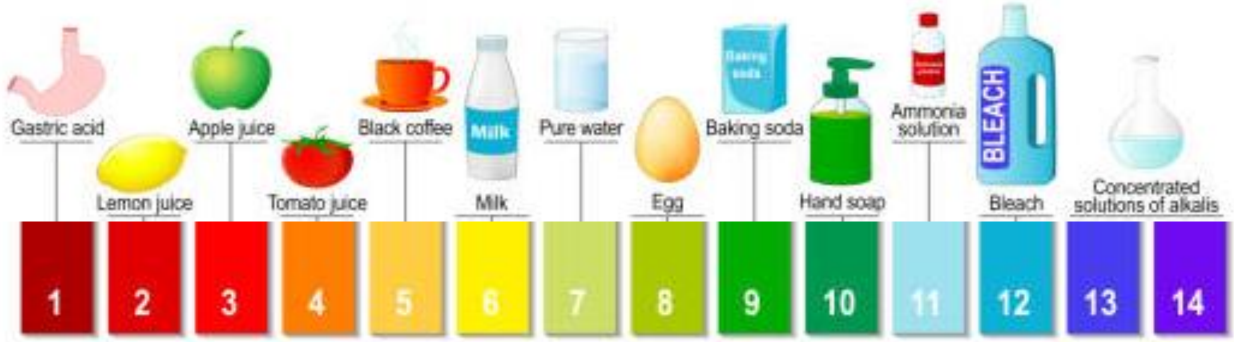
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
strong acids				weak acids			**neutral**	weak bases					strong bases.	

Acids have pH between 0 – 7. The smaller the number the stronger and/or more concentrated the acid

Bases have pH between 7 – 14. The closer to 14 the stronger and/or more concentrated the base. When a base dissolves in water it's called an **alkaline solution**.

Strong acids & bases are **corrosive** and can dissolve/react with ('eat away') metals and other materials.

Indicators are substances that have different colours at different pH's. Some have a single colour changes others have a range of colour changes eg. **universal indicator** (See p100)



Common acids	Formula	strength	common names & examples	pH	colour universal indicator
Hydrochloric	HCl	strong	stomach, swimming pool	0-1	red
Sulphuric	H_2SO_4		car battery acid	0-1	red
Nitric	HNO_3		most corrosive	0-1	red
Ethanoic / Acetic	CH_3COOH	weak	vinegar is a dilute solution.	3-5	orange
Carbonic	H_2CO_3		fizzy drinks. When CO_2 dissolved in water	3-5	orange
Common bases					
sodium hydroxide	$NaOH$	strong	caustic soda – sold as drain cleaner	13-14	purple
ammonia	NH_3	weak	Cleaning agent like Handy Andy with ammonia	11	blue
sodium bicarbonate	$NaHCO_3$		koek soda, baking soda, bicarb	9-10	blue

Indicators with a single colour change & the pH at which it occurs (see p102)

Indicator	**base**	**acid**	**pH**
Litmus	blue	pink / red	7
Phenolphthalein	pink	colourless	9--10
Bromothymol blue	blue	yellow	7

Typical Acid Reactions with Bases & Metals (p109 – 126)

Activity 1 p109 **-** *Discuss and do in class*

Acids and Bases **Neutralise** each other.

Demo 1:

1. *Add a few drops of universal indicator to about 300ml of dilute hydrochloric acid in a 1 litre measuring cylinder and swirl.*
2. *Using a pipette and suction bulb add an amount (±5ml) of dilute sodium hydroxide and swirl.*
3. *Repeat step 2. again & again. You need only add smaller and smaller amounts when the colour approaches green.*
   If you overshoot the pH = 7 mark (green) you can add a little more acid and then step 3 again.

Demo 2*: *Activity 2 p111 *Note instructions and all observations in your notebook.*

1. *A few drops of universal indicator are added to 50ml dilute acid in a 250ml measuring cylinder. Note the colour.*
2. *A teaspoon amount of sodium bicarbonate $NaHCO_{3\,(s)}$ is added using a* ***spatula****. Note observations.*
3. *Continue adding bicarb until the colour is green.*
4. *Word Eqn: acid + sodium bicarbonate → carbon dioxide + water + sodium salt*

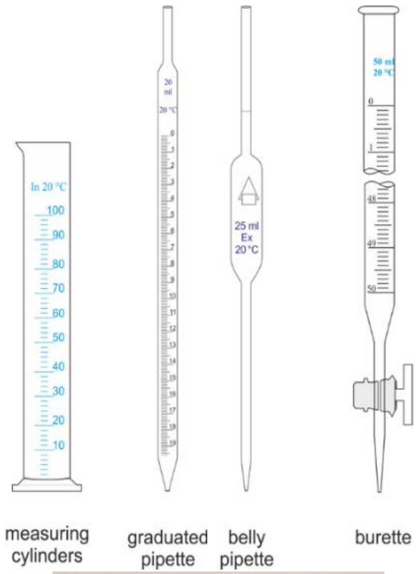
Case Study p 113 Read about acid rain and summarise the point in your notebook.

Four Types of Reactions:

Write all of these out in your notebook as we go through each one. Writing makes you pay attention to detail.

1. Acid + Alkaline – called neutralisation reaction. (p115-116)
2. Acid + metal oxide. (p114)
3. Acid + metal carbonate. (p118)
4. Acid + Metal. (p124)

1. Acid + Hydroxide salts (alkaline solution)



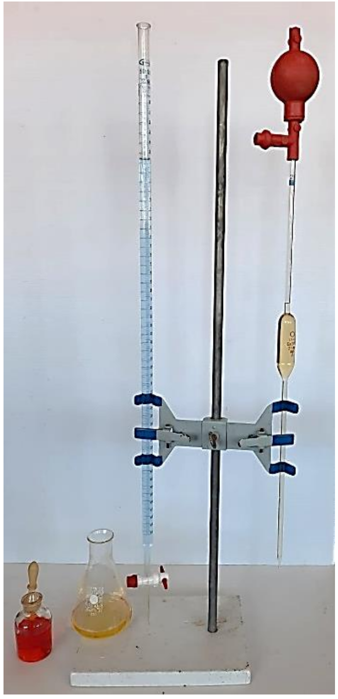
General Equation: Acid + Hydroxide salt $\rightarrow$ water + salt

e.g. hydrochloric acid + sodium hydroxide $\rightarrow$ water + sodium chloride

$$HCl_{(aq)} + NaOH_{(aq)} \rightarrow H_2O_{(l)} + NaCl_{(aq)}$$

If equal amounts are added, then the final pH = 7

This can be done accurately using equipment like a **burette** and **pipette** in a method called a **titration**. This can be used to determine the concentration of unknown acids and bases precisely.



Demo 1:

1. *Add a few drops of universal indicator to about 300ml of dilute hydrochloric acid in a 1 litre measuring cylinder and swirl.*
2. *Using a pipette and suction bulb add an amounts (±5ml) of dilute sodium hydroxide and swirl.*
3. *Repeat step 2. again & again, You need only add smaller and smaller amounts when the colour approaches green.*

If you overshoot the pH 7 mark you can add a little more acid and step 3.

Demo 2 Titration:

You can accurately determine the concentration of an acid if given the concentration of a base & vice versa.

1. *Fill a burette with the sodium hydroxide (NaOH) of known concentration of 0.15 units per volume.*
2. *Pipette 25ml of the unknown hydrochloric acid (HCl) into a conical flask.*
3. *Add a few drops of bromothymol blue indicator.*
4. *Titrate (add) NaOH from the burette until a single drop changes the colour to green.*

For Enrichment NOT EXAMINABLE

Concentration of the HCl, (c_A), is calculated as follows: conc Acid x Vol acid = conc Base x Vol base

i.e. $c_A \times V_A = c_B \times V_B$
$c_A \times 25 =$
$c_A =$
(amount per litre ie. mol.dm^{-3})

fill the values in that you teacher measures and calc C_A

$C_B = 0.15$ *units per volume*

$V_A = 25$ *ml (pipette)*

$V_B =$ *volume used in burette.*

read from bottom **meniscus**

5.7 ml

Understandably we cannot have all 270 Gr9's doing this as a prac. It's what we do in the senior science classes. Maybe the Science Club will give you a turn this year.

2. Acids + Metal Oxides (114)

These also form water + salt just like the hydroxide salts.

General Equation

Acid + Metal oxide → water + salt

Word eqn: Hydrochloric acid + copper oxide reacts to form water + copper chloride

e.g. $HCl_{(aq)} + CuO_{(s)} \rightarrow H_2O_{(l)} + CuCl_2{}_{(aq)}$

CuO: insoluble black solid; $CuCl_2$: green /cyan solution

Demo:
Gently heat a small amount of black CuO (insoluble solid) with concentrated HCl solution in a porcelain dish. After a while observe the liquid. The black CuO will have gotten less, maybe even all gone, and the colourless liquid will have turned green.
Add a little water and the colour will become cyan (turquoise).

3. Acid + carbonate salt (p118-123)

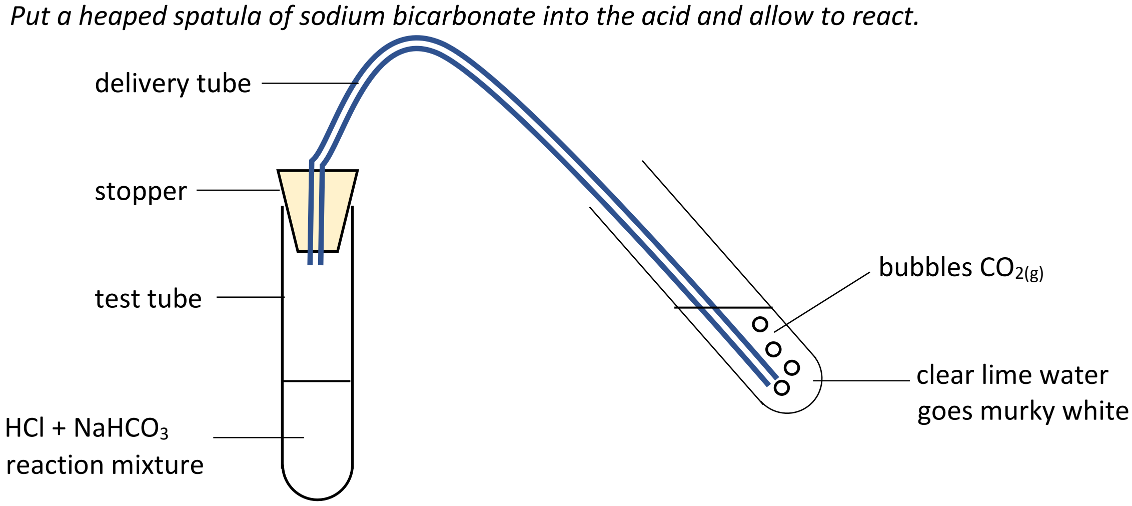
General Equation: acid + carbonate salt → carbon dioxide + water + salt

e.g. hydrochloric acid + sodium bicarbonate → carbon dioxide + water + sodium chloride

$$HCl_{(aq)} + NaHCO_3{}_{(s)} \rightarrow CO_2{}_{(g)} + H_2O_{(l)} + NaCl_{(aq)}$$

You saw this previously p11 Demo 2.

Demo :
1. *Add a small amount of dilute acid to a wide test tube.*
2. *Have a stopper and delivery tube ready. Place the end of the delivery tube into a 2nd test tube a quarter full with clear lime water ready.*
3. *Put a heaped spatula of sodium bicarbonate into the acid and allow to react.*



4. Acids + Metals

General equation

Acid + metal → hydrogen gas + salt

Word eqn: Sulphuric acid + Zinc reacts to form Hydrogen gas (explosive) + Zinc Sulphate

e.g. $2HCl_{(aq)} + Zn_{(s)} \rightarrow H_{2\,(g)} + ZnCl_{2\,(aq)}$

Zn: silvery metal; H_2: colourless gas; $ZnCl_2$: colourless solution

Test for Hydrogen:

- A small amount of hydrogen in a test tube makes a small 'popping sound' explosion when ignited.
- A larger amount in a plastic bottle makes a very loud explosion when mixed with pure oxygen or air.
- This is rocket fuel.
- You also see that if there is NO oxygen in the bottle it does NOT explode. It can only react with oxygen at the mouth of the bottle and therefore burns in a controlled way.

Demo:
Put Zinc metal into container with Hydrochloric acid. They react to form Hydrogen gas and the zinc dissolves. We used the Kipps apparatus. It is a clever instrument that switch the reaction off by separating the reagent when the pressure build up.

Test for other gases Oxygen and Carbon Dioxide (Gr8 Revision)

1. Test: pure oxygen will ignite a glowing splinter. Oxygen support combustion.
2. Carbon dioxide turns clear lime water a white murky colour.

Fire Safety

"Fire is a wonderful servant but a terrifying master"

Fire needs three things: fuel, heat & oxygen.

You can extinguish a fire by removing any one of those. It's best of course to remove all three.

True Story: A few years ago a Gr8 Alexan was frying chips at home with his younger brother. The kitchen door opens to the back yard.
By being distracted they didn't notice it getting out of control until the pan was on fire. The oil was burning. In a panic he grabbed the pan and dashed outside. The wind was blowing. He got a freight and the burning oil spilt onto his arms and hands resulting in third degree burn. He was off school for a whole term have multiple skin graphs and his hands are permanently scarred.
We hope this will never happen again.
What should he have done?
Covered the pan with a lid of bigger pan/pot and remove it from the heat. So simple. Problem solved.

A Few Tips for Extinguishing a Fire

1. *If your clothes catch alight:*

- *Never run – you are just giving it more oxygen.*
- *Smother the flames. If no blanket, drop and roll. This removes the oxygen.*
- *Cool it down. Immerse in water if at available.*
- *Keep in cold water for 20 minutes. Even though the flames are out the damage continues for quite some time. Add ice to the water.*

2. *If liquids like oil, solvents, petrol, paraffin are alight:*

- *do NOT squirt with water. It will just spread the fire.*

3. *Using a fire extinguisher: know there are different types.*

- *Some spray a powder thus smothering the flames. This leaves a big mess to clean up. Some empty the cylinder completely so you can't stop it. There might be a much simply solution*
- *Some spray very cold carbon dioxide gas thus smothering and cooling the flames. But when the gas moves away it could start up again.*

4. *Sand bucket – a very effect way of smothering a small fire.*

All our labs have fire extinguishers, fire blankets & fire buckets with sand.

You might be motivated to do a first aid course. Speak to Ms Sutherland and her wonderful team.

We hope you have seen that chemistry exists everywhere. It has application is all spheres of life. It's happening in the kitchen and in your body. You are largely wearing polyester (blazer is 100%). If not for our knowledge of chemistry, there would be no plastic. Clothes would have to be of cotton or wool (expensive). The list goes on and on.
But we also need to know about dangerous chemicals and pollution and how to treat toxic waste. e.g. never throw batteries in the bin.

Jobs for you, if you like Chemistry

Just click on any one of these links on the vip-site and read more about the career.

Analytical Chemist	**Pharmacologist**
Toxicologist	**Hazardous Waste Chemist**
Chemical Engineer	**Materials Scientist**
Chemistry Teacher	**Water Chemist**
Geochemist	**Forensic Scientist**
Environmental activist	