

A level Chemistry

Bridging Booklet

Answers

Understanding Chemical Formulae

Questions

State how many of each type of atom/ion there are in each of these chemical formulae.

1. Li_2O **Li = 2, O = 1**
2. MgBr_2 **Mg = 1, Br = 2**
3. KNO_3 **K = 1, N = 1, O = 3**
4. Al(OH)_3 **Al = 1, O = 3, H = 3**
5. $\text{Ca(CO}_3)_2$ **Ca = 1, C = 2, O = 6**

Balancing Chemical Equations

- 1) $\text{Na}_3\text{PO}_4 + 3 \text{KOH} \rightarrow 3 \text{NaOH} + \text{K}_3\text{PO}_4$
- 2) $\text{MgF}_2 + \text{Li}_2\text{CO}_3 \rightarrow \text{MgCO}_3 + 2 \text{LiF}$
- 3) $\text{P}_4 + 3 \text{O}_2 \rightarrow 2 \text{P}_2\text{O}_3$
- 4) $2 \text{RbNO}_3 + \text{BeF}_2 \rightarrow \text{Be}(\text{NO}_3)_2 + 2 \text{RbF}$
- 5) $2 \text{AgNO}_3 + \text{Cu} \rightarrow \text{Cu}(\text{NO}_3)_2 + 2 \text{Ag}$
- 6) $\text{CF}_4 + 2 \text{Br}_2 \rightarrow \text{CBr}_4 + 2 \text{F}_2$
- 7) $2 \text{HCN} + \text{CuSO}_4 \rightarrow \text{H}_2\text{SO}_4 + \text{Cu}(\text{CN})_2$
- 8) $\text{GaF}_3 + 3 \text{Cs} \rightarrow 3 \text{CsF} + \text{Ga}$
- 9) $\text{BaS} + \text{PtF}_2 \rightarrow \text{BaF}_2 + \text{PtS}$
- 10) $\text{N}_2 + 3 \text{H}_2 \rightarrow 2 \text{NH}_3$

Balancing Chemical Equations

- 11) $2 \text{NaF} + \text{Br}_2 \rightarrow 2 \text{NaBr} + \text{F}_2$
- 12) $\text{Pb}(\text{OH})_2 + 2 \text{HCl} \rightarrow 2 \text{H}_2\text{O} + \text{PbCl}_2$
- 13) $2 \text{AlBr}_3 + 3 \text{K}_2\text{SO}_4 \rightarrow 6 \text{KBr} + \text{Al}_2(\text{SO}_4)_3$
- 14) $\text{CH}_4 + 2 \text{O}_2 \rightarrow \text{CO}_2 + 2 \text{H}_2\text{O}$
- 15) $2 \text{Na}_3\text{PO}_4 + 3 \text{CaCl}_2 \rightarrow 6 \text{NaCl} + \text{Ca}_3(\text{PO}_4)_2$
- 16) $2 \text{K} + \text{Cl}_2 \rightarrow 2 \text{KCl}$
- 17) $2 \text{Al} + 6 \text{HCl} \rightarrow 3 \text{H}_2 + 2 \text{AlCl}_3$
- 18) $\text{N}_2 + 3 \text{F}_2 \rightarrow 2 \text{NF}_3$
- 19) $\text{SO}_2 + 2 \text{Li}_2\text{Se} \rightarrow \text{SSe}_2 + 2 \text{Li}_2\text{O}$
- 20) $2 \text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$

Atomic Structure

Look up carbon and pu

Carbon

6
C
Carbon
12.0

Now this is know
protons, neutrons

6	n
6	p
6	e

Use the periodic table at the back of the booklet to work out the number of protons neutrons and electrons in the following atoms

1.

helium

2.

Calcium

3.

Lithium

4.

Oxygen

5.

sulphur

1	2	n
	2	p
	2	e

2	20	n
	20	p
	20	e

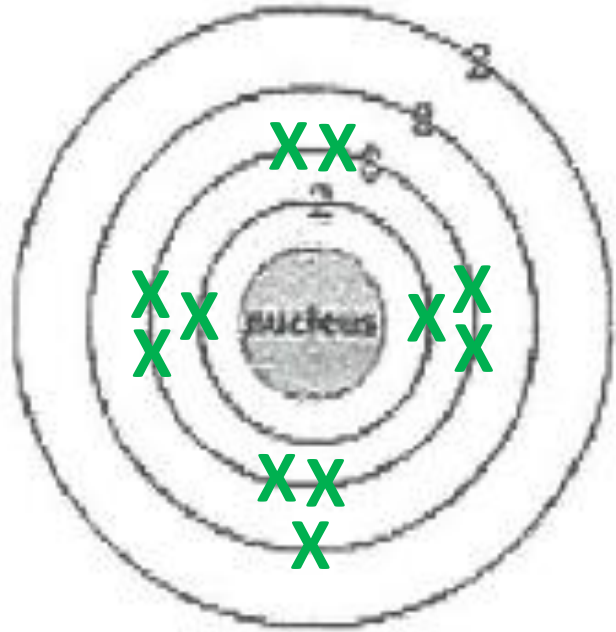
3	4	n
	3	p
	3	e

4	8	n
	8	p
	8	e

5	16	n
	16	p
	16	e

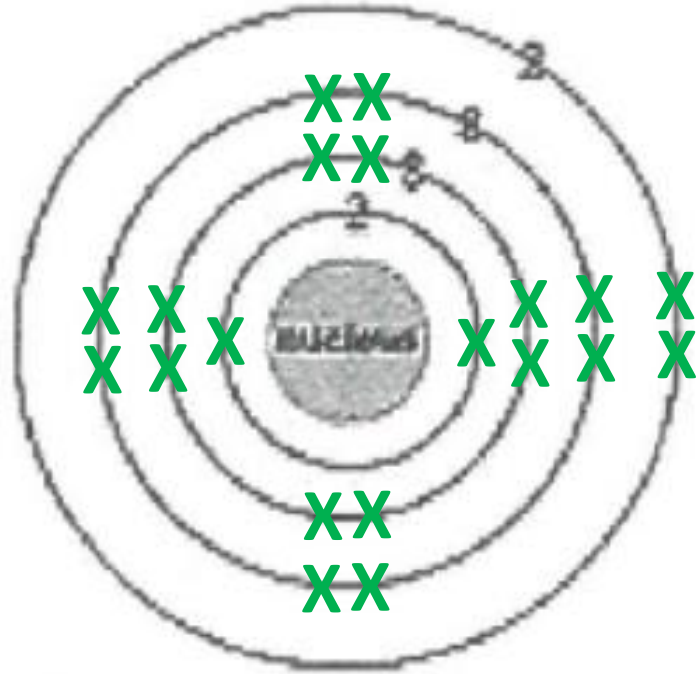
Atomic Structure

Na



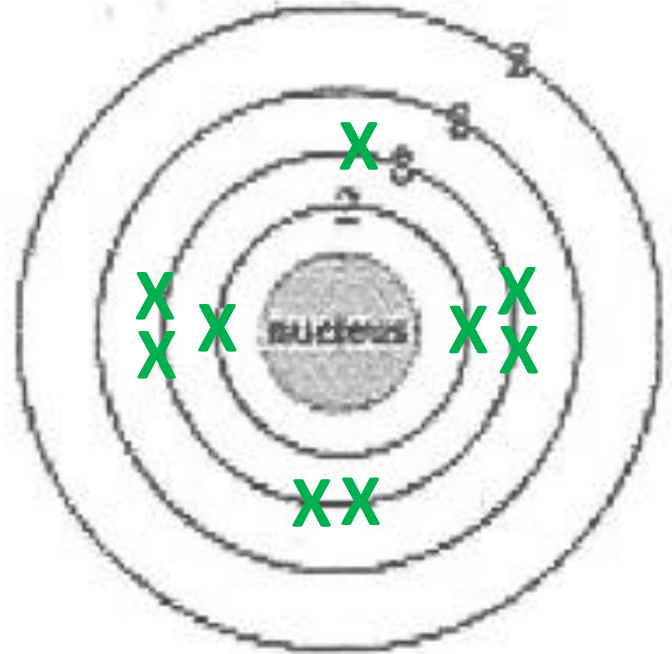
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Ca



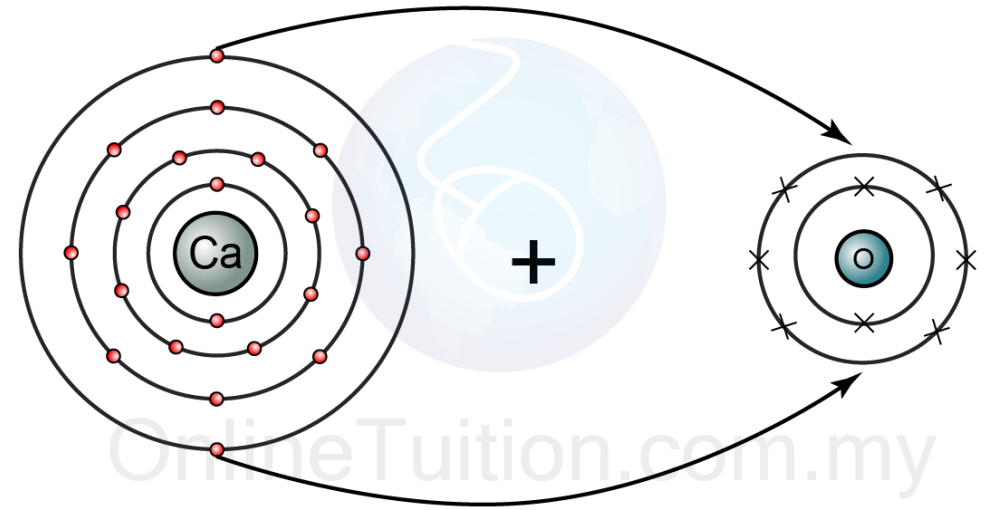
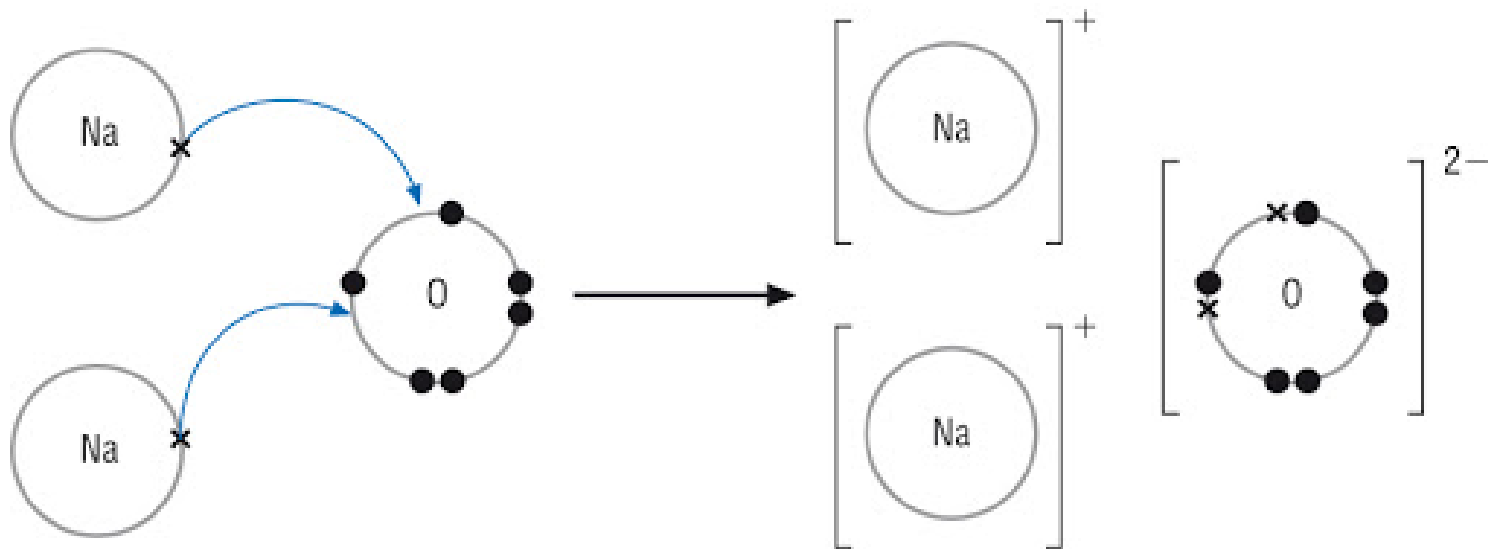
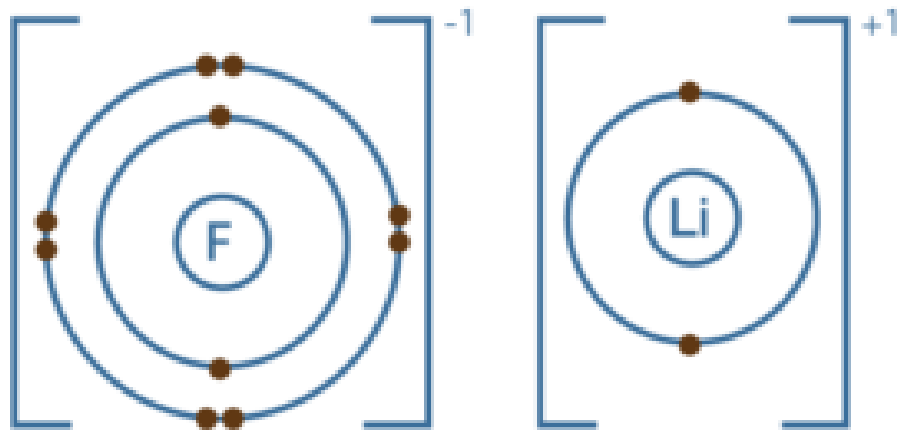
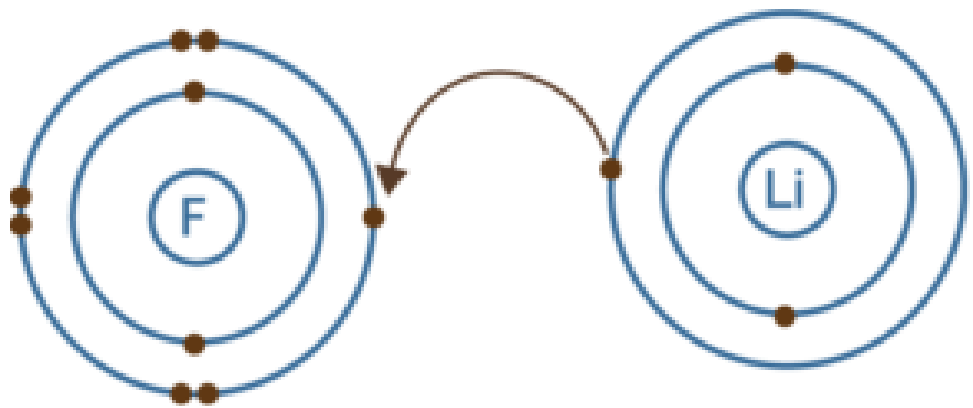
2, 8, 8, 2

F

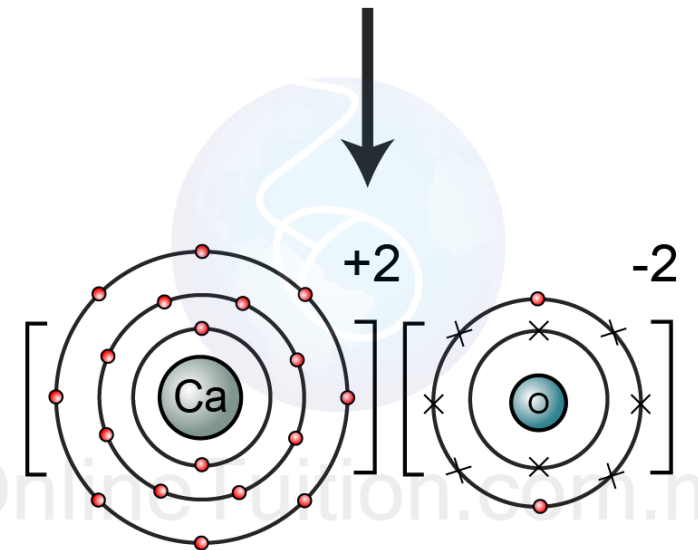


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Ionic Bonding



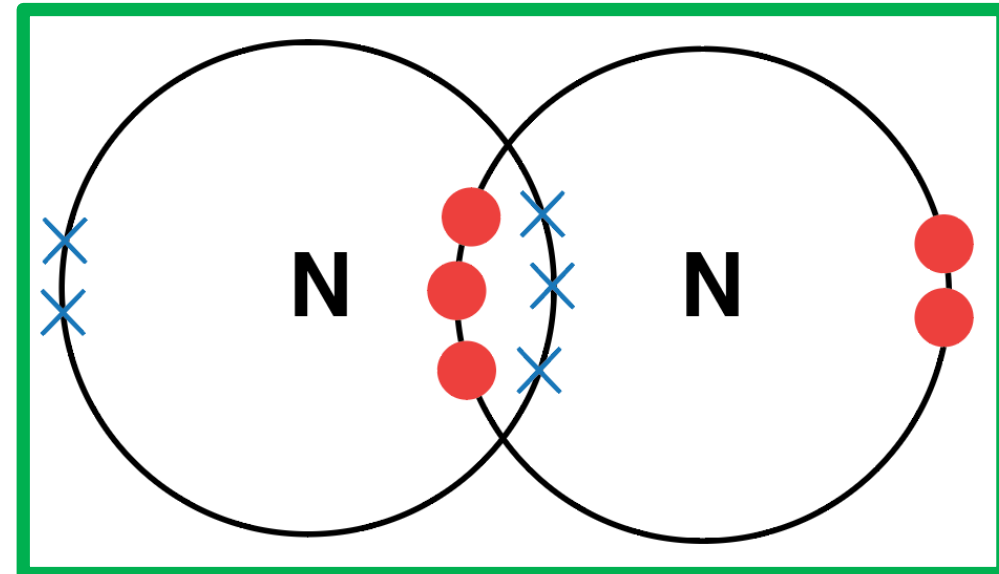
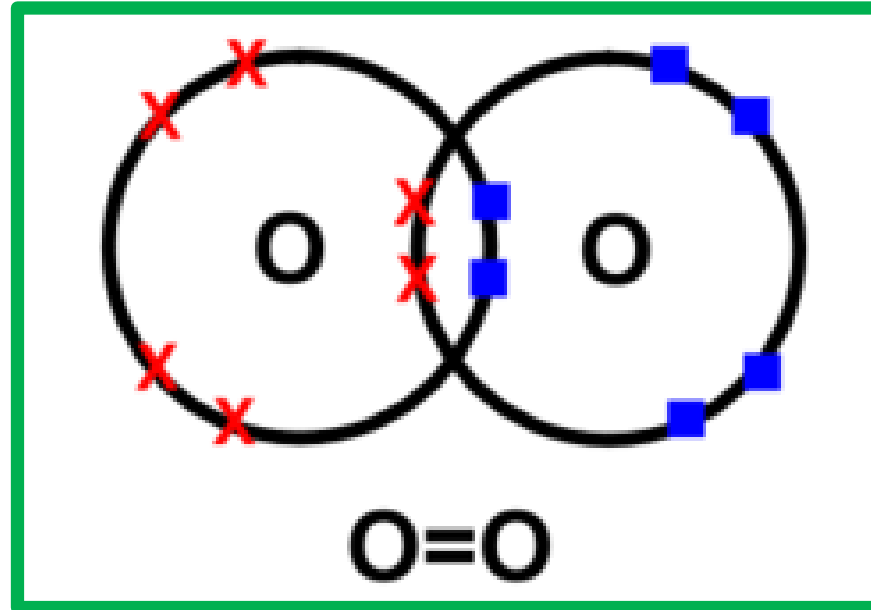
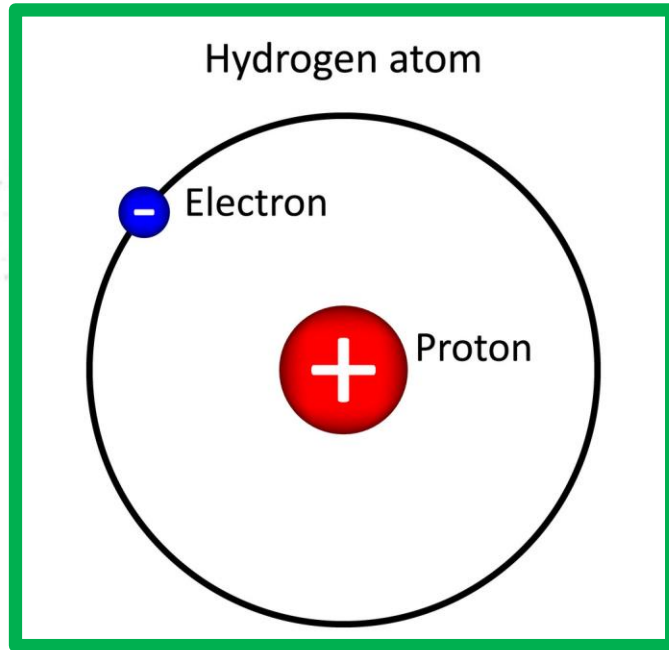
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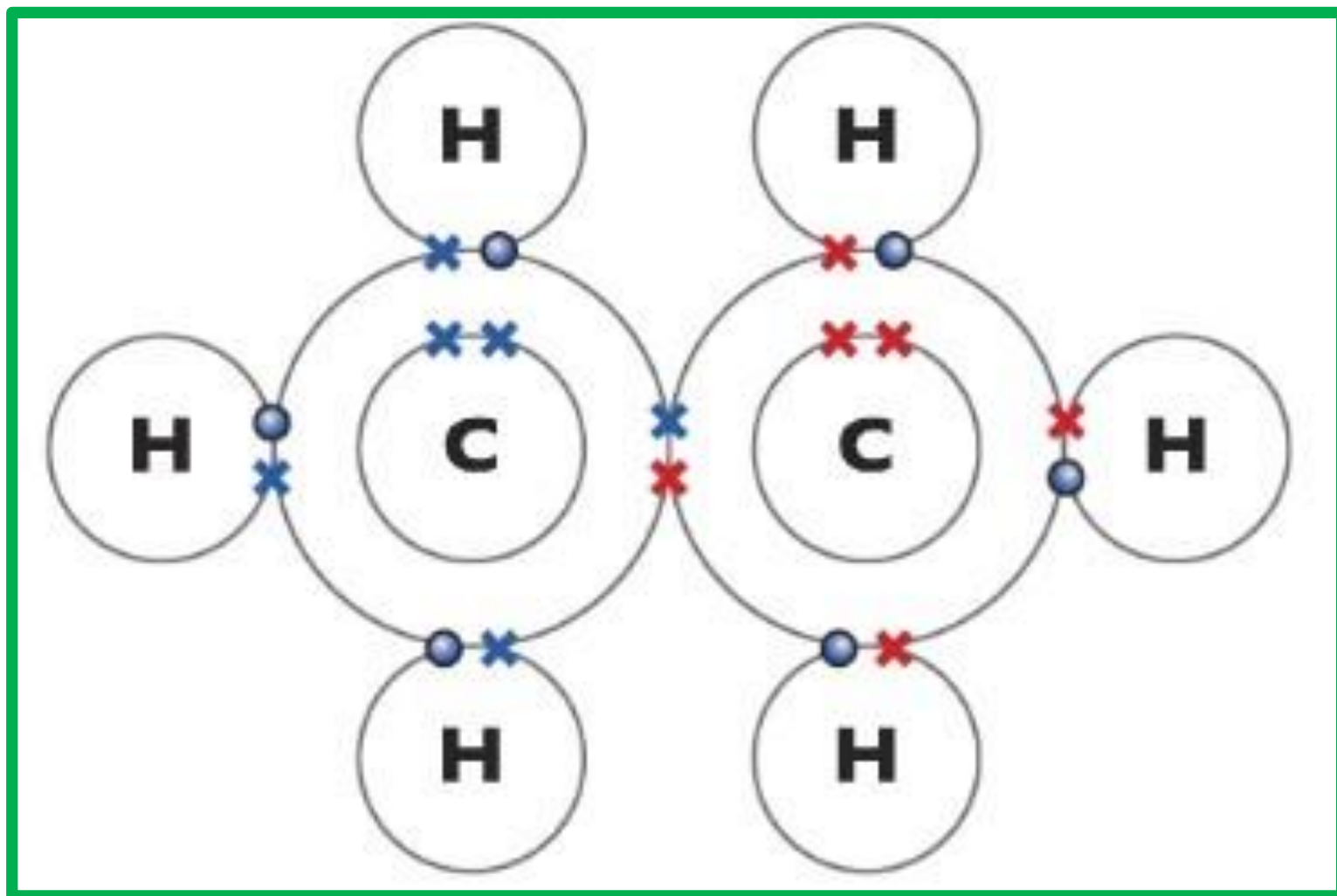
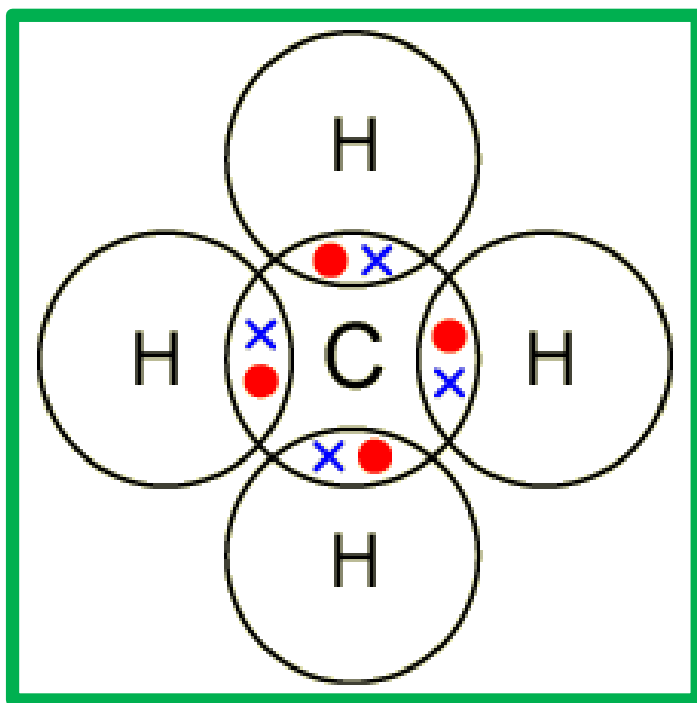
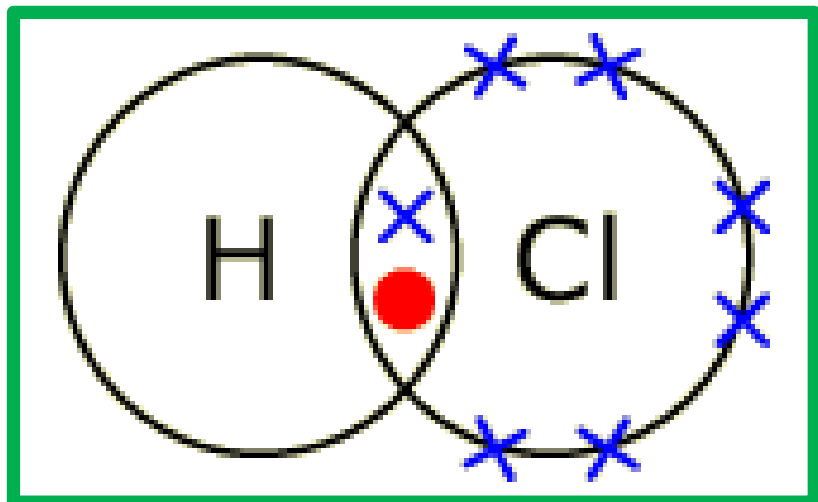
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Covalent Bonding

Let's take hydrogen as a starting point. A hydrogen atom has one proton and one electron. Draw the diagram of the atom in the box below



Covalent Bonding



Bonding

You should now have a good understanding of how atoms join to form compounds by either ionic or covalent bonding .

Which type of bonding would you expect in the following compounds? You will need to look at your periodic table.

1. *potassium oxide* **Ionic (potassium = metal, oxygen = non-metal)**
2. *propane* **Covalent (carbon = non-metal, hydrogen = non-metal)**
3. *lithium chloride* **Ionic (lithium = metal, chlorine = non-metal)**
4. *chlorine* **Covalent (chlorine = non-metal)**
5. *barium oxide* **Ionic (barium = metal, oxygen = non-metal)**

Naming compounds and writing their formulae

Try these. Give the formulae and the names of the compounds they form.

<i>elements</i>	<i>formula</i>	<i>name</i>
Hydrogen and chlorine	HCl	Hydrogen chloride (Hydrochloric acid)
Lithium and oxygen	Li₂O	Lithium oxide
Magnesium and chlorine	MgCl₂	Magnesium chloride
Hydrogen and carbon	CH₄	Hydrogen carbide/Carbon hydride (Methane)
Aluminium and chlorine	AlCl₃	Aluminium chloride
Aluminium and oxygen	Al₂O₃	Aluminium oxide

Naming compounds and writing their formulae

<i>Elements /groups</i>	<i>name</i>	<i>formula</i>
<i>Sodium and hydroxide</i>	Sodium hydroxide	NaOH
<i>Lithium and sulphate</i>	Lithium sulphate	Li₂SO₄
<i>Magnesium and carbonate</i>	Magnesium carbonate	MgCO₃
<i>Potassium and manganate</i>	Potassium manganate	KMnO₄
<i>Calcium and nitrate</i>	Calcium nitrate	Ca(NO₃)₂

Naming compounds and writing their formulae

<i>Ammonium nitrate</i>	<i>and</i>	Ammonium nitrate	NH_4NO_3
<i>Aluminium nitrate</i>	<i>and</i>	Aluminium nitrate	$\text{Al}(\text{NO}_3)_3$
<i>Aluminium sulphate</i>	<i>and</i>	Aluminium sulphate	$\text{Al}_2(\text{SO}_4)_3$

Equations to know

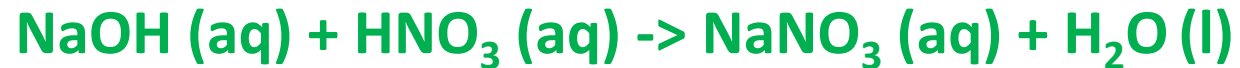
1. Magnesium + hydrochloric acid -> magnesium chloride + hydrogen



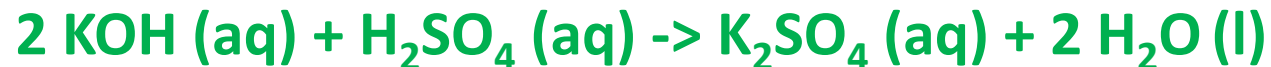
2. Zinc + sulphuric acid -> zinc sulphate + hydrogen



3. Sodium hydroxide + nitric acid -> sodium nitrate + water



4. Potassium hydroxide + sulphuric acid -> potassium sulphate + water



Equations to know

5. Magnesium + citric acid -> magnesium citrate + hydrogen



6. Hydrochloric acid + calcium carbonate -> calcium chloride + carbon dioxide + water



7. Sulphuric acid + copper carbonate -> copper sulphate + carbon dioxide + water



8. Methane + oxygen -> carbon dioxide + water



Equations to know

9. Ethanol + oxygen -> carbon dioxide + water



10. Glucose + oxygen -> carbon dioxide + water



This is the equation the for aerobic respiration!

Moles and chemical calculations

Relative atomic mass, A_r

element	Atomic mass	element	Atomic mass
Ca	40	U	238
P	31	Be	9
N	14	B	11
O	16	I	127
K	39	Ra	226

Moles and chemical calculations

Relative molecular mass, M_r

compound	M_r	compound	M_r
NaCl	58.5	NH_4NO_3	80
CuCO_3	123.5	$(\text{NH}_4)_2\text{SO}_4$	132
$\text{Cu}(\text{Cl})_2$	134.5	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$	249.5
$\text{Ca}(\text{NO}_3)_2$	164	$\text{Al}_2(\text{SO}_4)_3$	342

Moles and chemical calculations

Moles of compounds

$$\text{Moles} = \frac{\text{mass (g)}}{\text{Mr}}$$

$$\text{Mass (g)} = \text{moles} \times \text{Mr}$$

item	Atomic or molecular mass	Number of moles	Mass in grams
C	12	2	24
Ca	40	0.1	4
H ₂	2	0.125	0.25
N ₂	28	0.1	2.8
H ₂ O	18	0.5	9
CaCO ₃	100	0.02	2
C ₂ H ₆	30	0.02	0.6
C ₂ H ₄ O ₂	60	2.5	150
NaCl	58.5	0.16	9.36
CuSO ₄	159.5	1.4 x 10 ⁻³	0.2233

Moles and chemical calculations

Solutions and their concentrations

Moles of solution = $C \times V \text{ (dm}^3\text{)}$

No. of mols	Vol. of solution dm ³	Concentration mol dm ⁻³
1	1	1
0.5	1	0.5
1	0.5	2
0.5	1	0.5
0.1	1	0.1
0.2	0.5	0.4
0.25	0.25	1
0.15	0.2	0.75
1.12	2	0.56
0.125	0.05	2.5

Moles and chemical calculations

Solutions and concentrations

1.
 - i) Moles = $C \times V = 2 \times 1 = 2$ moles
 - ii) M_r (KOH) = $39 + 16 = 55$
 - iii) Mass = moles $\times M_r = 2 \times 55 = \underline{110 \text{ g}}$

2.
 - i) Moles = $C \times V = 0.1 \times 0.5 = 0.05$ moles
 - ii) M_r (KOH) = $39 + 16 = 55$
 - iii) Mass = moles $\times M_r = 0.05 \times 55 = \underline{2.75 \text{ g}}$

3.
 - i) Moles = $C \times V = 0.2 \times 0.25 = 0.05$ moles
 - ii) M_r (KOH) = $39 + 16 = 55$
 - iii) Mass = moles $\times M_r = 0.05 \times 55 = \underline{2.75 \text{ g}}$

4.
 - i) Moles = $C \times V = 0.25 \times 2 = 0.5$ moles
 - ii) M_r (CuSO₄) = $63.5 + 32 + 64 = 159.5$
 - iii) Mass = moles $\times M_r = 0.5 \times 159.5 = \underline{79.75 \text{ g}}$

Moles and chemical calculations

Solutions and concentrations

5. i) $M_r(\text{NaOH}) = 23 + 16 + 1 = 40$
 ii) $\text{Moles} = \text{mass (g)} / M_r = 10 / 40 = 0.25 \text{ moles}$
 iii) $\text{concentration} = \text{moles} / V = 0.25 / 0.1 = \underline{2.5 \text{ mol/dm}^3}$
6. i) $M_r(\text{NaOH}) = 23 + 16 + 1 = 40$
 ii) $\text{Moles} = \text{mass (g)} / M_r = 5 / 40 = 0.125 \text{ moles}$
 iii) $\text{concentration} = \text{moles} / V = 0.125 / 0.5 = \underline{0.25 \text{ mol/dm}^3}$
7. i) $M_r(\text{CuSO}_4) = 63.5 + 32 + 64 = 159.5$
 ii) $\text{Moles} = \text{mass (g)} / M_r = 10 / 159.5 = 0.0627 \text{ moles}$
 iii) $\text{concentration} = \text{moles} / V = 0.0627 / 0.1 = \underline{0.627 \text{ mol/dm}^3}$

Moles and chemical calculations

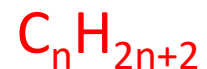
Solutions and concentrations

8. i) $M_r (\text{KMnO}_4) = 39 + 55 + 64 = 158$
 ii) Moles = mass (g) / $M_r = 0.167 / 158 = 1.057 \times 10^{-3}$ moles
 iii) concentration = moles / V = $1.057 \times 10^{-3} / 1.5 = \underline{7.05 \times 10^{-4} \text{ mol/dm}^3}$
9. i) $M_r (\text{KMnO}_4) = 39 + 55 + 64 = 158$
 ii) Moles = mass (g) / $M_r = 0.1 / 158 = 6.33 \times 10^{-4}$ moles
 iii) concentration = moles / V = $6.33 \times 10^{-4} / 0.1 = \underline{6.33 \times 10^{-3} \text{ mol/dm}^3}$
- 10 i) $M_r (\text{KOH}) = 39 + 16 + 1 = 56$
 ii) Moles = mass (g) / $M_r = 0.25 / 56 = 4.46 \times 10^{-3}$ moles
 iii) concentration = moles / V = $4.46 \times 10^{-3} / 0.25 = \underline{1.79 \times 10^{-2} \text{ mol/dm}^3}$

Organic chemistry

Alkanes

General formula



Functional group

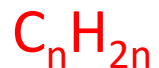
C-C

Number of carbon atoms in the chain	Name	Formula	Structure
1	Methane	CH_4	$\begin{array}{c} H \\ \\ H-C-H \\ \\ H \end{array}$
2	Ethane	C_2H_6	$\begin{array}{c} H \quad H \\ \quad \\ H-C-C-H \\ \quad \\ H \quad H \end{array}$
3	Propane	C_3H_8	$\begin{array}{c} H \quad H \quad H \\ \quad \quad \\ H-C-C-C-H \\ \quad \quad \\ H \quad H \quad H \end{array}$
4	Butane	C_4H_{10}	$\begin{array}{c} H \quad H \quad H \quad H \\ \quad \quad \quad \\ H-C-C-C-C-H \\ \quad \quad \quad \\ H \quad H \quad H \quad H \end{array}$

Organic chemistry

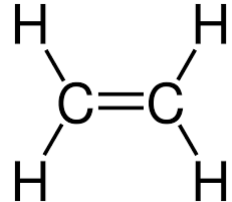
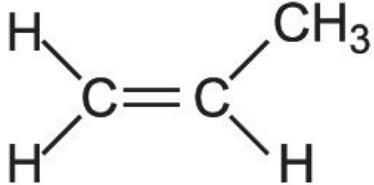
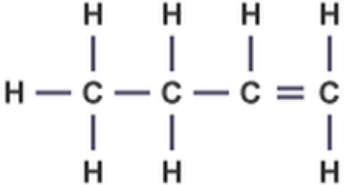
Alkenes

General formula



Functional group



Number of carbon atoms in the chain	Name	Formula	Structure
2	Ethene	C_2H_4	
3	Propene	C_3H_6	
4	Butene	C_4H_8	

Organic chemistry

Alcohols

General formula



Functional group

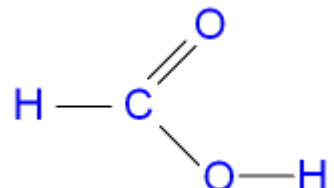
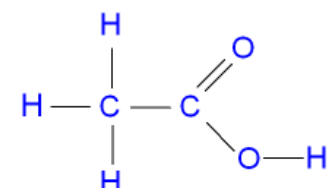
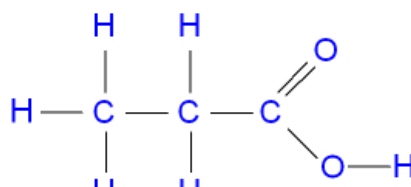
OH

Number of carbon atoms in the chain	Name	Formula	Structure
1	Methanol	CH_3OH	$\begin{array}{c} H \\ \\ H-C-O-H \\ \\ H \end{array}$
2	Ethanol	C_2H_5OH	$\begin{array}{c} H & H \\ & \\ H-C & -C-O-H \\ & \\ H & H \end{array}$
3	Propanol	C_3H_7OH	$\begin{array}{c} H & H & H \\ & & \\ H-C & -C & -C-OH \\ & & \\ H & H & H \end{array}$
4	Butanol	C_4H_9OH	$\begin{array}{c} H & H & H & H \\ & & & \\ H-C & -C & -C & -C-O-H \\ & & & \\ H & H & H & H \end{array}$

Organic chemistry

Carboxylic acids

Functional group
COOH

Number of carbon atoms in the chain	Name	Formula	Structure
1	Methanoic acid	HCOOH	
2	Ethanoic acid	CH ₃ COOH	
3	Propanoic acid	C ₂ H ₅ COOH	
4	Butanoic acid	C ₃ H ₇ COOH	